Ordinary Meeting of Council

Attachments

Monday 20 February 2023

Council Chamber Realm

ATTACHMENTS

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COUNCILLOR BRIEFING – PUBLIC RECORD

Briefing Details:

Date: Monday 12 December 2022 Time: 6:00pm Location: Meeting Rooms 1 & 2

Attendees:

Councillors		
Cr Rob Steane (Mayor)	Cr Marijke Graham	Cr Kylie Spears
Cr Tasa Damante (Deputy Mayor)	Cr Linda Hancock	Cr Suzy Stojanovic
Cr Tony Dib OAM, JP	Cr Mike Symon	

Council Officers:		
Steve Kozlowski	Chief Executive Officer	
Tony Rocca	Chief Financial Officer	
Adam Todorov	Director Assets & Leisure	
Marianne Di Giallonardo	Director People & Places	
Andrew Fuaux	Director Strategy & Development	
Chloe Messerle	Senior Governance Officer	
Emma Hills	Governance Officer	**Item**
Sherryn Dunshea	Senior Executive	2
Dale Bristow	Coordinator Strategic Planning & Sustainability	3
Doug Evans	Strategic Environment Planner	3
Tim Cocks	Manager Leisure & Major Facilities	4
Josh Burt	Coordinator Sport, Recreation & Events	4
Jeanette Ingram	Sport & Recreation Planning & Policy Officer	4

Apologies:

Councillors:	Cr Paul Macdonald
Council Officers:	Nil

Conflict of Interest Disclosure:

Councillors:	Cr Tasa Damante: Item 2 - Australia Day Awards 2023 Reason: Cr Damante knows one of the nominees Cr Kylie Spears: Item 2 - Australia Day Awards 2023 Reason: Cr Spears mentors one of the nominees Cr Marijke Graham: Item 4 - Maroondah Tennis Strategy and Lease Discussion Paper Reason: Cr Graham's daughter has tennis coaching at one of the clubs contained in the new lease.
Council Officers:	Nil

Items Discussed: **## Confidential**

1	Council Meeting Agenda
2	Australia Day Awards 2023 - Nominations
3	Vegetation reports for adoption and noting
4	Maroondah Tennis Strategy and Lease Discussion Paper
5	Late Item - Lease of Maroondah Sports Club Building
6	Items of a general nature raised by Councillors

Record completed by:

Council Officer	Chloe Messerle
Title	Senior Governance Officer

COUNCILLOR BRIEFING – PUBLIC RECORD

Briefing Details:

Date: Monday 6 February 2023 | Time: 6:00pm | Location: Meeting Rooms 1 & 2

Attendees:

Councillors		
Cr Rob Steane (Mayor)	Cr Marijke Graham	Cr Kylie Spears
Cr Tasa Damante (Deputy Mayor)	Cr Linda Hancock	Cr Mike Symon
Cr Tony Dib OAM, JP	Cr Paul Macdonald	
Council Officers:		
Steve Kozlowski	Chief Executive Officer	
Tony Rocca	Chief Financial Officer	
Adam Todorov	Director Assets & Leisure	
Marianne Di Giallonardo	Director People & Places	
Andrew Fuaux	Director Strategy & Development	
Chloe Messerle	Senior Governance Officer	
Emma Hills	Governance Officer	
		Item
Gill Pratt	Interim Manager Finance & Commercial	1
Damian Thorp	Coordinator Waste Management	1
Antonia Heward	Team Leader Waste Strategy & Policy	1
Jim Herron	Manager Cyber & Technology	2
Grant Meyer	Manager City Futures	3-4
Tim Cocks	Manager Leisure & Major Facilties	6
Tara Choudari	Leisure & Aquatics Manager	6
Christie Briggs	Membership Manager	6

Apologies:

Councillors:	Cr Suzy Stojanovic
Council Officers:	Nil

Conflict of Interest Disclosure:

Councillors:	Nil
Council Officers:	Nil

Items Discussed: **## Confidential**

1	Bin lid changeover project update
2##	Council Briefing - Contract VTS Telecommunications Mobile Services (Through State Government Contract)
3	Vegetation documents for noting/adoption - Biodiversity in Maroondah Volumes 1 & 2
4	Transport Position Statements
5	Croydon War Memorial
6	Aquanation Childcare Review
7	Draft Councillor Conference 2023 Agenda
8	The Blue Tree Project
9	Councillor Delegates' Meeting Report
10	Ringwood Highland Games
11	Items of a General Nature raised by Councillors

Record completed by:

Council Officer	Emma Hills
Title	Governance Officer

Maroondah Disability Advisory Committee – Minutes

These minutes are yet to be confirmed. They will be presented to the Committee at the next meeting to be held on the in February/March 2023

Meeting Details:

Date: Thursday 24 November 2022	Time: 10am-11.30m	Location: Maroondah Federation Estate, Room 5

Attendees:

Councilors Cr Kylie Spears (Chair) Cr Rob Steane **Council Officers:** Grant Meyer, Manager City Futures Fiona Burridge, Be Kind Maroondah Facilitator Jack Mulholland, Community Access and Inclusion Facilitator John Richardson, Coordinator Assets Projects & Facilities Sze lay Ng, Senior Assets Project Manager Adam Cooper, Coordinator Youth and Children's Services Amy Liddy, Community and Online Engagement Officer - Youth and Children's Services Judy Morris, Administration Officer (Minute Taker)
Agency Representative: Bruce Watson (NEAMI) Ellen Clacy (Interchange Outer East)
Community Representative: Lawrence Seah Norma Seip Lana Wheatfill

Apologies:

Councillors:	Cr Tony Dib, OAM, JP
Council Officers:	Nil
Agency Representatives:	Alison Marie, Eastland Cara Patterson (Vision Australia) Michelle Egan (EACH)
Community Representatives:	Gemma Lewer Melanie Adams Emily Dive David Sawyers

Conflict of Interest Disclosure:

Councillors:	Nil
Council Officers:	Nil
Agency Representatives:	Nil
Community Representatives:	Nil

Items Discussed

1. OPENING OF MEETING

2. WELCOME

CONFIRMATION OF MINUTES - THURSDAY, 8 SEPTEMBER 2022 ITEM 3

The minutes of the meeting held on Thursday 8 September 2022 were endorsed by the Committee.

Moved: Ellen Clacy Seconded: Lana Wheatfill

4. ITEMS

UPDATE ON PORN IS NOT THE NORM PROJECT ITEM 4.1

An outline of the project *Porn is Not the Norm* was provided to the Committee. This is a new initiative that aims to prevent pornography's harms to autistic young people by equipping them and their parents, carers, teachers, and workers with understanding of pornography's prevalence and impacts, and how they can safely navigate healthy and respectful relationships and sexuality in this context.

Porn is Not the Norm has been developed by a group of individuals and organisations who recognised the need for resources about pornography that are tailored for autistic young people and their communities. This consortium has worked together to identify how they could contribute to addressing this gap.

Some statistics were provided - the average exposure to pornography is 12-13, with 88% of themes include acts of physical aggressing particularly towards females. 35% of pornography has non-consensual themes. Practitioners working with young people regarding harmful sexual behaviour, and have found an over representation of autistic young people in the client group.

When the project commenced there were no existing resources in Australia or overseas. So far, there has been interest shown in this project from England and Denmark.

A consortium was developed, worked on a proposal, undertook research, and ran some events with funding received from the Westpac Foundation. The team consists of experts in autism, youth, pornography, violence prevention and harmful sexual behaviour with representatives from Interchange Outer East, Different Journeys, It's Time we Talked, AWARE program of South-Eastern Centre of Sexual Assault, Decipher Zone, Barwon

Adolescent Taskforce and Maroondah City Council. The Committee has autism representation and are applying an 'autism' lens to their work.

Project components - a range of resources have been developed

- Parent and carer education
- Professional learning - workshops and parent education sessions
- Resources for use with autistic young people
- Website
- Social media campaign

Each component has videos with young autistic people speaking from their perspective.

Education events

- Delivered six professional sessions across Australia
- Online sessions
- Each event gathered feedback from the audience
- More events will be presented next year

Questioned raised. Are we doing enough? Are we meeting the target?
The Committee was advised that there is a sustainable pathway for the future of this project. There are also organisations that are willing to pay for the training.
Currently, there is funding for six events, and there is capacity to do further training which will go beyond the current funding.
Presentations have been given to Victorian Family Court Judges and NSW Magistrates Conference.

Video Production
A film has been produced with the combination of 23 people, including 12 autistic young people, parents, families and workers
A range of short films developed for the use and as a resource
The videos are used during the presentations

Parent resources
A range of parent information and tip sheets have been developed but still need to be 'road tested' so are currently not available to the public. The team are also developing support materials for parents on how to start conversations

More information can be found on - **notthenorm.com.au**
Enquires can be made to the committee for presentations.

The Chair, Cr Spears asked about working with schools on this topic and was advised that the project can be developed in that direction.

It was also mentioned that this project could be presented to Australian Local Government Association (ALGA). Cr Spears would like to discuss this possibility at a later date.

It was asked if there was scope to consider mental health as part of this project. There is a need on this area but further work would need to be done.

CONSULTATION ON THE JUBILEE PRECINCT ITEM 4.2

Council is looking at how to assist the community to fully utilise the Jubilee precinct area ie accessibility, waterland, bushland, sporting areas, open space, play spaces for children, enhanced accessibility, precinct priorities. Currently work is between Stage 1 and Stage 2.

Last year the RO Spencer Pavilion was completed and Council is now working on Cricket Indoor Training Centre and Open Space Project for Jubilee 1 plus lighting at Russell Lucas oval.

RO Spencer Pavilion redevelopment - was completed 2021
The Committee were shown photographs of the Pavilion.

- The upstairs area has a social space and balcony has access available to wheelchair and prams access.
- An accessible change room has been installed with shared access between both the home and away teams. It has an accessible shower, toilets and a smart locking system. Signage has been placed on the doors with instructions on facility use.

A question was raised re instructions inside? **Action - Jack to follow up enquiry**
Clubs have been advised about the locking system. Main usage will be for Spiders (All accessible football team) as it's their home ground. They will co-habit the facility with Ringwood football club.

Russell Lucas Oval Lighting
It has enhanced accessibility and is mainly used for passive and occasionally recreation as well as sport

- Football and cricket training
- Night football and cricket games
- 500lux at cricket wickets
- Home of Ringwood Spiders
- All abilities

Regional Cricket Indoor Training Centre
This centre is currently being constructed and will be a Regional centre. The Centre will include:

- 5 indoor cricket nets being built.
- A section that can be used for multipurpose area.
- A half netball court to be installed.
- Can have multisport at same time.
- If there are down times and people are not training, nets can be pushed back for further utilisation of the space
- Accommodating of wheelchairs and prams.

Question Any thought looking how different communities can be invited to use the space? Any consideration given to safety?

- It is an enclosed space so people may feel safer than a large open space.
- Possible for it to be used in other ways but we will need to consider peak usage times
- Council's Leisure services is overseeing the facility.
- A dedicated parents/carers change room - space for microwave, baby feeding/change, quick breakaway area, access to natural light, nature outlook, blinds for privacy, coffee making facilities.

The group was advised that feedback had been received from the previous Disability Advisory Committee re quite spaces, around families and children and around accessibility to incorporate those elements into this development. The aim is to break down barriers for young families with children who may not have traditionally used these types of facilities.

The parents room can also be used as a breakaway room. However it is not built for this purpose. The 'usage' demand on this room will be monitored.

Cr Spears - if it is to receive a large amount of use - may need signage to identify it being used as a parents/carers room.

This will be a Council operated facility with a Council employee working at the facility. They can change signs for quiet room to parents room when needed.

Question asked re accountability/achievement
The Committee was advised that they have looked at past projects, and asked the question - did those aspects work with consideration to the layout of toilets and the rooms. All feedback assists with future projects and the sectors that contribute towards input into facilities has grown. Council's Projects Team is open to innovation and change.

It may not be compatible to use as a quiet room
It was suggested that this may not be relevant to use as a quiet space. It would be more relevant to use a room that can be converted to/from an office space. RO Spencer Pavilion has multiple rooms that can be reconfigured at short notice.

Jubilee Park Changing Places
Council has been successful in obtaining a grant for a changing facility at the Jubilee Precinct.

Carparking at Russell Lucas Oval
Council is looking at improvements to accessibility throughout the reserve, working on designs for pathways with a shared user path and open space areas with two playgrounds included. There are competing priorities such as terrain, bushland, passive recreation, sport and recreation, gatherings, etc.

Cr Spears asked if with the two playgrounds within close proximity - can one be fenced off. From an disability perspective a fence is required with a pool gate. The other consideration that is the requirement for senior exercise spaces.

CONSULTATION ON CHILDREN & FAMILIES AND YOUTH ACTION PLANS — ITEM 4.3

Council is currently consulting the community regarding their thoughts on needs for children, families, and young people. Following advice at a previous meeting about how to reach children, young people and families on their experiences with disability, with this session, Adam and Amy are keen to tap into MDAC members experiences from a personal perspective.

What can Council do to improve outcomes for children, young people and families? Young people age range is 10 to 25 years of age.

The aims of the current Strategies are:

- To identify strategic actions that address the needs and aspirations of children, young people and their families in Maroondah which is understanding the current topics and issues that are impacting them,
- What are the strengths that they are experiencing in themselves and in the community
- Identifying gaps in services and supports, and
- Getting ideas from people as to address challenges or improve the strengths.

The current Engagement Plan was outlined showing the different methods and approaches used to engage the community, and feedback was given from this committee at the last

meeting in September. The committee raised the importance of grandparents and kinship carers and extended families and the role they play.

Council's consultation postcards were shared as consultation is open until the 30 November 2022. People were encouraged to share the postcard with their networks.

A broad range of consultation has already been undertaken or is planned including focus groups with community members from Aboriginal and Torres Strait Islander and newly arrived communities, consultation at Maroondah Festival and with various other community groups. At Festival Council received over 500 pieces of data with a broad range of representation.

Alison from Eastland offered the community space at Eastland in the last meeting which was also utilized by Council.

What about young people who are leaving school?
They have nowhere to go, how do we tap into them?
It was suggested we could to talk to families and reach out to Service Providers so they can share the experiences of their clients.
If this group can think of any specific agencies please let Council know.
Universities would be another good option but there is a high dropout rate in the first semester.

What's currently going well for children, young people and their families in Maroondah?

- Wellbeing language and behaviour - positivity in students and their school environment
- Community education about disability and mental health being talked about and normalised
- Parks, open spaces, walking trails and accessibility.

What issues or challenges are children, young people and their families in Maroondah currently experiencing?

- Family violence and support for kids in these situations
- Support for kids with unwell parents
- Support for young carers
- Mental health awareness and support across cultures and access
- Access to mental health support - long waitlists and frustration
- Services meeting needs of all clients.

What could be improved in Maroondah to help raise the wellbeing of children, young people and their families?

- Information sharing - to grow awareness and knowledge
- Promote help seeking before crisis
- Promote services with shorter waitlists
- Prevention and early intervention
- Clever messaging about help seeking
- Stop gap measures and alternatives
- Promote access to NDIS and support for those who aren't eligible
- Educate about expectations for NDIS.

UPDATE FROM MEMBERS ITEM 4.4

The Chair asked if anyone wishes to share information.

Bruce Watson NEAMI - their framework involves collaborative recovery which is evolving to change to collaborative relationship practice. Bruce will update the Committee in the new year.

The Resilience Project is next Wednesday night - in person is almost full with 250 enrolments but there is ample room for online participation.

Change Makers in Maroondah - Thursday 1 December 2022. Celebrating International Day of People with Disability 2022 - so far 24 coming would like 50. If anyone interested in attending please let Fiona know.

CLOSE OF MEETING ITEM 4.5

Cr Spears thanked all for their attendance and support over 2022. The Meeting concluded at 11:45 am.

Attachment A

EASTERN TRANSPORT COALITION MINUTES OF MEETING

Date: Thursday, 17 November 2022

Time: 6.30pm – 8.30pm

Hosted by: Video conferencing

Attendees

Councillors

- Cr Stuart James, City of Monash (Chair)
- Cr Susan Laukens, Knox City Council
- Cr Tina Liu, City of Whitehorse
- Cr Anna Chen, Manningham City Council
- Cr Marijke Graham, Maroondah City Council

Officers

- Christopher Marshall, City of Greater Dandenong
- Lucas Sikiotis, City of Greater Dandenong
- Sandra Worsnop, City of Monash
- Chris Hui, City of Whitehorse
- Ron Crawford, Knox City Council
- Terry Tillotson, City of Monash
- Mark Varmalis, Yarra Ranges Council
- Karen O'Gorman, Yarra Ranges Council
- Daniele Raneri, Manningham City Council
- Michael Blowfield, Maroondah City Council
- Dale Bristow, Maroondah City Council
- Kim O'Connor, Yarra Ranges Council
- Elissa Merriweather, Yarra Ranges Council

Secretariat

- James McGarvey, The Agenda Group

Guests

- Danny Davis and Maurice Thaung, LINK Community & Transport

Apologies

- Cr Jim Child, Yarra Ranges Council
- Cr Rhonda Garad, City of Greater Dandenong
- Frank Vassilacos, Manningham City Council
- Matthew Hanrahan, Knox City Council

1. Welcome and apologies

Cr James assumed the chair and welcomed the attendees.

2. Conflicts of interest

No conflicts of interest were raised.

3. Ratify previous draft Minutes and actions arising

Minutes of the October 2022 ETC meeting (amended to include the attendance at the meeting of Vaughn Allan from the City of Whitehorse):

M: Cr Susan Laukens
S: Cr Tina Liu Carried

4. ETC Finance Report

Terry Tillotson, City of Monash provided a verbal finance report, noting that formal financial reports are not yet available, pending introduction of a new accounting system at Council.

He indicated the balance at 30th October 2022 should be $66,470.

A more detailed financial report, including revenue and expenditure items will be provided for future meetings.

Terry asked officers to follow up with their respective Councils to ensure ETC membership invoices have been paid.

5. Presentation – Link Community and Transport

Danny Davis and Maurice Thaung, LINK Community & Transport provided the group with an explanation of their Local Assisted Transport service for people suffering transport disadvantage.

In particular, they explained how their service can work within the context of the Victorian Bus Plan to provide the 'last mile' local transport service, with last mile responsive transport to the home, enabling access to arterial transport, shops, schools, and more.

A copy of Danny and Maurice's presentation will be circulated with the minutes.

6. 2022 State Election advocacy

Update on election commitments

Cr James reported to the group that since the last ETC meeting, Rod Barton MP, the Transport Matters Party representative in the Eastern Metro Region, and Bridget Vallance, the Liberal MP for Evelyn had both publicly expressed their support for the duplication of the rail line between Mooroolbark and Lilydale.

Federal funding for the Caulfield-Rowville Trackless Rapid Transit business case was announced just prior to the release of the federal budget in October. It is believed a media event involving both state and federal government to announce the funding had been planned, but didn't proceed. Vicinity is pursuing both governments to have this event rescheduled.

Regardless of formalities around the announcement, the commitment by the federal government to funding the TRT business case is a resounding advocacy win for all stakeholders including the ETC.

James McGarvey, ETC secretariat took the group through all transport-related election commitments to date (i.e. 17/11) from the major parties, as recorded by the Parliamentary Budget Office's online tracker:

Party	Commitment
Greens	**Public transport free for under 21s under 'Climate Ticket'** The Victorian Greens have announced a new 'Climate Ticket' that would allow people to travel on public transport across Victoria for free or with significantly reduced fares to reduce carbon emissions and lower the cost-of-living. The Greens' Climate Ticket would be free for under 21s, $1 a day for concession card holders and $3 a day for adults. The ticket would be available as a monthly, quarterly or yearly ticket.

Party	Commitment
ALP	**Deliver better roads in Ashwood** A re-elected Andrews Labor Government will deliver safer roads for road users, improved rail trails and better pedestrian and cycling underpasses for families in Ashwood. We will invest $3.5 million to deliver: · A $1 million grant to Monash Council to widen and improve Scotchmans Creek Trail near Warrigal Road and Blackburn Road · A $1.5 million grant to improve the Waverley Rail Trail between Mount Waverley and Jordanville stations – including lighting upgrades and secure Parkiteer bike facilities · Designs for a pedestrian and cycling underpass for the Anniversary Trail at High Street with an investment of $1 million
Liberals	**Duplicate the Lilydale to Mooroolbark rail line** $5 million to kickstart the scoping works for the Lilydale to Mooroolbark rail duplication and station at Kinley!
Liberals	**Extend the Route 75 tram from Vermont South to Westfield Knox** The Liberal Party has committed $134 million to finally extend the Route 75 tram from Vermont South to Westfield Knox. This 5.1 kilometre extension along Burwood Highway will include a number of new tram stops which provide better public transport connections for Knox residents. We will also undertake a feasibility study to explore further extensions of route 75 towards Upper Ferntree Gully and Bayswater.
Liberals	**Deliver 45 new or expanded bus services across the state** The Liberals and Nationals will deliver an express bus service with limited stops for communities in Monash and Whitehorse, getting people where they want to go, when they want to, while easing road congestion. The new bus route will run express between Glen Waverley Station and Box Hill Station, servicing the Syndal shops, Mount Waverley Secondary College and Deakin University along the way. Commuters will be able to jump on the bus every 10 minutes during peak times, every 15 minutes in off peak, and every half an hour in the evenings and on weekends.

Party	Commitment
Liberals	**$2 flat fare public transport and half-price V/Line fares** Victorians would pay a flat fee of $2 a day on almost all public transport if Matthew Guy is elected premier as the Coalition pledges to slash fares to tackle the cost of living. It would reduce daily zone 1 and 2 fares from $9.20 to a capped daily cost of $2, with concession fares limited to $1.
ALP	**Deliver electronic speed signs along Centre Road in Clayton** A re-elected Andrews Labor Government will improve safety for road users, cyclists and pedestrians along Centre Road, Clayton by delivering electronic speed signs.
Greens	**Continue to push for more low floor trams** **Doubling the number of accessible tram stops** **Upgrade train stations across the city to make them accessible**
Greens	**Implement a big bike build** The Greens have pledged $2.5 billion dollars over the next four years to implement a 'Big Bike Build' with hundreds of kilometres of safe and separated bike superhighways. The funding would also go towards creating more safe pedestrian crossings, upgraded footpaths and walkable neighbourhoods.
Liberals	**Extend route 48 tram to Balwyn North and Doncaster**

Party	Commitment
ALP	**Upgrade Boronia Station** A re-elected Andrews Labor Government will invest $60 million to completely revitalise Boronia Station. Decking over the southern rail trench will create new open space for the community, as well as better connections to the surrounding shopping strips. The decking will also create direct pedestrian access from car parking to the Dorset Road shops, making it easier for locals to get around central Boronia. The station itself will undergo a major overhaul with façade upgrades, improved lighting, CCTV, platform upgrades, and furniture to create the modern, safe station that Boronia deserves. Disability access will be improved with upgraded paths, more handrails and tactile surfaces. The bus interchange will receive new shelters and furniture so passengers can be protected from the elements and can transfer from train to bus services in comfort.
Liberal	**Rebuild the state's road network** $10 billion commitment to road maintenance over ten years.
Greens	**Electric Vehicle Rapid Uptake Plan** • Scrap Labor's tax on electric vehicles. • Solar cars - Support for people to connect their EVs to their homes so they can use their cars as solar-powered batteries on wheels • Affordable Electric Vehicles with an eco-bonus of up to $15,000 to help people make the switch from expensive, polluting cars to electric vehicles • Rollout of more than 1000 EV Chargers so you can charge your EV no matter where you live • No new petrol cars sales from 2030 • Manufacture 3,000 electric buses to create a network of high frequency electric bus routes across Melbourne and regional cities • A Jobs, Industry and Innovation Fund to support the development of new clean transport technology and develop our local manufacturing, repair and technology capacities • Clean Air Zones to reduce air pollution and carbon emissions in the CBD and Inner West
Liberal	**Drop the $34.5 billion Suburban Rail Loop and redirect to healthcare**

Party	Commitment
Liberal	**Upgrade intersection in Warrandyte South** $5 million towards safety upgrades at Croydon Rd, Brumbys Rd, Ringwood-Warrandyte Rd, Halls Rd and Husseys Lane intersection.
Greens	**More frequent train and tram services** Victorian commuters would experience a major boost in metropolitan train and tram services under a plan released today by the Greens. Trains would run every ten minutes or even less across the majority of the network from 7am to 7pm, seven days a week, and most would run every ten minutes in the early morning and evening. Trams would run at peak-hour frequency all day from 7am to 7pm, and every ten minutes during off-peak times. The plan has been independently costed by the Parliamentary Budget Office and would require $821.5 million over the forward estimates.

The election commitment tracker can be accessed at:

2022 Election Commitment Tracker (pbo.vic.gov.au)

7. 2023 ETC Meeting Dates

A draft schedule of ETC meeting dates and locations for 2023 had been circulated for feedback prior to the meeting.

The suggested ordering for 2023 continued the meeting pattern from 2022 which meant that Yarra Ranges would host the end of year (celebratory) meeting each year.

To share the responsibility for this around it was suggested that the schedule for 2023 be adjusted to allocate the December meeting to the City of Greater Dandenong

A finalised set of meeting dates will be circulated to members.

8. Other Business

The group acknowledged this was Cr Marijke Graham's final attendance at the ETC, and thanked her for her commitment and service to the ETC over her years of involvement, and wished her well with her future endeavours.

9. Next Meeting

The next meeting will be hosted online, and will commence at 6.30pm on Thursday, 15th December 2022.

Action Summary

Action Items	Owner(s)	Deadline
1. Provide final ETC meeting schedule for 2023	ETC Secretariat	December 2022

Attachment A

EASTERN TRANSPORT COALITION MINUTES OF MEETING

Date: Thursday, 15 December 2022

Time: 6.30pm – 8.30pm

Hosted by: Yarra Ranges Council and online

Attendees

Councillors

- Cr Stuart James, City of Monash (Chair)
- Cr Anna Chen, Manningham City Council
- Cr Tony Dib, Maroondah City Council
- Cr Andrew Fullager, Yarra Ranges Council

Officers

- Christopher Marshall, City of Greater Dandenong
- Lucas Sikiotis, City of Greater Dandenong
- Chris Hui, City of Whitehorse
- Ron Crawford, Knox City Council
- Terry Tillotson, City of Monash
- Mark Varmalis, Yarra Ranges Council
- Karen O'Gorman, Yarra Ranges Council
- Daniele Raneri, Manningham City Council
- Michael Blowfield, Maroondah City Council
- Kim O'Connor, Yarra Ranges Council
- Elissa Merriweather, Yarra Ranges Council

Secretariat

- James McGarvey, The Agenda Group

Apologies

- Cr Tina Liu, City of Whitehorse
- Cr Susan Laukens, Knox City Council
- Dale Bristow, Maroondah City Council
- Sandra Worsnop, City of Monash
- Cr Rhonda Garad, City of Greater Dandenong
- Frank Vassilacos, Manningham City Council
- Matthew Hanrahan, Knox City Council

1. Welcome and apologies

Cr James assumed the chair and welcomed the attendees, including new Councillor representatives joining the ETC for the year ahead.

2. Conflicts of interest

No conflicts of interest were raised.

3. Ratify previous draft Minutes and actions arising

Minutes of the November 2022 ETC meeting:

M: Cr Stuart James
S: Cr Anna Chen Carried

4. ETC Finance Report

Terry Tillotson, City of Monash provided a finance report as detailed below for the period September to November 2022:

Opening balance was $84,000 – (All council contributions of $12,000 received)

September Invoice from TAG	$10,029.09	Paid
October Invoice from TAG	$7,500.00	Paid
November Invoice from TAG	$7,500.00	Paid

Closing balance for November is $58,970.91

M: Cr Stuart James
S: Lucas Sikiotis Carried

5. 2022 State Election advocacy

The State Election Results

ETC Secretariat James McGarvey provided a report on the recently finalised State Election.

There were large swings against the Andrews Government in many outer suburban seats - mainly in Melbourne's west and north. Despite this, the Government has been returned, holding 56 of the 88 seats in the Legislative Assembly.
Of note, Labor did particularly well across the eastern suburbs – particularly the Maroondah Highway belt of seats, holding existing seats in the area, and adding the new seats of Ashwood and Glen Waverley.

In the region, the Coalition held seats in Bulleen, Croydon, Ringwood, Warrandyte and Evelyn.

The vote of the Chinese community, more favourable opinion of the Government's Covid response (particularly those comfortable with a transition to work from home – evidenced in large numbers across the western end of the ETC catchment) and localised support for the Suburban Rail Loop may have all contributed to some extent to the Andrews Government's stronger performance in the east than in other parts of Melbourne and Victoria.

The Andrews Government also performed well across sandbelt electorates, which have been the beneficiary of significant investment in public transport infrastructure over the last two terms.

Off the back of the varying vote across Melbourne, it is likely that in the shorter term, the Victorian Government will pivot to considering the policy and investment needs of communities in the outer suburbs.

Given budget constraints to be addressed, it may be later in this electoral term before the east is prioritised for more significant investment.

Despite commentary in the media suggesting a deep electoral malaise for the Coalition, the 2026 state election is not a lock for Labor.

The Upper House result in the State Election will see the Government in a minority position (with 15 of the 40 votes) and again dependent on gaining crossbench support to pass legislation.

In the Eastern Metro region covering much of the ETC, the two Labor members were returned, Nick McGowan is a new Liberal MP for the region, and Rod Barton MP from the Transport Matters Party lost his seat to the Greens' Aiv Puglielli.

There are a number of Ministerial changes arising from the election results. Of interest to the ETC, Melissa Horne MP has added the Roads and Road Safety portfolio (previously with Ben Carroll MP) to her Local Government responsibilities. Jacinta Allan MP and Ben Carroll continue with heir respective public transport portfolios.

In machinery of government changes, Planning has been combined with Transport to form the reconfigured Department of Transport and Planning.

Update on election commitments

As had been tracked and presented to previous ETC meetings, the Coalition had made a greater range of public transport commitments across Melbourne and in the east than has been the case in previous elections. (From broad policies like capped $2 travel fees to local announcements like extending the 48 tram to Doncaster Hill).

In comparison, Labor had not promised an extensive list of new transport initiatives.

Despite the Federal Labor Government reiterating at the October budget that there is $6 million available for the Caulfield-Rowville TRT business case, there is yet to be a formal announcement by the Andrews Government that it will be commencing this work.

This may require further advocacy in the new year from the ETC and partners to get this project underway.

A copy of Mr McGarvey's presentation will be circulated with the meeting minutes

6. Local Presentation

Karen O'Gorman, Yarra Ranges Council provided an update on progress of Council's Integrated Transport Strategy (ITS) titled '*Connected*' and endorsed by Council in May 2020, with the objective of making the municipality more accessible to all.

One of the key aims is to be able to reduce the number of trips to work in private cars from 89% in 2016 to 70% by 2036. This will be achieved by encouraging people to walk or cycle short distances (up to 3km) to local destinations including schools, shops, and to access points for public transport.

The aim are underpinned by the principles to make Yarra Ranges Safer, Healthier, Sustainable and More Connected and Inclusive.

42 actions have been identified around seven main themes:

- Built form
- Cycling
- Public transport
- Walking
- Travel demand
- Motor Vehicles
- Organisational

The ITS is as relevant for Council staff as it is for the community.

About 40% of Council's budget is spent on transport and related initiatives.

Key initiatives in the last 18 months include:

- Anderson St bike lane and Blacksmiths way
- Prioritised footpath program
- Smart parking technology
- Organisational leadership and zero emissions fleet policy
- Public transport advocacy (for bus, rail and pedestrian facilities investment)
- A plan is being developed to facilitate real behavioural change.

A copy of Karen's presentation will be circulated with the meeting minutes

7. Other Business

James McGarvey, ETC Secretariat flagged that the first meeting in the new year will have as its main item of business consideration of a workplan for 2023, looking at advocacy items/policies to pursue and a review of how we go about our advocacy. He asked members to give some thought to this in advance of the next meeting in February.

Terry Tillotson, City of Monash, suggested the ETC continue to push for funding for its pedestrian crossing priorities list, despite this not being picked up in the recent State Election.

Michael Blowfield, Maroondah City Council, suggested we consider what the ETC might be competing with from other regions in putting forward a set of asks to Government, and how that intelligence may set the timing and priorities for the ETC's agenda.

Cr Chen asked about the timing of the release of the report on the pilot bus review program, which had been flagged for December. This may be an issue for follow up in the new year.

Ron Crawford, Knox City Council and Chris Hui, City of Whitehorse reported that Infrastructure Victoria had recently released a report on buses 'Making the most of Melbourne's Buses'.

In closing the meeting, Cr James thanked everyone for their effort over the course of 2022, and particularly around advocacy leading up to the 2022 state election.

Cr Chen joined Cr Stuart in recognising the group's hard work over 2022 and wished the group well for 2023.

8. Next Meeting

The next meeting will be hosted online, and will commence at 6.30pm on Thursday, 16th February 2023.

Action Summary

Action Items	Owner(s)	Deadline
1. Add '2023 workplan' as the main item for the February 2023 meeting	ETC Secretariat	February 2022

Commuters Count Eastern Transport Coalition

ETC 2022 State Election Outcome



Lower House results in the East

Electorate	Won by	Successful candidate	Swing	Final Margin
Ashwood	ALP	Matt Fregon MP	4.2% to ALP	6.2%
Bayswater	ALP	Jackson Taylor MP	4.8% to ALP	4.2%
Box Hill	ALP	Paul Hamer MP	3.7% to ALP	6.8%
Bulleen	Liberal	Matthew Guy MP	0.4% to Lib	5.9%
Croydon	Liberal	David Hodgett MP	0.4% to Lib	1.4%
Evelyn	Liberal	Bridget Vallance MP	3.4% to Lib	5.2%
Glen Waverley	ALP	John Mullahy	4.2% to ALP	3.3%
Monbulk	ALP	Daniela De Martino	0.5% to ALP	7.6%
Oakleigh	ALP	Steve Dimopoulos MP	2.6% to Lib	13.5%
Ringwood	ALP	Will Fowles MP	4.3% to ALP	7.5%
Rowville	Liberal	Kim Wells MP	1.8% to ALP	3.7%
Warrandyte	Liberal	Ryan Smith MP	0.4% to Lib	4.2%

Upper House - North-Eastern Metropolitan Region

North-Eastern Metropolitan Region

Party	Candidates	MLC?	Status
ALP	Shaun Leane	Yes	Re-elected
ALP	Sonja Terpstra	Yes	Re-elected
LIB	Matthew Bach	Yes	Re-elected
LIB	Nick McGowan	No	Likely elected
GRN	Aiv Puglielli	No	Probably elected

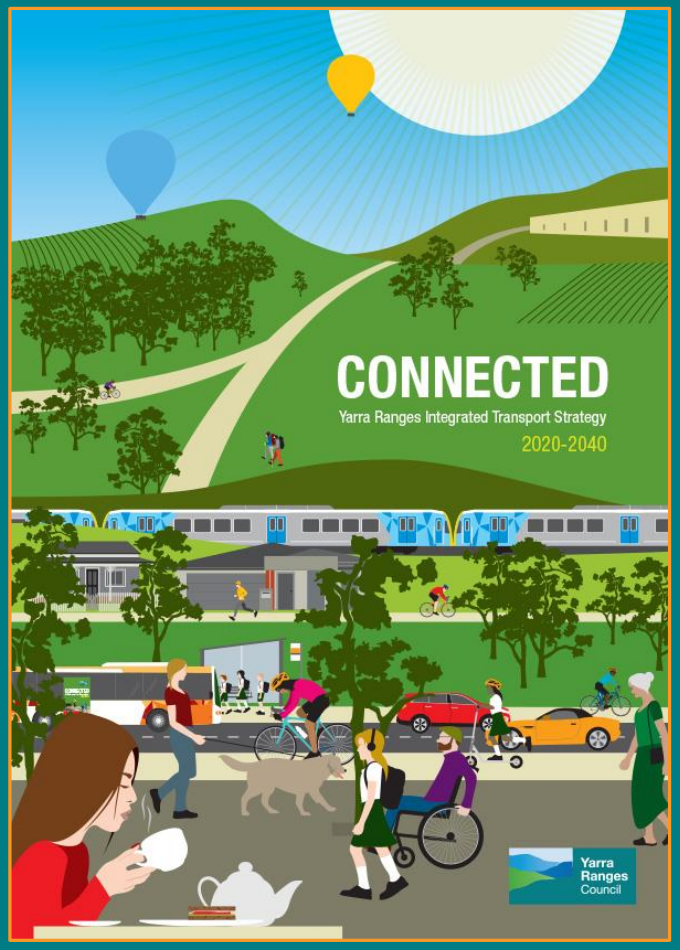
Defeated - Rod Barton (Transport Matters Party)

Did not contest - Liberal Bruce Atkinson retired

2022 State Election

- ALP Transport Commitments

Commitment	Funding
Road blitz to get families home sooner and safer	$674,000,000
Better Boronia station for locals	$60,000,000
Delivering more local buses	$9,800,000
Delivering local road upgrades	$50,200,000
Deliver better roads in Ashwood	A $1 million grant to Monash Council to widen and improve Scotchmans Creek Trail near Warrigal Road and Blackburn Road A $1.5 million grant to improve the Waverley Rail Trail between Mount Waverley and Jordanville stations – including lighting upgrades and secure Parkiteer bike facilities Designs for a pedestrian and cycling underpass for the Anniversary Trail at High Street with an investment of $1 million



Integrated Transport Strategy

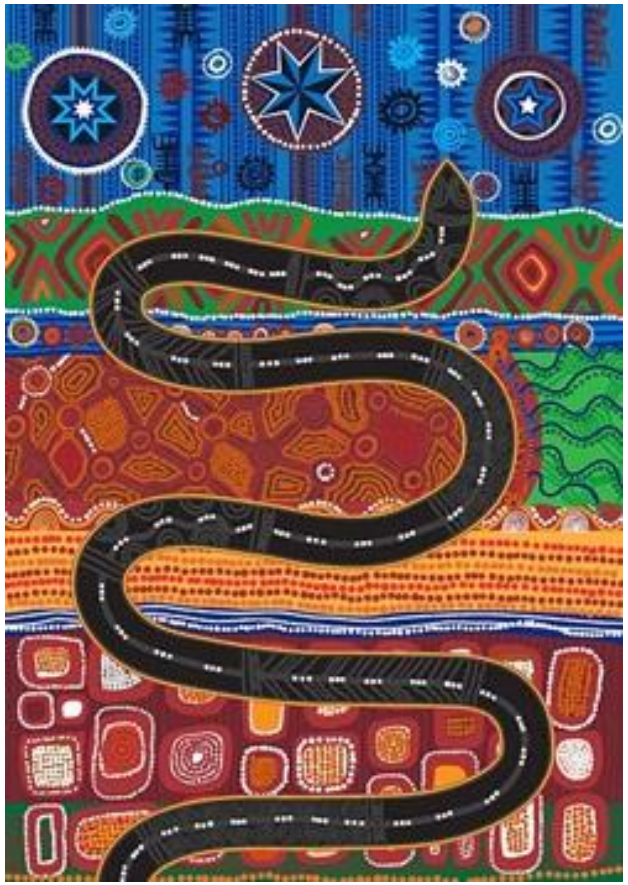
Yarra Ranges Council

Eastern Transport Coalition

Thursday 15 December 2022

By Karen O'Gorman





"Travelling" by Gilimbaa for Queensland Department of Main Roads

Acknowledgement of Country



Yarra Ranges Council

Summary



- Summary of the Strategy
- Challenges to Behaviour Change
- Some of our Projects to Date
- Next Steps
- Questions

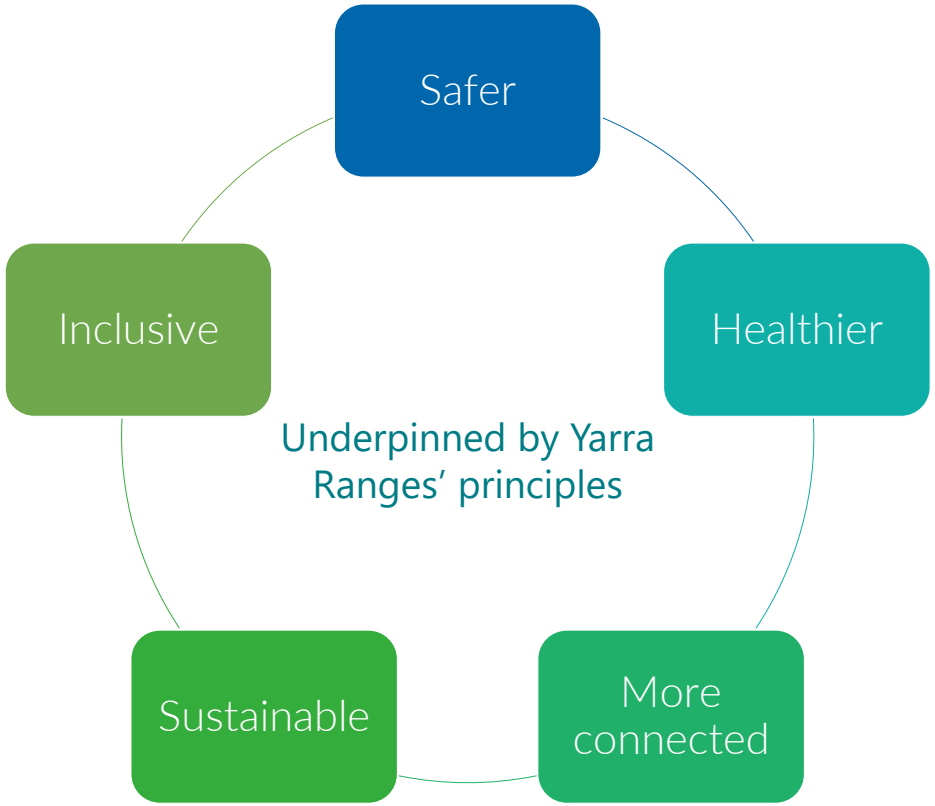


Yarra Ranges Council

Our Aims



- Reduce private car use from 89% to 70% by 2036
- Increasing opportunities for walking and cycling
- Enabling Public Transport to be a viable option



Action Themes



Built Form (1)

Infrastructure

Public Transport (15)

Advocacy
Policy / Planning
Infrastructure

Travel Demand Management (2)

Research

Organisational (7)

Policy / Planning
Research

Cycling (2)

Infrastructure
Advocacy
Engagement
Behavioural Change

Walking (1)

Infrastructure
Behavioural Change

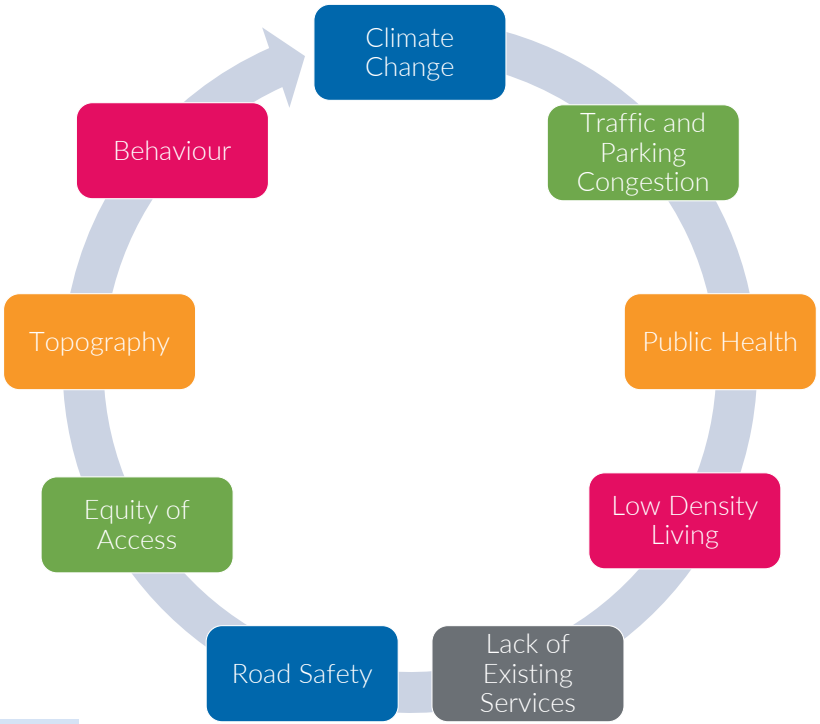
Motor Vehicles (14)

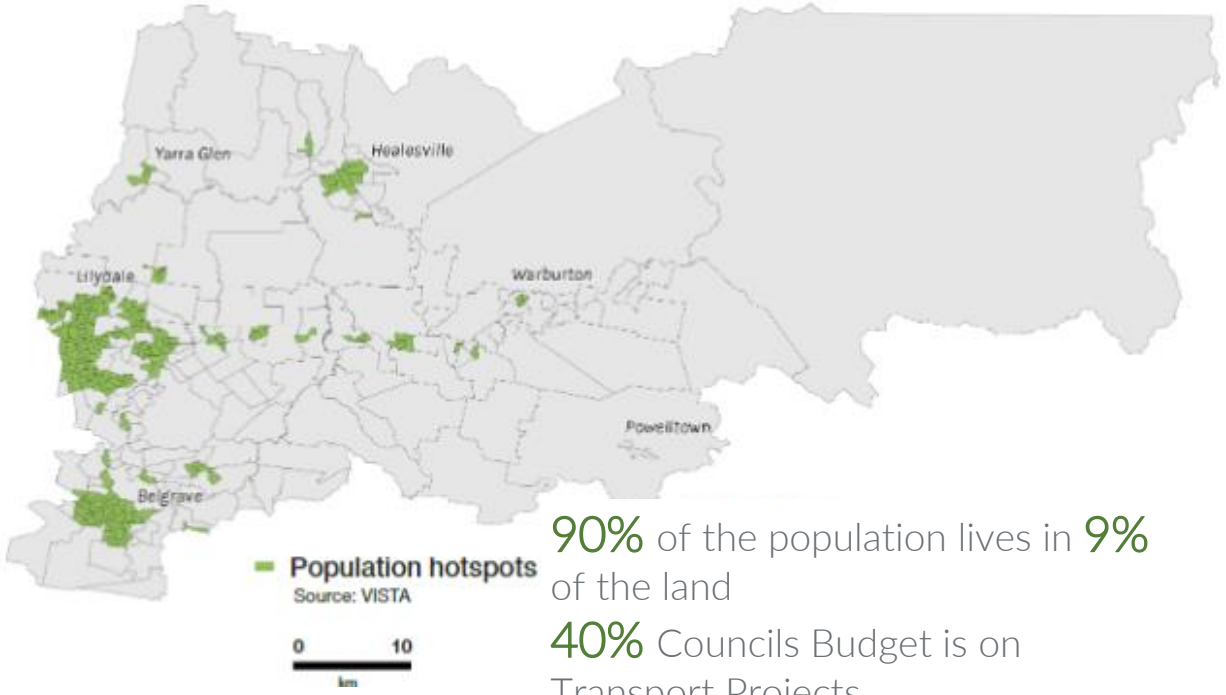
Research
Infrastructure
Policy / Planning
Engagement

Yarra Ranges Council

Our Challenges







90% of the population lives in 9% of the land

40% Councils Budget is on Transport Projects

All areas of Council and the Community are impacted by Transport Issues

Yarra Ranges Council

Key Projects



- Anderson Street Bike Lane
- Footpath Program
- Smart Parking Technology
- Zero Emissions Fleet Policy
- Advocacy

Yarra Ranges Council

Anderson Street Bike Lane & Blacksmith Way





Yarra Ranges Council

PRIORITISED FOOTPATH PROGRAM



Current Footpath Assets

- 654kms of existing footpaths
- Maintenance: $1.6M (2022-23)
- New Works: $749K (2022-23)
- No strategic method of prioritising

Proposed 20-year Program

- Additional 140kms of footpath identified
- Prioritised program based on strategic analysis
- approximate cost of **$28M** for construction of 150 paths
- Scoping documents prepared for first 4 years

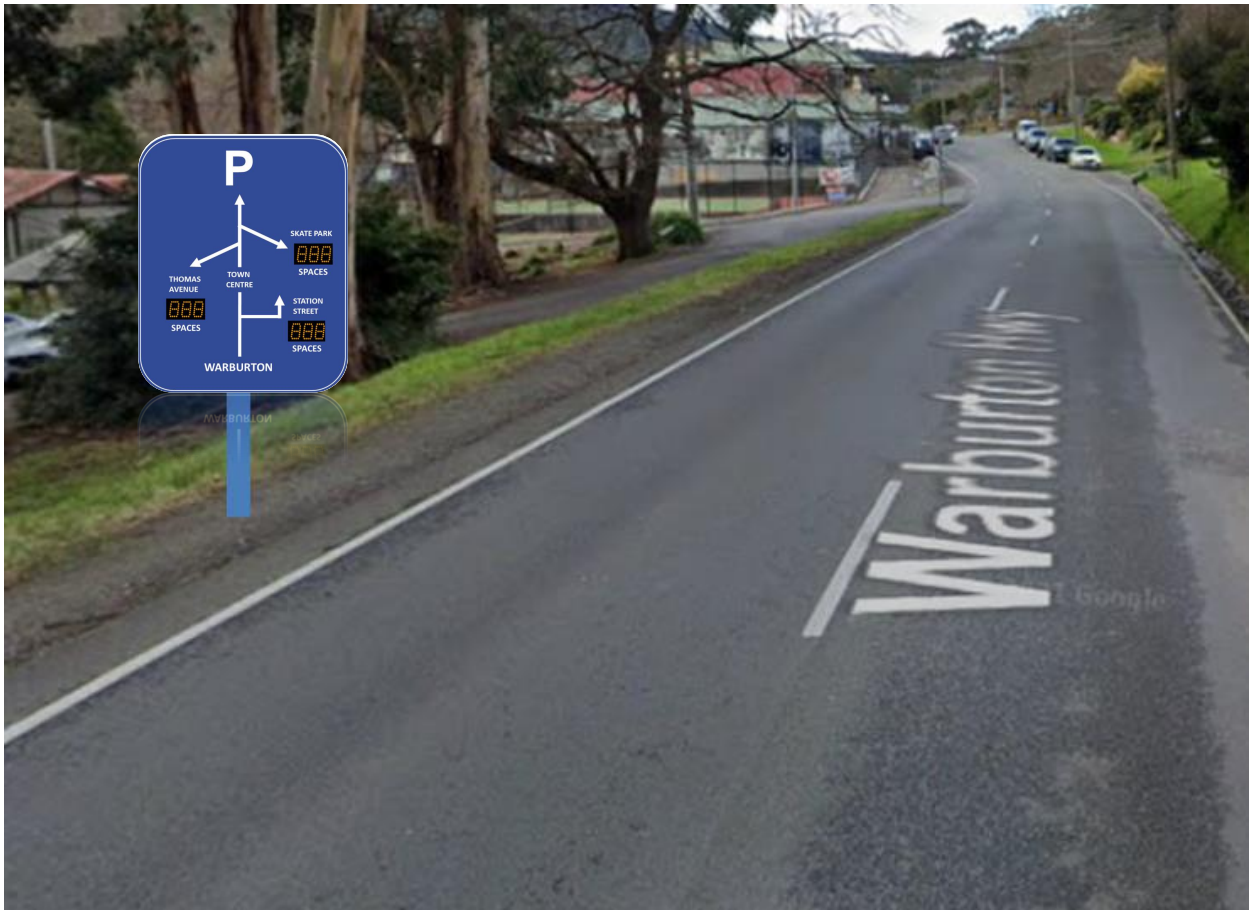


Yarra Ranges Council

SMART PARKING TECHNOLOGY



- Raise awareness of existing parking
- Reduce circulating traffic congestion
- Trial in Warburton
- Improve compliance
- Collect parking utilisation data



Yarra Ranges Council

Zero Emissions Fleet Policy





- Motor Vehicle Policy Review
- Transition to zero missions vehicles by 2030
- Use of Grey Fleet vehicles
- Review of travel patterns
- Existing E-Vehicles & e-bikes

Yarra Ranges Council

ADVOCACY



- Flexi-Ride Services
- Increased Bus Services
- New CaveHill Station
- Rail Duplication – Lilydale to Mooroolbark
- Upwey & Tecoma Station Improvements
- Improved Pedestrian Crossings



Yarra Ranges Council

Next Steps



Apply 20-minute neighbourhood principles with active transport priority	Develop and construct a Cycling Network	Advocate for much-needed public transport infrastructure	Capitalise on large infrastructure projects	Real time car parking information displays
Increase walking and cycling infrastructure to train stations	Support the use of community co-working spaces	Work with Schools to increase walking and cycling	Create electric vehicle charging hubs	Monitor and act on emerging transport technology
Investigate lower speed limits to improve safety	Transforming Yarra Ranges Council to become a leader in sustainable mobility	Improve safety around residential areas and town centers	Improved infrastructure at bus stops	Increased access for school and community bus services

Yarra Ranges Council





Questions

Karen O'Gorman
Coordinator Special Engineering Projects
☎ 9294 6326
K.OGorman@yarraranges.vic.gov.au

Yarra Ranges Council


Yarra
Ranges
Council

Attachment B

Commuters Count Eastern Transport Coalition

ETC 2023 Work Plan Considerations



2022's Priorities

1. Bus Network Review
2. Caulfield-Rowville TRT
3. Lilydale line – duplication & Cave Hill Station
4. Regional Trails (ERTS)
5. Pedestrian Crossing priorities
6. Roads

2022 was a busy election year

In fact it was a dual election year: Federal and State.

For the Federal Election, the Eastern Region Group of Councils (ERG) was provided with ETC's priorities:

- Trails
- Bus infrastructure package
- Road projects

- ERG Councils engaged local members/candidates, with response suggesting interest only extends to 'local projects'.

2022 was a busy election year

For the State Election, the ETC put forward a comprehensive election package, with emphasis on all of our priority areas.

- The ETC directly advocated to representatives of the Government, Opposition, Greens and Crossbench (i.e. Rod Barton MP).
- We also worked with Vicinity and Monash to campaign for the TRT project

Issues for 2023

Legacy issues (carried over from 2022)

- Bus network reform
- Rail projects
- Roads
- Pedestrian crossings
- Regional trails

Other issues to consider for 2023 and beyond

- SRL issues
- North East Link project issues
- Opportunities to work with new bus franchisee (Kinetic)
- Others?

Looking forward - timeframes

Elections:

- The next State Election will be held in November 2026
- The next Federal Election is due by May 2025

State and Federal Budget processes:

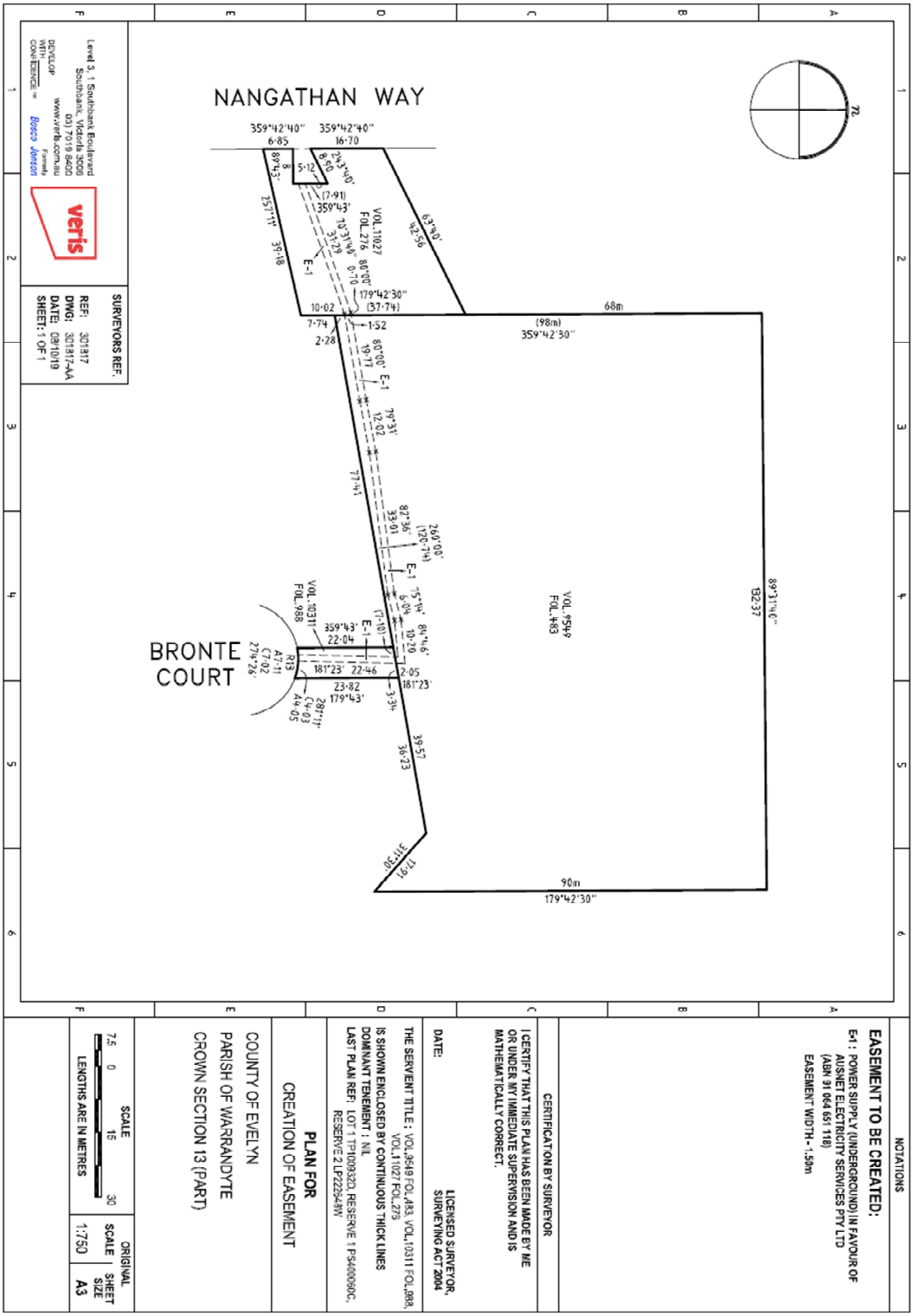
- Government starts considering first cut of projects by September/October
- Local MPS nominate local projects by late October
- Most decisions made by the following February
- Budgets announced in May.

Refining our advocacy

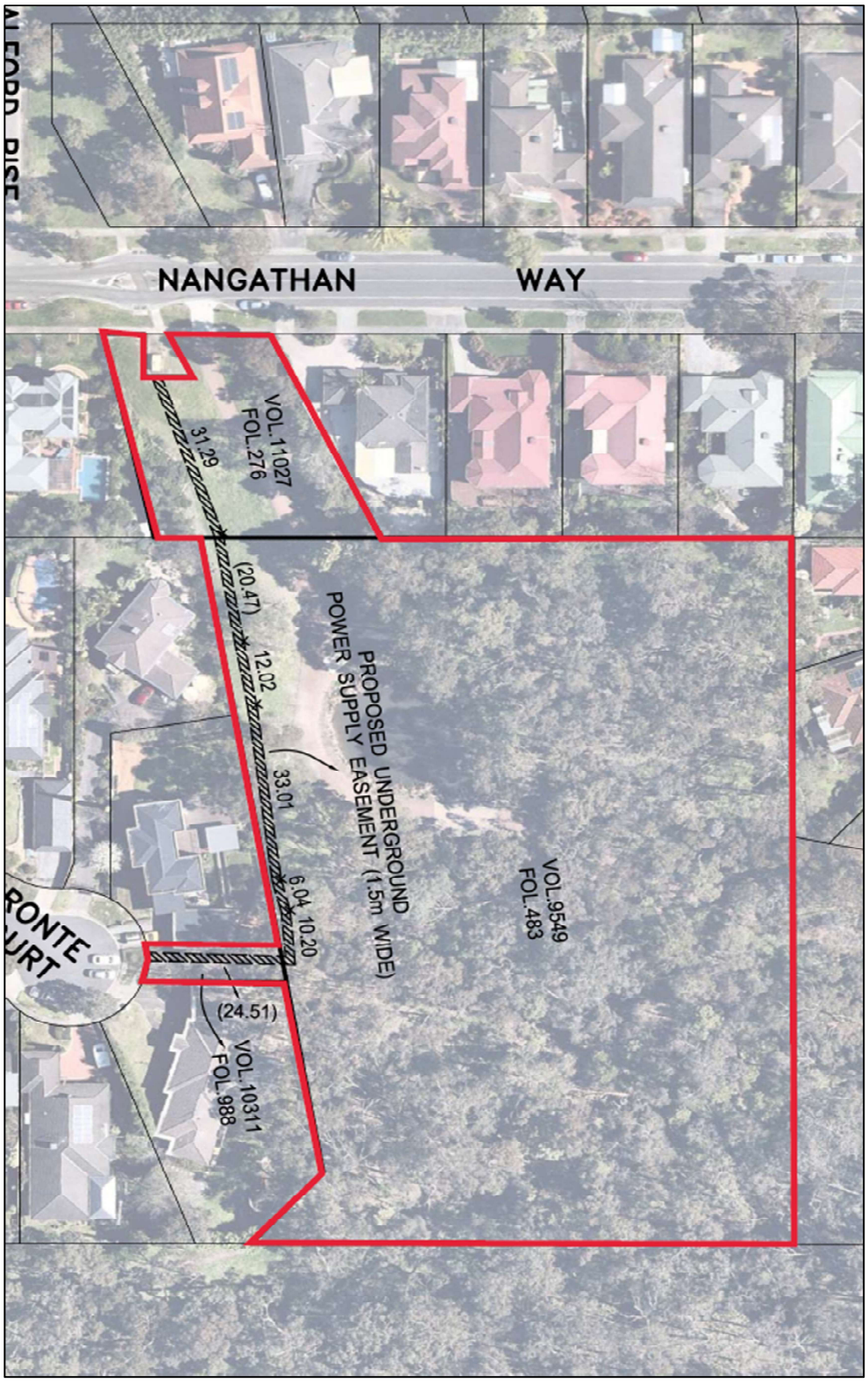
Hallmarks of good advocacy

- A clear and justified prioritisation of advocacy asks
  - Why this and why now?
- A well argued case
  - Evidence and data
- Demonstrable support from community and stakeholders
  - Who can we engage, and how?
- Early engagement with decision-makers
  - How do we work with Government?

Schedule 1 - Creation of Easement Plan



Schedule 2 - Locality Plan



Council Plan 2021 - 2025 Priority Actions Progress Report
Quarter 2, 2022/23 - As at 31 December 2022



Progress Report on Council Plan 2021-2025 Priority Actions - Year 2 (2022/23)
Q2, 2022/23) - as at 31 December 2022

Introduction

The Council Plan 2021-2025 is Maroondah City Council's key medium-term strategic document that sets key directions and priority actions to work towards the long-term community vision outlined in the refreshed *Maroondah 2040: Our future together* community vision.

The Council Plan plays a vital role in shaping Maroondah's future over a four year period. It identifies both challenges and opportunities for our community at local and regional level within the context of the community's long term Maroondah 2040 vision. It also forms the basis for Council to make decisions regarding resources and priorities in response to community needs and aspirations.

Each year, Council presents to the community an updated set of key directions and priority actions for implementing the four-year Council Plan. This helps to ensure that the Plan continues to be aligned with *Maroondah 2040: Our future together*, the community's long-term vision, and is responsive to community needs and expectations.

The Council Plan is implemented through a service delivery planning process, and outcomes are measured and reported regularly. This report identifies Council's progress in relation to the Council Plan Priority Actions for the 2022-23 financial year. Some actions span multiple years as identified in the Council Plan 2021-2025. Progress is identified as at 31 December 2022.

- Priority action is currently on track and/or progressing as expected.
- Priority action is at risk of not being on track.
- Priority action is currently not on track and/or not progressing as expected
- ✓ Priority action has been achieved
- → Priority action has been deferred to another year

Summary of Progress



	Assets and Leisure	CFO	People and Places	Strategy and Development
Not Started	0	0	0	0
In Progress	7	3	12	13
Complete	1	0	0	0
Deferred	0	0	0	0
Total	**8**	**3**	**12**	**13**

Council Plan 2021 - 2025
Year 2 - 2022/23 Priority Actions
Q2 Progress Reporting - as at 31 December 2022

Maroondah 2040 Outcome Area	No.	Council Plan Priority Action	Progress Comment	Project Status	On Track	Target Completion	Directorate	Service Area
A safe, healthy and active community	1	**Continue to monitor the social and economic impacts of the COVID-19 pandemic and provide responses aligned to community needs**	Council has continued to engage with the different sectors of the community regarding the on-going social and economic impacts of the coronavirus (COVID-19) pandemic. Relevant social and economic data is being collected and reported to ensure that service delivery is aligned with community needs. Mental health and business support initiatives continue to be implemented.	In Progress	☺	2024-25	Strategy and Development	Community Safety
	2	**Design and construct a dog park in Ringwood North**	Council was successful in advocating for $275,000 in Victorian Government funding through the Local Parks Program for a purpose-built dog park in Ringwood North. The fully enclosed Parkwood Dog Park is now open for community use and is the second dog-only park for the municipality, following the opening of Maroondah's first dog park at Eastfield Park in Croydon in May 2017. The Parkwood Dog Park is fully enclosed and features multiple entry gates and a range of elements to keep dogs of all sizes entertained, including a time-out zone for younger and quieter dogs.	Complete	✓	**2022-23**	Assets and Leisure	Major Projects and Assets Management
	3	**Design and construct sporting infrastructure upgrades at Jubilee (regional cricket hub), Proclamation, Springfield, Cheong and Ainslie Parks, and at Dorset Recreation, Silcock and JW Manson Reserves**	Council is continuing to construct infrastructure upgrades including pavilions at Jubilee (stage 2 - regional cricket hub), JW Manson and Dorset Recreation Reserve. Cheong, Ainslie, Proclamation, Springfield and Silcock pavilions have been completed.	In Progress	☺	**2022-23**	Assets and Leisure	Major Projects and Assets Management
	4	**Review, update and implement Council's *Physical Activity Strategy* , and develop and implement an Indoor Sports Facilities (basketball, netball and volleyball) Strategy**	Community consultation has been undertaken for the Stadium Sports Strategy and it is anticipated that a draft will be developed for internal consultation by February 2023. Community consultation for the Physical Activity Strategy commenced with Café Consult at Maroondah Festival in November 2022.	In Progress	☺	2024-25	Assets and Leisure	Leisure and Major Facilities
	5	**Finalise and implement the *Maroondah Liveability, Wellbeing and Resilience Strategy 2021-2031* ^ (including the *Health and Wellbeing Action Plan 2021-2023* and *Positive Ageing Framework and Action Plan 2021-2025*)**	In 2022/23, Council will continue implementation of Year 2 actions associated with the Maroondah Liveability, Wellbeing and Resilience Strategy and Health and Wellbeing Action Plan. Actions will be undertaken across priority areas of healthy lifestyles, liveable neighbourhoods, safe communities, social inclusion, embracing diversity and social harms. Highlights will include continued delivery of mental health initiatives in response to the coronavirus (COVID-19) pandemic; developing the Croydon Community Wellbeing Precinct (CCWP); implementing the Gender Equality Action Plan; celebrating and recognising indigenous culture; and delivering the Maroondah Youth Wellbeing Advocates program.	In Progress	☺	2024-25	Strategy and Development	City Futures

Maroondah 2040 Outcome Area	No.	Council Plan Priority Action	Progress Comment	Project Status	On Track	Target Completion	Directorate	Service Area
A safe, healthy and active community	6	**Work in partnership with a broad range of service providers and agencies, to develop and deliver services and cultural experiences in the Croydon Community Wellbeing Precinct**	Council has continued to work in partnership with a broad range of service providers and agencies to progress the staged development of the Croydon Community Wellbeing Precinct (CCWP).	In Progress	☺	2024-25	People and Places	Community Services
A prosperous and learning community	7	**Advance planning and implementation of 20-Minute Neighbourhood initiatives, including completion of a strategic review of shopping centres in Maroondah**	Council has continued to advance planning of 20-Minute Neighbourhood initiatives and has been invited to participate in the 20-Minute Neighbourhoods Municipal Planning Project in 2022/23. This will provide access to grant funding and the opportunity to work with the Victorian Government to better plan for 20-Minute Neighbourhoods in Maroondah. The shopping centres strategic review has resulted in a 20-Minute neighbourhoods investment strategy, which is currently being finalised. A five-year capital works program is being developed that will see a significant infrastructure investment to support local businesses in centres where 20-minute neighbourhood characteristics have been identified and in smaller local centres.	In Progress	☺	2024-25	People and Places	Business and Precincts
	8	**Work in partnership to implement the Bayswater Business Precinct Transformation Strategy and investigate and implement opportunities to enhance business capability, skill development, employment and education pathways for the manufacturing sector**	Council is working in partnership with Knox and Yarra Ranges Councils to implement the Bayswater Business Precinct Transformation Strategy adopted by Council in March 2022. The external consultant has presented a governance structure for consideration by the partner councils. Economic activities continue to focus on building awareness of the precinct along withnd understanding and strengthening local business connections. Work has progressed on the case for a Hub to provide a connecting space for business and support agencies, and on engaging all relevant internal teams with the Action Plan and priorities.	In Progress	☺	2024-25	People and Places	Business and Precincts

Maroondah 2040 Outcome Area	No.	Council Plan Priority Action	Progress Comment	Project Status	On Track	Target Completion	Directorate	Service Area
A prosperous and learning community	9	**Work in partnership with the Victorian Government to plan for and support the rollout of funded three year old kindergarten in Maroondah**	Council is working closely with the Department of Education and Training (DET) to support the rollout of funded three-year-old kindergarten in Maroondah. In 2022, three-year-old-children were able to access five hours a week in a funded kindergarten program, increasing to 15 hours per week by 2029. Through DET funding, Council has employed a Kindergarten Initiative Project Officer to work with services to understand their needs and ensure that infrastructure will meet community demand. The Kindergarten Infrastructure and Services Plan (KISP) for the City of Maroondah was finalised in 2022. Following this, there was an announcement of 30 hours of funded kindergarten for all four-year-olds (up from the current 15 hours) and the implications of this policy announcement are now being worked through. Council was recently successful in obtaining funding of $150,000 to support planning for the new Croydon Central Kindergarten and Occasional Care facilities, which are part of the Croydon Community Wellbeing Precinct (CCWP). Council has also employed two short-term roles (Kindergarten Outreach Officer - CALD; and Bilingual Children's Services Officer) to support CALD children's access to early childhood education and care.	In Progress	☺	2024-25	People and Places	Community Services
	10	**Facilitate co-working opportunities and spaces in Maroondah**	The BizHub Coworking space continues to provide flexible and professional space that inspires collaboration and business connection. The space continues to attract enquiries and tours, predominantly from those seeking casual use. The BizHub team continue to build the cowork community through engagement, social events and networking opportunities and promotions. A new breakfast networking opportunity for members has been introduced - "Wake Up Wednesdays". The festive season was marked by "bauble bonanza" for those in the space as well as a members Christmas networking lunch.	In Progress	☺	2024-25	People and Places	Business and Precincts
A vibrant and culturally rich community	11	**Design the Karralyka redevelopment, and undertake staged redevelopment works**	During 2022/23, Council will undertake renewal of Karralyka theatre seating and make improvements to the loading dock. Council will also continue planning for the staged redevelopment of the venue subject to funding. The proposed redevelopment will include: a new multi-purpose foyer expansion, outdoor paved terraced area leading from the enhanced foyer space and some accessibility improvements.	In Progress	☺	2023-24	Assets and Leisure	Major Projects and Assets Management

Maroondah 2040 Outcome Area	No.	Council Plan Priority Action	Progress Comment	Project Status	On Track	Target Completion	Directorate	Service Area
A vibrant and culturally rich community	12	**Implement the Arts and Cultural Development Strategy 2020-2025 and work with the Maroondah Arts Advisory Committee to maximise arts and cultural opportunities across Maroondah**	Implementation of the Arts and Cultural Development Strategy 2020-2025 continues. Key projects include the delivery of significant public art commissions for the Croydon multi-level carpark and Melview Reserve in Ringwood North, and the recently completed mural at the GloBird headquarters in Ringwood. Grant funding of $110,000 was received from the Victorian Government for 'Reignite Croydon -Laneway Lights' public art project to revitalise the night time economy in the Croydon Main Street and the Activity Centre. Further planning for arts activations at local shopping centres and 20-Minute Neighbourhoods is ongoing, as well as planning for the integration of arts and cultural facilities within the Croydon Community Wellbeing Precinct (CCWP). Scoping of the Wyreena Heritage Masterplan and proposed roll-out has commenced. Arts participation and exhibition projects have engaged with target groups including disability and intersectional communities. Special events including Halloween House at Wyreena and ArtsBus creative workshops at Maroondah Festival were delivered to over 1,200 people, alongside regular programming across these sites. The creative community continued to be supported following impacts of the coronavirus (COVID-19) pandemic, via the final Arts and Resilience Awards and the re-introduction of quarterly in-person events for the Maroondah Arts Collective, which provides networking and professional development opportunities.	In Progress	☺	2024-25	People and Places	Business and Precincts
A clean, green and sustainable community	13	**Work in partnership to implement the Reimagining Tarralla Creek project**	During 2022/23, Council is seeking to continue partnership with Melbourne Water to deliver the next stage of the Re-imagining Tarralla Creek project. Discussions are underway to identify opportunities to align works on the upcoming Kilsyth to Croydon South Water Mains Renewal Project with delivery of the Swinburne section (Stage 4) of the Re-imagining Tarralla Creek project.	In Progress	☺	**2022-23**	Strategy and Development	City Futures
A clean, green and sustainable community	14	**Review, update and implement Council's *Sustainability Strategy* , and Climate Change Risk and Adaptation Strategy**	Council adopted the Sustainability Strategy 2022-2031 in August 2022. The Strategy includes actions that will promote environmental, social and economic sustainability, addressing themes of the built environment, climate change, community connections, a green economy, green infrastructure, governance, evaluation and improvement. The Climate Change Risk and Adaptation Strategy will be replaced by the Climate Change Plan.	In Progress	☺	2024-25	Strategy and Development	City Futures
	15	**Review, update and implement Council's *Carbon Neutral Strategy* , including participation in the power purchasing agreement**	In 2022/23, Council's Carbon Neutral Strategy will be combined with the Climate Change Risk and Adaptation Strategy to form a single Climate Change Plan. The Plan will provide a holistic approach to managing climate change mitigation, adaptation and risk across Council and the community. An Issues and Options paper for the Climate Change Plan is currently being prepared.	In Progress	☺	2024-25	Strategy and Development	City Futures

Maroondah 2040 Outcome Area	No.	Council Plan Priority Action	Progress Comment	Project Status	On Track	Target Completion	Directorate	Service Area
A clean, green and sustainable community	16	**Develop and implement Council's *Waste, Litter and Resource Recovery Strategy 2020-2030***	In 2022/23, the new Food Organics and Garden Organics (FOGO) service will be rolled out to households commencing in May 2023, including standardising of the garden bin lid from maroon to lime green. New receipt and sort, general waste processing, collections and hard waste contracts will come into effect, including changes allowing an additional paid hard waste collection and bookings for collection of garden prunings. A waste services policy, to outline the governance of the new contracts, will be developed including the introduction of the new FOGO service to non-residential properties.	In Progress	☺	2024-25	CFO	Finance and Commercial
	17	**Prepare and implement a Maroondah Habitat Connectivity Action Plan**	Following the identification of key locations for improving habitat connectivity across the municipality, in partnership with a community advisory group, a detailed action plan is being prepared to enable implementation of measures within the Mullum Mullum Biolink.	In Progress	☺	2024-25	Strategy and Development	City Futures
	18	**Implement a streetscape enhancement program, including a significant increase in tree planting**	During 2022/23, Council will implement a strategic open space tree renewal program to help replace dead or storm affected trees with the municipality.	In Progress	☺	2024-25	Assets and Leisure	Operations
An accessible and connected community	19	**Work in partnership with the Victorian Government to implement road improvement works at New Street Ringwood, Reilly Street and Wantirna Road Ringwood, Eastfield Road Ringwood East, Plymouth Road and Kirtain Drive Croydon; and undertake carpark improvement works at McAlpin Reserve Ringwood North and Dorset Recreation Reserve Croydon**	In 2022/23, Council will continue to work in partnership with the Victorian Government to implement road improvement works in: New Street in Ringwood; Reilly Street and Wantirna Road in Ringwood; Eastfield Road in Ringwood East; and Plymouth Road and Kirtain Drive in Croydon. Carpark improvement works at McAlpin Reserve in Ringwood North were completed in July 2021, and the carpark upgrade at Dorset recreation Reserve in Croydon is scheduled to be completed in December 2022.	In Progress	☺	**2022-23**	Strategy and Development	Engineering and Building
	20	**Design and construct activity centre carparks in Croydon, Ringwood and Heathmont; and at Heatherdale station**	In 2022/23, Council will continue the design and construction of the Activity Centre carpark in Ringwood.	In Progress	☺	2023-24	Assets and Leisure	Major Projects and Assets Management

Maroondah 2040 Outcome Area	No.	Council Plan Priority Action	Progress Comment	Project Status	On Track	Target Completion	Directorate	Service Area
An accessible and connected community	21	**Work in partnership with the Victorian Government to support the removal of level crossings at Bedford Road Ringwood, Dublin Road Ringwood East and Coolstore Road Croydon; and the construction of new stations at Ringwood East and Croydon**	In 2022/23, Council will continue to work in partnership with Level Crossing Removal Authority on the Bedford, Dublin and Coolstore Roads level crossing removal projects. Following project announcements and initial public consultation for both the Bedford and Dublin level crossing removals, the Bedford Road level crossing removal project has been enhanced to include a shared walking and cycling path connecting the Heathmont Rail Trail to Bedford Park alongside the Belgrave railway line. Approximately 460 upgraded car parking spaces at Ringwood East Station will be provided, including 200 spaces funded by the Car Parks for Commuters program. Bedford Road early works commenced in late 2022, with major construction commencing in 2023. Dublin Road major construction will start in 2023, with trains running in the new trenches. It is expected Bedford and Dublin roads will have level crossings removed by 2025. Initial site investigations and assessment for the Coolstore Road level crossing indicate that the most suitable design solution for the community would be to build a new rail bridge over the road to remove the Coolstore Road level crossing, connecting central Croydon which is currently divided by the railway line. Further community engagement and engineering assessments are expected to be undertaken during 2022/23 on these projects.	In Progress	☺	2024-25	Strategy and Development	Engineering and Building
	22	**Advocate to the Australian and Victorian Governments for provision of new and upgraded major transportation infrastructure in Maroondah, including public transport enhancements**	In 2022/23, Council will continue advocacy work to address the major transport needs of the Maroondah community.	In Progress	☺	2023-24	People and Places	Communications and Citizen Experience
	23	**Work in partnership to undertake renewal works on the Mullum Mullum Creek and Colchester Road shared trails; and continue footpath construction in the Principle Pedestrian Network**	During 2022/23, Council will work in partnership to undertake renewal works on the Mullum Mullum Creek and Colchester Road shared trails. Design works for the section of trail from Marilyn Crescent to Kalinda Road is underway with community consultation to be completed by the end of 2022/23. The footpath construction program for Maroondah's Principal Pedestrian Network for 2022/23 is planned to include: Eastfield Road (Mt Dandenong Road to Railway Avenue); Sunhill Avenue (Wonga Road to Hendra Grove); Sang Court (Ambrie Avenue to Hendra Grove); Hendra Grove (Graeme Avenue to 27 Hendra Grove); Lavender Street (Great Ryrie Street to Ford Street); Belle Vue Avenue (Great Ryrie Street to Heathmont Road); Pearwood Street (Great Ryrie Street to Ford Street); Gardini Avenue (Shared User Pathway, Greenwood Avenue to Thomas Street); Devon Avenue (Great Ryrie Street to Leoni Avenue); Erica Court (Great Ryrie Street to 23 Erica Court); Leoni Avenue (Devon Avenue to Viviani Crescent; Dresden Avenue, Great Ryrie Street to Leoni Avenue); Langley Street (Knaith Road to School); Anzac Street (Mt Dandenong Road to Mena Avenue); Bond Street (New Street to Market Street); and Colchester Road (Canterbury Road to Collier Road).	In Progress	☺	2024-25	Strategy and Development	Engineering and Building

Maroondah 2040 Outcome Area	No.	Council Plan Priority Action	Progress Comment	Project Status	On Track	Target Completion	Directorate	Service Area
An attractive, thriving and well built community	24	**Develop a new Croydon Structure Plan and prepare a planning scheme amendment to incorporate the policy into the Maroondah Planning Scheme**	In 2022/23, Council will continue to develop the new Croydon Structure Plan, which will be available for community consultation in early 2023. After the Structure Plan has been adopted by Council, permission will be sought from the Minister for Planning to commence preparation of a planning scheme amendment.	In Progress	☺	**2022-23**	Strategy and Development	City Futures
	25	**Work in partnership to implement the Greening the Greyfields project to facilitate a sustainable approach to urban redevelopment in identified residential precincts**	In 2022/23, Council will continue to work with stakeholders to implement the Greening the Greyfields project in two identified residential precincts. Following the Government gazettal of the Planning Scheme Amendments for the two precincts, participation will be sought from relevant landowners. It is anticipated that additional suitable precincts will be identified, and a similar approach applied to transform other neighbourhoods within the municipality.	In Progress	☺	2024-25	Strategy and Development	City Futures
	26	**Undertake the staged redevelopment of the Croydon Community Wellbeing Precinct**	In 2022/23, Council will continue to design and construct the Croydon Community Wellbeing Precinct (CCWP).	In Progress	☺	2024-25	Assets and Leisure	Major Projects and Assets Management
	27	**Undertake flood mitigation works in New Street, Ringwood, Sherbrook Avenue catchment in Ringwood, and Scenic Avenue and Wingate Avenue catchments in Ringwood East; and work in partnership to develop flood mitigation solutions for central Croydon**	In 2022/23, Council will continue to implement flood mitigation works at identified sites. In the Sherbrook Avenue catchment in Ringwood, Stage 3 drainage upgrade works (from Bourke Street to Charter Street) are scheduled for construction in 2022/23. Drainage upgrade (stage 4) works commenced in November 2022 for the Scenic Avenue catchment, and are expected to be completed in February 2023. Development and prioritisation of drainage upgrade solutions for the central Croydon catchment is continuing with work programmed for future years. Flood mitigation works in New Street in Ringwood were completed in April 2022, whilst the final stage of the upgrade works in Wingate Avenue in Ringwood East were completed in March 2022.	In Progress	☺	2024-25	Strategy and Development	Engineering and Building
An inclusive and diverse community	28	**Work in partnership to support volunteer-based organisations and facilitate volunteerism within Maroondah**	In 2022/23, Council will continue to work with Eastern Volunteers and volunteer led community groups and organisations to encourage volunteering and support local community groups to recover from impacts of the coronavirus (COVID-19) pandemic.	In Progress	☺	**2022-23**	Strategy and Development	City Futures
	29	**Investigate and implement additional female changing facilities at local sporting venues**	In 2022/23, Council has scheduled sporting pavilion works which will include the provision of women's, unisex and accessible amenities at JW Manson Reserve in Wantirna.	In Progress	☺	2024-25	Assets and Leisure	Leisure and Major Facilities
	30	**Implement the Children and Families Strategy and Action Plan; and the Youth Strategy and Action Plan**	During 2022/23, Council is undertaking a consultation with children, young people, families and stakeholders, which will inform the development of new Action Plans (2023/24 to 2024/25) for the Children and Families Strategy and the Youth Strategy.	In Progress	☺	2024-25	People and Places	Community Services
	31	**Implement the Gender Equality Act 2020, including Council's Gender Equality Action Plan**	The Commission for Gender Equality in the Public Sector, through its functions under the *Gender Equality Act 2020* , has published Council's workplace gender audit data highlights and Gender Equality Action Plan. In 2022/23, Council will continue to document the status of its first year's actions and prepare for its second workforce audit and analysis.	In Progress	☺	2024-25	People and Places	People and Culture

Maroondah 2040 Outcome Area	No.	Council Plan Priority Action	Progress Comment	Project Status	On Track	Target Completion	Directorate	Service Area
An inclusive and diverse community	32	**Continue to monitor and respond to Australian Government Aged Care Reforms to ensure that Council services adapt appropriately to meet current and future community needs**	Council will continue to monitor the My Aged Care reform agenda. The Australian Government has announced that reforms will not occur prior to July 2024 in line with the recommendations of the Royal Commission into Aged Care.	In Progress	☺	2024-25	People and Places	Community Services
A well governed and empowered community	33	**Implement the new *Local Government Act 2020***	In 2022/23, Council will see the implementation of the new Rating Reform Bill, which was made publicly available in June 2022. All other elements of the *Local Government Act 2020* have been implemented. Councils are currently awaiting guidance material to be issued by Local Government Victoria (LGV) regarding review of statutory policies in the lead-up to the 2024 Council Election.	In Progress	☺	**2022-23**	CFO	Governance and Performance
	34	**Advocate on key local issues on behalf of the Maroondah community, including in the lead up to the Victorian and Australian Government elections in 2022**	During 2022/23, Council will continue its advocacy to both the Australian and Victorian governments to seek funding to address a range of key priority infrastructure, and sporting and transportation improvement projects that will benefit the Maroondah community. Council received funding commitments from both the Liberal Party and the Labor Party totalling $12.5 million in the lead up to the Federal election in May 2022 and is working with the new government to secure funding agreements. Council advocacy campaign in the lead up to the Victorian Government election in November 2022 resulted in commitments totalling over $32.5 million.	In Progress	☺	**2022-23**	People and Places	Communications and Citizen Experience
	35	**Develop and implement a new Customer Service Strategy that will continue to advance Council's commitment to be highly responsive and customer focused**	Council has developed a new Customer Service Strategy in line with evolving customer expectations. This Strategy includes the development of online engagement channels and focuses on strengthening internal service partnerships. These partnerships are reviewed on a regular basis with action plans developed to ensure continued and integrated service provision to the Maroondah community.	In Progress	☺	2024-25	People and Places	Communications and Citizen Experience
	36	**Deliver a broad range of Council services to meet current and future community needs along with sustainable management of Maroondah's resources, assets and environment**	In 2022/23, Council will continue to plan for future service delivery considering community needs and aspirations, national and regional trends, financial sustainability and the challenges arising from the coronavirus (COVID-19) pandemic.	In Progress	☺	2024-25	CFO	Governance and Performance

Local Government Performance Reporting Framework 2022/23 Reporting Year



SERVICE PERFORMANCE INDICATOR RESULTS - YTD Quarter 2
(1 October – 31 December 2022)

Introduction

The Local Government Performance Reporting Framework (LGPRF) is a key initiative to improve the transparency and accountability of council performance to ratepayers and to provide a more meaningful set of information to the public. The framework is made up of a range of performance measures and a governance and management checklist items which together build a comprehensive picture of council performance.

The following report provides the prescribed Local Government Performance Reporting Framework service performance indicator results for end Q2 2022/23.

The following status icons may assist in interpreting these service performance results

	Result is currently on track / progressing as expected / within expected range for the reporting period
	Result is neutral / yet to be finalised / being monitored
	Result is currently not on track / not progressing as expected / outside expected range for the reporting period
	Result not available / New measure with no comparison available

Animal Management

Provision of animal management and responsible pet ownership services to the community including monitoring, registration, enforcement and education

Service *indicator/measure*	Measure expressed as:	Q2 YTD 2022/23	Q2 YTD 2021/22	EoY 2021/22	EoY 2020/21	Comment	Status
Timeliness Time taken to action animal requests	Number of days taken to action animal requests *Expected range: 1 to 10 days*	**1.02 days**	*1.01 days*	*1.03 days*	*1.05 days*	This measure relates to the average number of days since receipt and the first response for all animal management requests. The time taken to action animal management requests in well within the expected range.	
Service standard Animals reclaimed	% of collected animals reclaimed *Expected range: 30% to 90%*	**67.43%**	*66.50%*	*70.3%*	*48.2%*	This measure considers the percentage of collected registrable animals reclaimed under the *Domestic Animals Act 1994*. The number of animals reclaimed by owners has increased due to a focused effort by Council officers to reunite animals with owners and an increase in registration numbers providing up-to-date contact details.	
Service standards Animals rehomed	% of animals rehomed *Expected range: 20% to 80%*	**19.16%**	*25.38%*	*19%*	*44.01%*	This measure considers the percentage of collected registrable animals under the *Domestic Animals Act 1994* that are rehomed. The number of animals rehomed has decreased due to an increase in the number of animals being reclaimed by owners.	
Service cost		**$2.06**	*$2.09*	*$5.33*	*$4.20*	This measure captures the direct cost of the animal management service per registered animal	

Cost of animal management service	$ direct cost of the animal management service per registered animal *Expected range: $3 - $40*					under the *Domestic Animals Act 1994*. There is only slight variation for the cost of animal management services compared to the same time in the previous financial year.	
Health and safety Animal management prosecutions	No of prosecutions *Expected range: 50% - 200%*	**100%**	*100%*	*100%*	*N/A*	This measure captures the percentage of successful animal management prosecutions under the *Domestic Animals Act 1994*. This measure has changed to a percentage value instead of a numeric value. The number of animal management prosecutions remains within the expected range.	

Aquatic Facilities

Provision of indoor and outdoor aquatic facilities to the community and visitors for wellbeing, water safety, sport and recreation

Service indicator/measure	Measure expressed as:	Q2 YTD 2022/23	Q2 YTD 2021/22	EoY 2021/22	EoY 2020/21	Comment	Status
Service standard Health inspections of aquatic facilities	Number of health inspections per Council aquatic facility *Expected range: 1 to 4 inspections*	**2 inspections**	*1 inspection*	*1 inspection*	*2 inspections*	From 1 January 2021, aquatic facilities were required to be registered with Council. Inspections are carried out by Council's Community Health team for each aquatic facility annually, with a follow up inspection if required. Annual health inspections are conducted annually in November and December 2022, and all have now been completed.	
Utilisation Utilisation of aquatic facilities	Number of visits to aquatic facilities per head of municipal population *Expected range: 1 to 10 visits*	**3.37 visits**	*0.76 visits*	*4.43 visits*	*3.34 visits*	The municipality has three Council-owned and operated aquatic facilities. The utilisation of aquatic facilities has increased when compared to the same time in the previous financial year and is beginning to resemble pre-COVID attendance numbers.	
Service cost Cost of aquatic facilities	$ direct cost less any income received of providing aquatic facilities per visit *Expected range: $3 to $20*	**$0.85**	*$14.45*	*$2.91*	*$5.70*	This measure considers the overall cost to Council of running its aquatic facilities less revenue received. The cost of aquatic facilities per visit has decreased compared to the same time last financial year due to an increase in the number of visits and the reduced impacts from COVID19.	

Food Safety

Provision of food safety services to the community including registrations, education, monitoring, inspections and compliance

Service indicator/measure	Measure expressed as:	YTD Calendar Year (Q4) 2022	YTD Calendar Year (Q4) 2021	EOY Calendar Year 2021	EoY Calendar Year 2020	Comment	Status
Timeliness Time taken to action food complaints	Number of days taken to action food complaints *Expected range: 1 to 10 days*	***1.53 days***	*1.51 days*	*1.67 days*	*1.95 days*	The indicator measures the average number of days taken for Council to respond to food complaints from receipt to first response action. Data shown is for the 2022 calendar year to align with reporting to the Department of Health (DoH). The number of days to action food complaints is within expected range. Where possible Council and the Environmental Health Officer's ensure they respond to requests as soon as they are received.	
Service standard Food safety assessments	% of registered class 1 food premises and class 2 food premises that receive an annual food safety assessment *Expected range: 50% to 120%*	**98.24%**	*98.11%*	*99.11%*	*93.61%*	This measure relates to the percentage of registered Class 1 food premises and Class 2 food premises that receive an annual food safety assessment. Data shown is for the 2022 calendar year to align with reporting to the Department of Health (DoH). The number of food safety assessments decreased slightly due to premises transferring ownership late in the calendar year, meaning assessments for these premises are now not due until 2023.	
Service cost	$ direct cost of the food safety service per registered food premises	**$347.53 (financial year)**	*$317.77 (financial year)*	*$641.56 (financial year)*	*$599.36 (financial year)*	This measure captures the direct cost of providing food safety services per food premises. The	

Cost of food safety service	*Expected range: $300 to $1,200*					cost of the food safety service has increased slightly compared to the same time in the previous financial year due to workforce fluctuations.	
Health and safety Critical and major non-compliance notifications	% of critical and major non-compliance outcome notifications that are followed up by council *Expected range: 60% to 100%*	***100%***	*100%*	*83.33%*	*100%*	This indicator measures the percentage of critical and major non-compliance outcome notifications that are followed up by Council. Council aims to respond to 100% of these notifications. Data shown is for the 2022 calendar year to align with reporting to the Department of Health (DoH). There was no variation compared to the same time in the previous financial year.	

Governance

Provision of good governance to the community including making and implementing decisions with reference to community engagement, policy frameworks and agreed practice

Service indicator/measure	Measure expressed as:	Q2 YTD 2022/23	Q2 YTD 2021/22	EoY 2021/22	EoY 2020/21	Comment	Status
Transparency Council resolutions at meetings closed to the public	% of Council resolutions made at meetings closed to the public *Expected range: 0% to 30%*	**10.67%**	*27.66%*	*15.49%*	*13.13%*	This indicator measures the percentage of Council resolutions made at an ordinary or special Council meeting, or at a meeting of a special committee consisting only of Councillors, closed to the public under Section 66 of the *Local Government Act 2020*. The percentage of Council resolutions at meetings closed to the public has decreased due to less tender evaluation recommendations/ reports that required Council approval (>$500,000).	
Consultation and engagement Satisfaction with community consultation and engagement	Satisfaction rating out of 100 *Expected range: 40 to 70*	***Not available***	*Not available*	*59*	*55*	Satisfaction is measured as part of the annual Community Satisfaction Survey, with results to be made available in June 2023.	
Attendance Council attendance at Council meetings	% of Council attendance at ordinary and special Council meetings *Expected range: 80% to 100%*	**90.48%**	*83.33%*	*83.33%*	*92.86%*	Each year, a range of ordinary and special meetings of Council are held. This indicator measures the overall attendance levels for these meetings. The percentage of attendance at Council meetings has increased compared to the previous	

						financial year due to easing of coronavirus (COVID-19) restrictions.	
Service cost Cost of elected representation	$ direct cost of the governance service per councillor *Expected range: $30,000 to $80,000*	**$25,587.89**	*$22,826.56*	*$54,133.44*	*$46.640.44*	This measure captures the direct cost of delivering the governance service per elected representative. The cost of elected representation has increased slightly when compared to the same time in the previous financial year due to increase in activities as the Council term progresses.	
Decision making Satisfaction with Council decisions	Satisfaction rating out of 100 *Expected range: 40 to 70*	***Not available***	*Not available*	*59*	*60*	Satisfaction is measured as part of the annual Community Satisfaction Survey, with results to be made available in June 2023.	

Libraries

Provision of print and digital based resources to the community in a variety of formats including collection services, e-services, research tools and interactive learning programs

Service indicator/measure	Measure expressed as:	Q2 YTD 2022/23	Q2 YTD 2021/22	EoY 2021/22	EoY 2020/21	Comment	Status
Utilisation Physical library collection usage	Number of physical library collection item loans per library collection item *Expected range: 1 to 9 items*	**4.26**	*2.37*	*6.22*	*4.97*	Maroondah is a member of the Eastern Regional Libraries Corporation, which is a co-operative venture serving three outer eastern metropolitan councils. These results relate to libraries in the Maroondah municipality, which are located in Croydon and Ringwood (Realm). The number of physical collection loans showed a slight increase compared to the same time in the previous financial year due to the removal of coronavirus (COVID-19) restrictions.	
Resource standard Recently purchased library collection	% of recently purchased library collection that has been purchased in the last 5 years *Expected range: 40% to 90%*	**78.86%**	*78.11%*	*78.43%*	*79.27%*	This measure refers to the percentage of the library collection that has been purchased in the last five years. There is only slight variation of the percentage of the library collection recently purchased compared to the same time in the previous financial year.	
Participation Active library members	% of the municipal population that are active library members *Expected range: 10% to 40%*	**9.95%**	*12.87%*	*12.03%*	*13.83%*	This indicator highlights the percentage of the municipal population that are active library members. The number of active library borrowers within the municipality can be expected to	

						vary over time. Borrowing can include print and loan identifiable digital materials. The number of active borrowers has decreased slightly compared to the previous financial year as this measure is tracked over three years, two of which were significantly impacted by the (COVID-19) coronavirus pandemic.	
Service cost Cost of library service	$ direct cost of the library service *Expected range: $10 to $90*	**$10.01**	*$9.66*	*$19.71*	*$17.37*	This measure captures the direct cost of the library service per municipal population. Cost of library services per population has been consistent, even with the change in the indicator moving from cost of library service per visit to per population in 2020. Cost of library services per population has been consistent and in line with expected increases.	

Maternal and Child Health

Provision of universal access to health services for children from birth to school age and their families including early detection, referral, monitoring and recording child health and development

Service indicator/measure	Measure expressed as:	Q2 YTD 2022/23	Q2 YTD 2021/22	EoY 2021/22	EoY 2020/21	Comment	Status
Service standard Infant enrolments in the MCH service	% of infants enrolled in the MCH service *Expected range: 90% to 110%*	**100.57%**	*102%*	*101.33%*	*101.09%*	The Maternal Child Health (MCH) service enrols newborn infants in the service at the home visit following receipt of a birth notification from the hospital. All birth notifications received by Council result in an MCH enrolment, however, the phasing of birth notifications and enrolment across reporting periods can result in the reported figure being less than or greater than 100%.	
Service cost Cost of the MCH service	$ cost of the MCH service per hour of service delivered *Expected range: $50 to $200*	**$71.38**	*$153.09*	*$76.47*	*$97.53*	This measure refers to the cost of Councils MCH service per hour of service delivered. The cost has decreased due to nurse vacancies not filled.	
Participation Participation in MCH service	% of children enrolled who participate in the MCH services *Expected range: 70% to 100%*	**43.79%**	*44.08%*	*73.42%*	*76.19%*	This measure captures participation of children in key age and stage appointments which can vary due to timing of appointments during the financial year.	
Participation Participation in MCH service by Aboriginal children	% of Aboriginal children enrolled who participate in the MCH service *Expected range: 60% to 100%*	**44.19%**	*52.50%*	*84.69%*	*78.31%*	This measure captures the percentage of Aboriginal children enrolled who participate in the MCH service, which can vary due to timing of appointments during the financial year.	
Satisfaction Participation in first MCH home visit	% of infants enrolled in the MCH service who receive the first MCH home visit *Expected range: 90% to 110%*	**88.54%**	*105.71%*	*101.33%*	*96.99%*	This measure considers the percentage of infants enrolled in the Maternal Child Health (MCH) service who participated in 4-week Key Age and Stage visit. The percentage remains at 100%. Anything below 100% reflects appointments made	

						but not yet attended within the financial year.	

Roads

Provision of a network of sealed local roads under the control of the municipal council to all road users

Service indicator/measure	Measure expressed as:	Q2 YTD 2022/23	Q2 YTD 2021/22	EoY 2021/22	EoY 2020/21	Comment	Status
Satisfaction of use Sealed local road requests	Number of sealed local road requests per 100 kilometres of sealed local road *Expected range: 10 to 120 requests*	**63.41**	*0.47*	*113.31*	*93.96*	Road requests are defined as customer requests logged within the Council corporate customer service application Infor Pathway. Requests include line marking, pothole repairs, damaged roads and patching, and road sweeping. The number of sealed road requests has increased due to more motorists being on the road following the easing coronavirus (COVID-19) restrictions.	
Condition Sealed local roads below the intervention level	% of sealed local roads that are below the renewal intervention level *Expected range: 80% to 100%*	**97.71%**	*93.24%*	*98.65%*	*98.85%*	Council defines a technical level of service intervention figure to be a Pavement Condition Index (PCI) of 5 in Council's pavement management system, SMEC Pavement Management System. The deterioration of our road network has been modelled by our PMS. There was only minor variation in this result when compared to the previous year.	
Service cost Cost of sealed local road reconstruction	$ direct reconstruction cost per square metre of sealed local roads reconstructed *Expected range: $20 to $200*	**Not available**	*Not available*	*$385.77*	*$250.31*	The total project cost associated with the reconstruction of a sealed local road is considered. The project cost may include but is not limited to traffic control, road base, road surface, kerb,	

						stormwater drain and traffic management device costs. Some works have commenced in the second quarter however the costs have not been fully released. This measure will be updated in coming quarters.	
Service cost Cost of sealed local road resealing	$ direct resealing cost per square metre of sealed local roads resealed *Expected range: $4 to $30*	**Not available**	*Not available*	*$36.89*	*$25.37*	Council only uses asphalt products for resealing in line with community expectations. Generally, where advanced pavement deterioration is present (i.e. crocodile cracking) Council undertakes deep lift patching prior to resealing. Only reseals for a full road block as defined in Council's asset register has been included in this figure. Reseals that do not cover an entire road block are considered to be a patch and are not included. Some works have commenced in the second quarter however the costs have not been fully released. This measure will be updated in coming quarters.	
Satisfaction Satisfaction with sealed local roads	Satisfaction rating out of 100 *Expected range: 50 to 100*	**Not available**	*Not available*	*63*	*67*	Satisfaction is measured as part of the annual Community Satisfaction Survey, with results to be made available in June 2023.	

Statutory Planning

Provision of land use and development assessment services to applicants and the community including advice and determination of applications

Service indicator/measure	Measure expressed as:	Q2 YTD 2022/23	Q2 YTD 2021/22	EoY 2021/22	EoY 2020/21	Comment	Status
Timeliness Time taken to decide planning applications	Days between receipt of a planning application and a decision on the application *21.25Expected range: 30 to 110 days*	34	*26*	*29*	*28*	This measure looks at the median number of days taken between receipt of a planning application and a decision on the application. In addition to Councils dedication to provide timely decisions, Councils electronic planning application processes allowed for more efficient processing time. The time taken to decide on planning applications remains low at 34 days on average for the quarter. This is at the lower end of the target range of between 30 and 110 days.	
Service standard Planning applications decided within 60 days	% of planning application decisions made within required timeframe days *Expected range: 40% to 100%*	**74.74%**	*86.58%*	*83.54%*	*86.87%*	In accordance with the Planning and *Environment Act 1987*, a council is permitted 60 statutory days to determine a planning application. The 60 statutory days includes weekends, public holidays and commences when the application is lodged. The legislation allows for the 60-day statutory clock to be stopped and re-started in certain circumstances. The number of planning applications decided within required timeframes decreased compared to the same time in the previous financial year due to staff movements and recruitment.	

Service cost							
Cost of statutory planning service	$ direct cost of the statutory planning service per planning application *Expected range: $500 to $4,000*	**$1,373.47**	*$1,706.06*	*$1917.15*	*$1,919*	This measure looks at the direct cost of Council to provide the statutory planning service per planning application received. The direct cost of the statutory planning service was higher than the same time in the previous financial year due to there being a reduction in the number of planning applications.	
Decision making							
Planning decisions upheld at VCAT	% of decisions subject to review by VCAT that were not set aside *Expected range: 30% to 100%*	**93.33%**	*83.33%*	*89.19%*	*81.82%*	If an applicant disagrees with the decision of Council in relation to a planning application, they have the opportunity to appeal the decision at the Victorian Civil and Administrative Tribunal (VCAT). This indicator measures the percentage of planning application decisions made by Council, appealed by an applicant and subject to review by VCAT that were not set aside (i.e. VCAT agreed with the decision of Council). Of the nine VCAT decisions made, 9 have been upheld by the Tribunal, resulting in a success rate of 93% of Council decisions being affirmed.	

Waste Collection

Provision of kerbside waste collection service to the community including garbage and recyclables

Service indicator/measure	Measure expressed as:	Q2 YTD 2021/22	Q2 YTD 2020/21	EoY 2021/22	EoY 2020/21	Comment	Status
Satisfaction							
Kerbside bin collection requests	Number of kerbside bin collection requests per 1000 kerbside bin collection households *Expected range: 10 to 300 requests*	**44.03**	*44.45*	*88.87*	*76.91*	Council provides a comprehensive waste management service that strives to meet best practice standards in terms of kerbside collection. This indicator focuses on the kerbside bin collection service. Council provides a three-bin waste collection service (garbage, recyclables, and green organics). These requests relate to cancellations, damaged bin repairs/replacements or replacing stolen bins. This figure tends to fluctuate according to population movement within the municipality.	
Service standard							
Kerbside collection bins missed	Number of kerbside collection bins missed per 10,000 scheduled kerbside collection bin lifts *Expected range: 1 to 20 bins*	**5.57**	*4.71*	*4.7*	*4.55*	This indicator identifies the ratio of bins missed compared to scheduled bin collections. This includes 120L, 80L, second bin and fortnightly recycling kerbside bin collection. There was a slight increase in kerbside bin collections missed compared to the same time in the previous year due to a change in contract with trucks and drivers now from a different depot, which has a different disposal site. It is expected that this measure will improve going forward as drivers start to get use to their routes.	

Service cost Cost of kerbside garbage collection service	$ direct cost of the kerbside garbage bin collection service per kerbside garbage collection bin *Expected range: $40 to $150*	**$65.49**	*$66.01*	*$131.30*	*$109.55*	This measure looks at the direct cost of Council to provide the kerbside garbage bin collection service per kerbside garbage bin. The cost of the kerbside garbage collection increased slightly due to an increase in the landfill levy from $105.90 per tonne to 125.90 as of 1 July 2022 as well as an increase in fuel prices.	
Service cost Cost of kerbside recyclables collection service	$ direct cost of the kerbside recyclables collection service per kerbside recyclables collection bin *Expected range: $10 to $80*	**$33.44**	*$37.94*	*$75.74*	*$77.45*	This measure looks at the direct cost of Council to provide the kerbside recyclables collection service per kerbside recyclables bin. There is only slight variation in the cost of kerbside recyclables compared to the same time in 2021/22.	
Waste diversion Kerbside collection waste diverted from landfill	% of garbage, recyclables and green organics collected from kerbside bins that is diverted from landfill *Expected range: 20% to 60%*	**56.22%**	*57.22%*	*55.50%*	*56.71%*	This measure refers to the percentage of garbage, recyclables and green organics collected from kerbside bins that is diverted from landfill. There is only a slight variation on the amount of waste diverted from landfill compared to the same time in 2021/22	

FINANCIAL REPORT

Six months ended

30 December 2022



Financial Report
Six months ended 30 December 2022

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Financial Report
Six months ended 30 December 2022

1. Income Statement

For the six months ending 30 December 2022

	YTD Forecast Budget	YTD Actual	YTD Forecast Variance	Annual Forecast	Adopted Budget	Variance Adopted to Forecast
	$'000	$'000	$'000	$'000	$'000	$'000
Income						
Rates & charges	101,736	101,708	(28)	102,347	102,337	10
Statutory fees & fines	2,173	2,271	98	5,119	5,190	(71)
User fees	14,666	15,306	639	28,027	28,262	(235)
Contributions - cash	3,408	3,441	33	6,796	5,925	871
Grants - Operating (recurrent)	2,649	2,682	33	8,919	8,314	605
Grants - Operating (non-recurrent)	864	792	(71)	16,467	446	16,022
Other Income	1,259	1,356	97	1,632	1,178	454
Net gain (loss) on disposal of property, infrastructure, plant & equipment	139	394	255	(113)	(93)	(20)
Total Income	**126,893**	**127,949**	**1,055**	**169,193**	**151,558**	**17,635**
Expenses						
Employee costs	31,923	31,669	255	64,052	63,388	(664)
Materials and services	17,170	15,567	1,604	31,069	30,258	(812)
Contractors	13,322	11,315	2,007	41,506	25,950	(15,556)
Depreciation and amortisation	13,604	13,605	0	27,209	27,209	0
Amortisation - Right of Use Assets	0	0	0	862	862	0
Finance costs	182	182	1	355	926	571
Finance Costs - Leases	0	0	0	61	61	0
Other Expense	828	626	202	770	769	(1)
Total expenses	**77,030**	**72,962**	**4,068**	**165,884**	**149,423**	**(16,461)**
Underlying Surplus (Deficit)	**49,864**	**54,987**	**5,123**	**3,309**	**2,135**	**1,174**
Grants - Capital (recurrent and non-recurrent)	4,702	4,685	(18)	27,761	23,585	4,176
Comprehensive result	**54,566**	**59,671**	**5,106**	**31,070**	**25,720**	**5,350**

Financial Report
Six months ended 30 December 2022

2. Balance Sheet - as at 31 December 2022

	31/12/2022 $ '000	31/12/2021 $ '000	30/06/2022 $ '000
Assets			
Current assets			
Cash and cash equivalents	11,916	16,227	45,875
Trade and other receivables	79,958	70,848	29,071
Other financial assets	66,320	29,840	22,925
Inventories	475	467	480
Other assets	398	1,001	724
Total current assets	**159,068**	**118,383**	**99,076**
Non-current assets			
Trade and other receivables	447	571	571
Other financial assets	1,057	1,057	1,057
Investments in associates, joint arrangements and subsidiaries	2,534	3,733	2,533
Property, infrastructure, plant and equipment	2,000,493	1,943,930	2,014,272
Right-of-use assets	1,308	2,149	1,308
Intangible assets	748	874	748
Total non-current assets	**2,006,586**	**1,952,314**	**2,020,489**
Total assets	**2,165,654**	**2,070,697**	**2,119,564**
Liabilities			
Current liabilities			
Trade and other payables	(8,451)	(12,576)	(9,881)
Trust funds and deposits	(13,359)	(5,231)	(6,537)
Unearned income - Operating Grants	(10,770)	(10,844)	(11,529)
Unearned income - Capital Grants	(5,917)	(14,519)	(4,421)
Provisions	(13,895)	(14,543)	(13,909)
Interest-bearing liabilities	(1,617)	(1,578)	(2,715)
Lease liabilities	(93)	(934)	(645)
Total current liabilities	**(54,102)**	**(60,225)**	**(49,637)**
Non-current liabilities			
Trust funds and deposits	(330)	(330)	(330)
Unearned income - Capital Grants	(25,549)	-	(25,661)
Provisions	(1,507)	(1,507)	(1,507)
Interest-bearing liabilities	(20,967)	(13,479)	(21,562)
Lease liabilities	(1,252)	(1,252)	(699)
Total non-current liabilities	**(49,605)**	**(16,568)**	**(49,759)**
Total liabilities	**(103,707)**	**(76,793)**	**(99,396)**

Financial Report
Six months ended 30 December 2022

Net assets	**2,061,947**	**1,993,904**	**2,020,168**
Equity			
Accumulated surplus	902,545	837,204	848,766
Surplus (deficit) for period		55,517	-
Reserves	1,159,403	1,101,183	1,171,402
Total equity	**2,061,947**	**1,993,904**	**2,020,168**

Financial Report
Six months ended 30 December 2022

3. Statement of Cash Flows

For the six months ended 31 December 2022

	31/12/2022 $'000	31/12/2021 $'000
Cash flows from operating activities		
Rates and charges	43,503	34,513
Statutory fees and fines	2,271	2,141
User fees	22,648	13,394
Grants - operating	3,474	6,191
Grants - capital	4,685	7,767
Contributions - monetary	3,441	3,249
Interest received	1,456	281
Trust funds and deposits taken	2,448	3,422
Net GST refund/payment	7,901	
Employee costs	(31,270)	(29,366)
Materials and services	(26,918)	(22,514)
Short-term, low value and variable lease payments	552	-
Trust funds and deposits repaid	(2,240)	(3,960)
Net cash provided by/(used in) operating activities	**31,950**	**15,118**
Cash flows from investing activities		
Payments for property, infrastructure, plant and equipment	(40,434)	(34,234)
Proceeds from sale of property, infrastructure, plant and equipment	568	500
Payments for investments	(47,457)	(33,191)
Proceeds from sale of investments	23,359	41,268
Net cash provided by/(used in) investing activities	**(63,965)**	**(25,657)**
Cash flows from financing activities		
Finance costs	(182)	(388)
Repayment of borrowings	(1,210)	(761)
Interest paid - lease liability	-	-
Repayment of lease liabilities	(552)	-
Net cash provided by/(used in) financing activities	**(1,944)**	**(1,149)**
Net increase (decrease) in cash and cash equivalents	(33,959)	(11,687)
Cash and cash equivalents at the beginning of the financial year	45,875	27,914
	11,916	**16,227**

Financial Report
Six months ended 30 December 2022

4. Statement of Capital Works

For the six months ending 30 December 2022

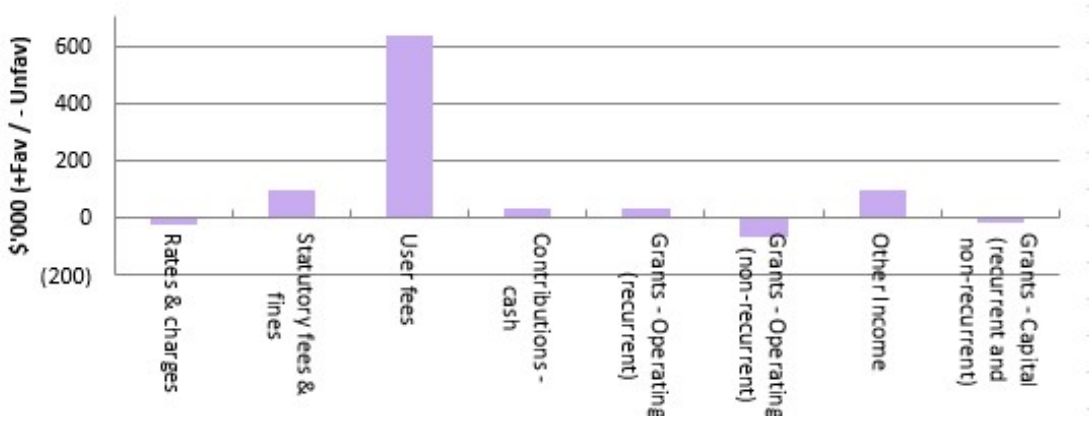
	YTD Forecast Budget	YTD Actual *	YTD Bud Var	Forecast Budget **	Amount Carried Forward	Adopted Budget
	$'000	$'000	$'000	$'000	$'000	$'000
Classification						
Buildings	5,627	7,837	**(2,210)**	14,575	5,228	2,800
Roads	2,173	2,213	**(40)**	4,258	778	2,638
Footpaths and Cycleways	1,361	1,173	**188**	2,601	221	3,446
Carparks	478	451	**27**	19,491	440	24,050
Drainage	1,421	1,394	**27**	6,165	1,559	4,292
Waste Management	831	829	**2**	2,587	37	2,550
Other Capital Roads and Drainage	182	158	**24**	1,436	667	1,045
Recreational Leisure and Community Facilities	1,345	1,593	**(248)**	1,888	348	1,201
Parks and Open Space	769	732	**37**	2,533	697	2,197
Commercial Centres	0	0	**0**	220	0	0
Fixtures, Fittings and Furniture	87	56	**31**	133	33	95
Plant, Machinery and Equipment	1,649	1,250	**399**	3,698	500	3,238
Computers and Telecommunications	111	125	**(14)**	1,802	1,618	359
Property Sales	0	(9)	**9**	0	0	0
Building Renewal	578	573	**5**	1,153	651	3,787
Total capital works	**16,612**	**18,375**	**(1,763)**	**62,540**	**12,777**	**51,698**

* YTD Actual expenditure includes Carried Forwards
** Forecast Budget expenditure includes Carried Forwards, future years' projects brought into this year and projects related to new capital grants

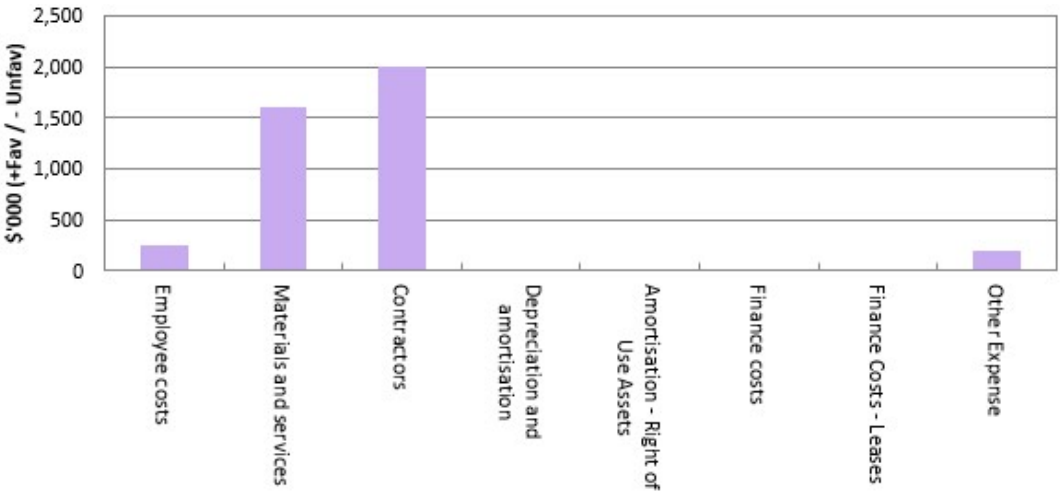
Financial Report
Six months ended 30 December 2022

5. Financial and Capital Analysis

Income – YTD Forecast Budget variances



Expenses – YTD Forecast Budget variances



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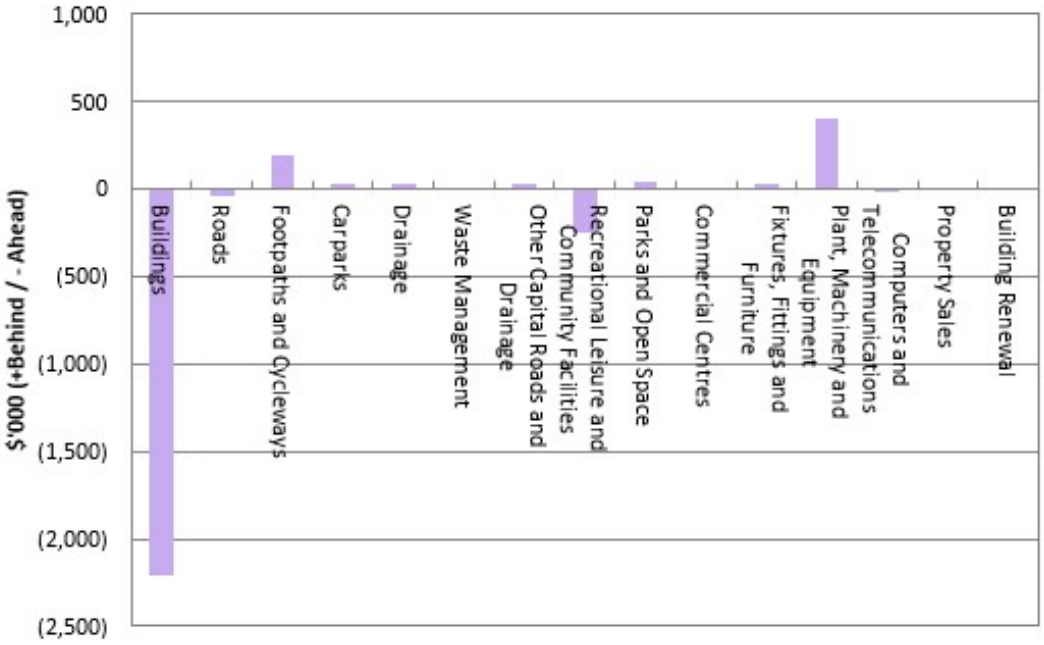
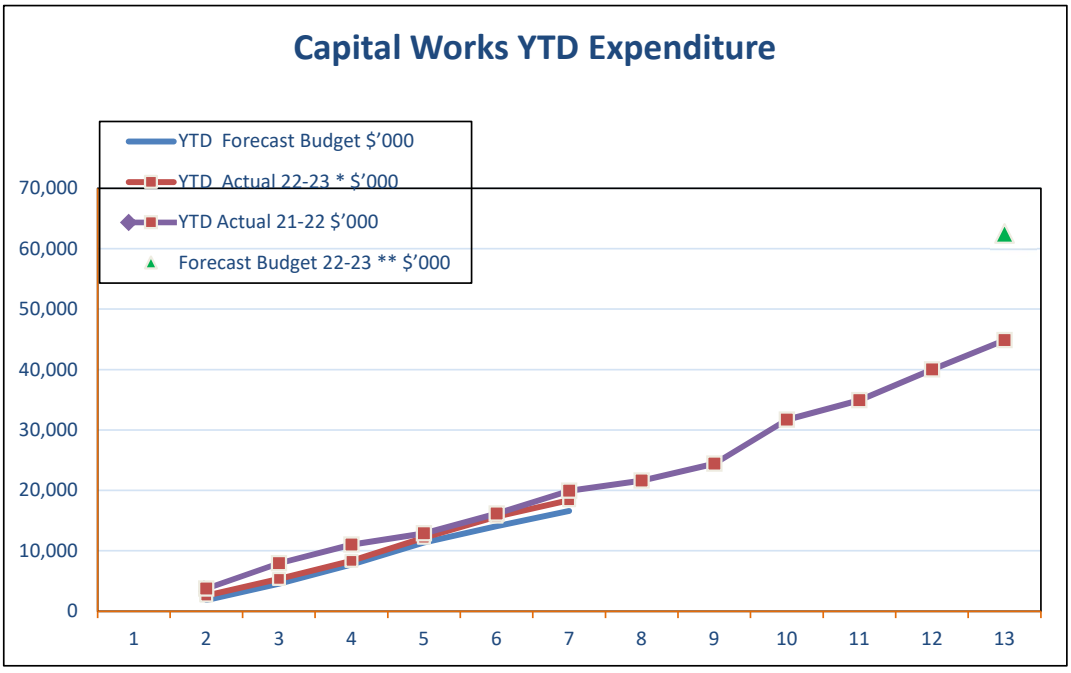
Capital Works – YTD Forecast Budget variances by asset class



Capital works YTD expenditure cumulative



*YTD Actual expenditure includes Carried Forwards

**Forecast Budget expenditure includes Carried Forwards and future years' projects brought forward

Financial Report
Six months ended 30 December 2022

These graphs demonstrate that the capital program is on par with overall budget predictions.

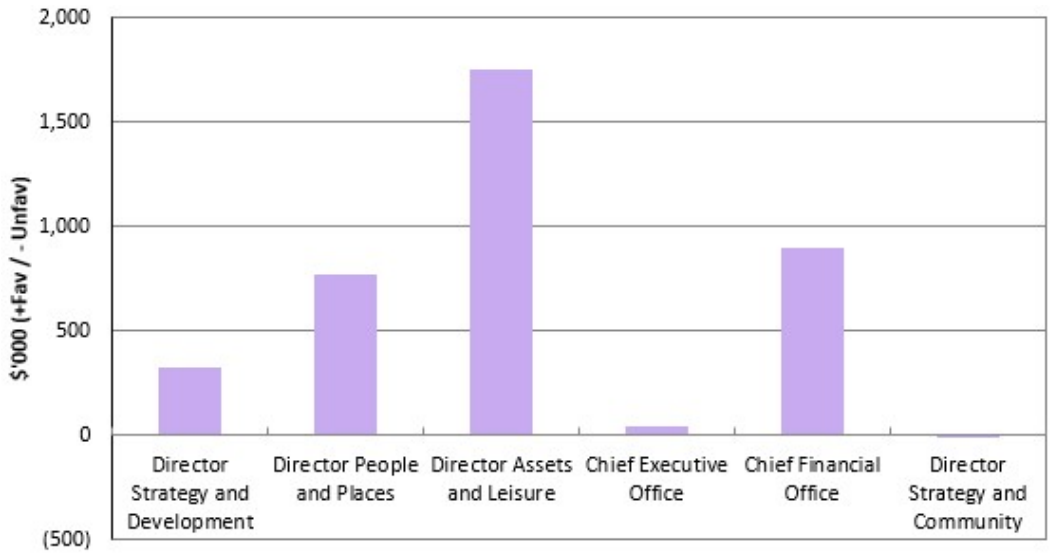
Financial Report
Six months ended 30 December 2022

Directorate Analysis

	YTD Forecast Net $'000	YTD Actual Net $'000	YTD Bud Var Net $'000	Annual Forecast Net $'000
Department				
Director Strategy and Development	(2,278)	(1,952)	326	(4,168)
Director People and Places	(7,709)	(6,942)	768	(17,032)
Director Assets and Leisure	(15,032)	(13,282)	1,750	(28,647)
Chief Executive Office	(682)	(643)	39	(1,406)
Chief Financial Office	73,827	74,726	899	50,795
Director Strategy and Community	(167)	(181)	(14)	(184)
	47,958	**51,727**	**3,769**	**(643)**
Capital Gains & Contributions	4,702	4,685	17	27,761
Net (Gain)/Loss on disposal of equipment	139	394	255	(113)
Other non-attributable	112,927	112,916	(44)	78,686
Net (surplus) deficit	165,726	169,721	3,997	105,692

* Other non-attributable includes rate & charges revenue, grants commission, depreciation, and insurance.

Department net cost YTD Budget variances (depiction of the table above)



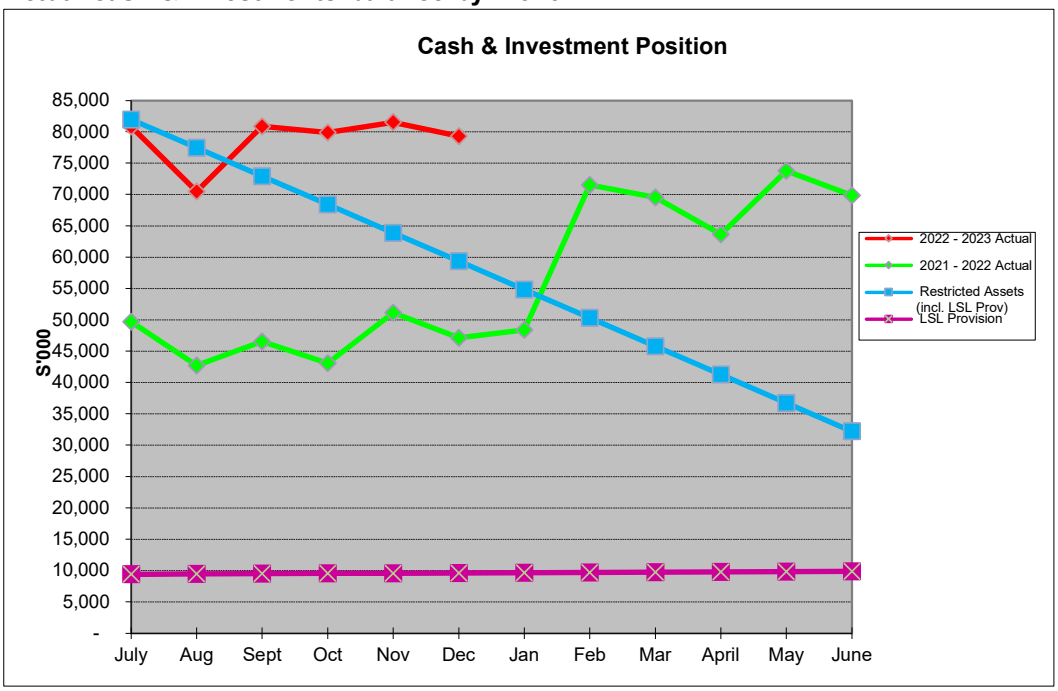
Financial Report
Six months ended 30 December 2022

6. Financial Position

	2022-23 December Actual $'000	2021-22 December Actual $'000	2022-23 Adopted Budget $'000	2021-22 June EOFY Actual $'000
Cash and investments	**79,294**	**47,124**	**32,850**	**69,856**
Net current assets	**104,966**	**58,158**	**10,378**	**50,256**
Net assets and total equity	**2,061,947**	**1,993,904**	**2,003,755**	**2,020,168**

The Financial Position as at 31 December 2022 shows cash and investment balances of approximately $80 million and a net current asset position of $105 million. The net asset position as at 31 December 2022 is $2.06 billion. Cash and investment balances are above expectations identified in the Long-Term Financial Strategy for the current period of 2022/2023.

Actual cash & investments balance by month



This graph reflects that there are sufficient cash reserves to cover both restricted assets and any fluctuations in cash flow. The levels fluctuate during the year in line with inflows from peak rate payment periods and expense cycles. Restricted Assets refer to unexpended grants and developer's contributions as well as provision for Long Service Leave.

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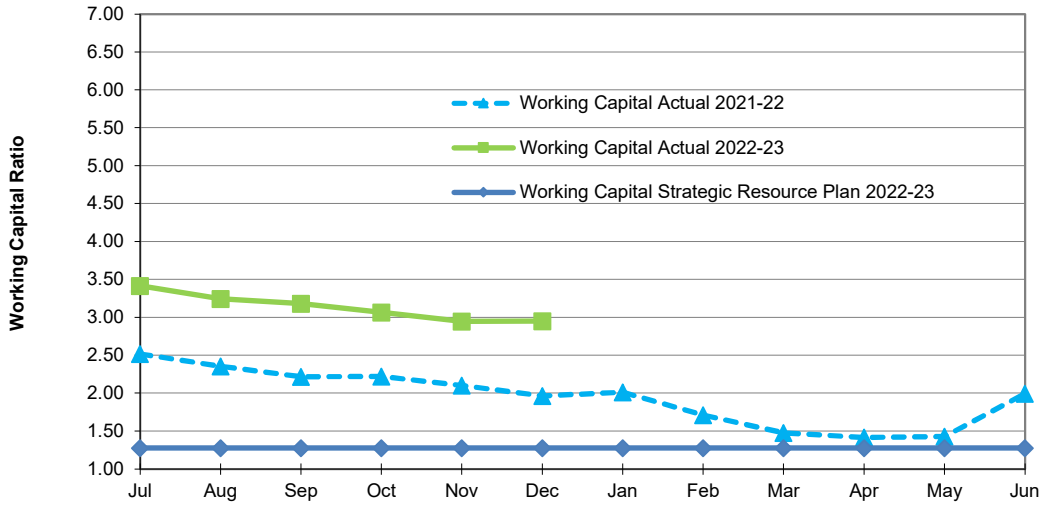
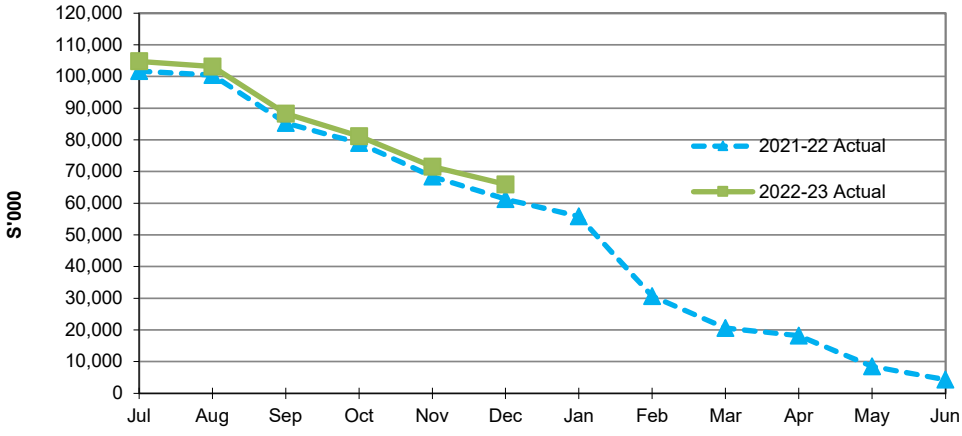
Actual working capital ratio by month
(Current Assets / Current Liabilities)



The working capital ratio is a measure of liquidity. It is always essential for this figure to be greater than 1.00, with the VAGO recommended level being more than 1.50.
Council's working capital ratio as at 31 December 2022 is 2.95.

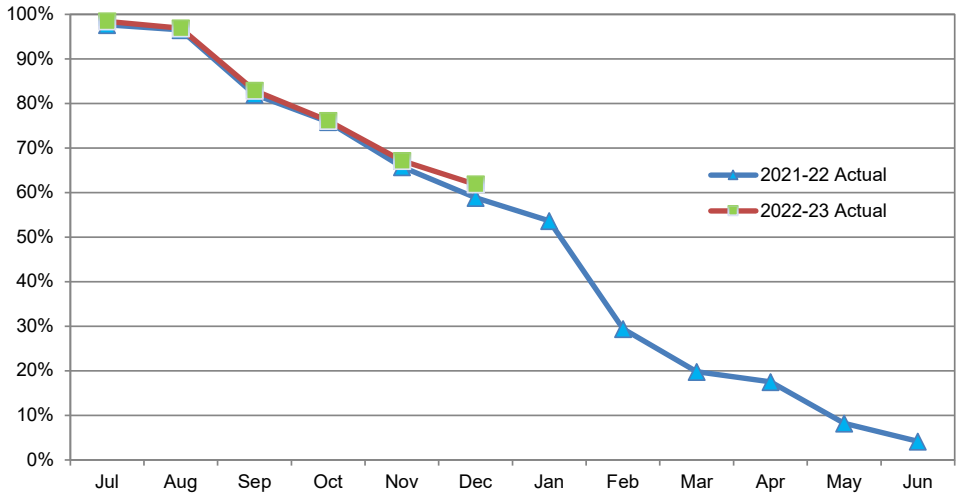
Actual rates outstanding balances by month



The December result indicates a similar trend of rates outstanding as compared to the same stage last year, taking into account rates being struck in July of this year.

Financial Report
Six months ended 30 December 2022

Rates debtor collection rate by %

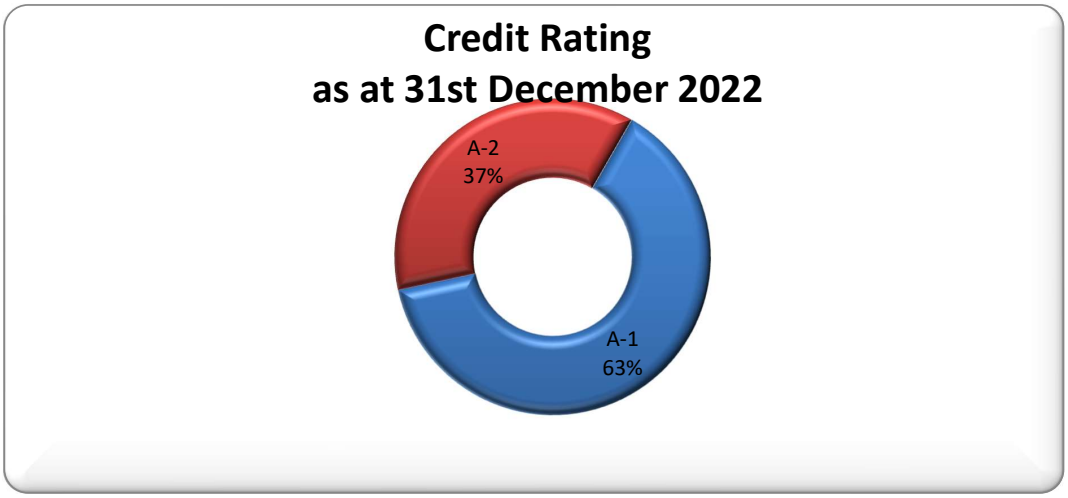


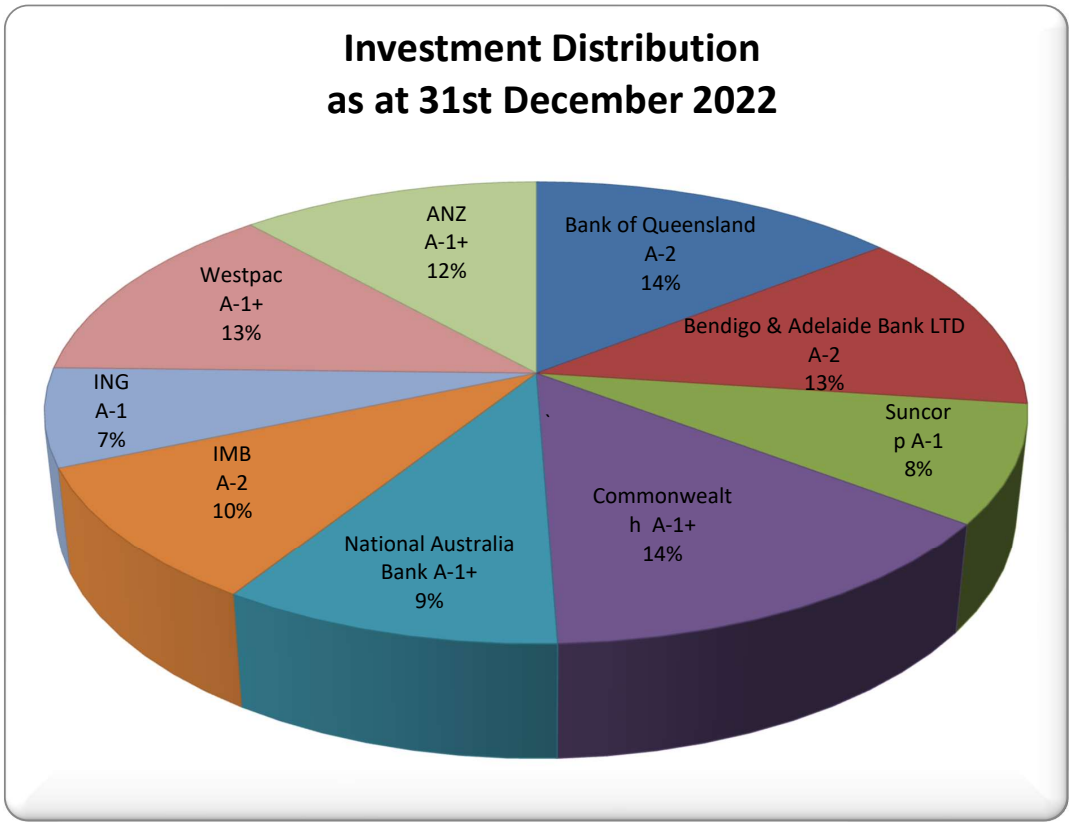
Rate debtor's collection levels during 2022/2023 are in line with expectations, taking into account rates being struck in July of this year.

Financial Report
Six months ended 30 December 2022

7. Cash and Investments

The following graphs indicate the diversification and credit ratings of the investment portfolio at the end of December. The table lists all the investments held as at 31 December 2022. Council's Investment Policy guidelines requests to maintain a portfolio's balance between A-1 and A-2 investments and hold no greater than 15% of the portfolio with one investing partner.





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Six months ended 30 December 2022

	INVESTMENTS AS AT 31 DECEMBER 2022						
	CREDIT	MATURITY	PERIOD	YIELD	TYPE	AMOUNT	
	RATING	DATE	DAYS	%		$	%
Commonwealth	A-1+			0.3	On-Call	3,860,951	5%
National Australia Bank	A-1+	23-Jan-23	75	3.24	Term Dep	2,522,861	3%
IMB	A-2	05-Jan-23	99	3.3	Term Dep	1,507,486	2%
ANZ	A-1+	05-Jan-23	92	3.01	Term Dep	1,500,000	2%
Bank of Queensland	A-2	11-Jan-23	91	3.3	Term Dep	2,023,322	3%
Bank of Queensland	A-2	19-Jan-23	183	3.45	Term Dep	1,003,008	1%
ANZ	A-1+	19-Jan-23	98	3.08	Term Dep	1,509,966	2%
National Australia Bank	A-1+	01-Feb-23	105	3.55	Term Dep	2,520,970	3%
Suncorp	A-1	08-Feb-23	97	3.63	Term Dep	2,526,725	3%
ANZ	A-1+	15-Feb-23	112	3.27	Term Dep	3,019,373	4%
ING	A-1	20-Feb-23	123	3.4	Term Dep	1,021,271	1%
Bank of Queensland	A-2	20-Feb-23	96	3.5	Term Dep	1,011,866	1%
IMB	A-2	27-Feb-23	103	3.5	Term Dep	2,014,671	3%
Commonwealth	A-1+	27-Feb-23	98	3.65	Term Dep	1,005,075	1%
ANZ	A-1+	02-Mar-23	101	3.24	Term Dep	2,526,256	3%
Westpac	AA-	08-Mar-23	105	3.47	Term Dep	2,524,116	3%
National Australia Bank	A-1	15-Mar-23	104	3.71	Term Dep	2,000,000	3%
ING	A-1	15-Mar-23	104	3.31	Term Dep	2,000,000	3%
Bank of Queensland	A-2	23-Mar-23	183	4	Term Dep	1,500,000	2%
Westpac	AA-	29-Mar-23	118	3.72	Term Dep	3,028,208	4%
IMB	A-2	29-Mar-23	98	3.7	Term Dep	2,021,193	3%
Commonwealth	A-1+	29-Mar-23	98	4	Term Dep	3,500,000	5%
IMB	A-2	05-Apr-23	118	3.8	Term Dep	1,510,829	2%
ING	A-1	12-Apr-23	114	3.37	Term Dep	1,012,704	1%
Bendigo & Adelaide Bank LTD	A-2	12-Apr-23	112	3.75	Term Dep	2,000,000	3%
Bendigo & Adelaide Bank LTD	A-2	01-Jun-23	162	4.05	Term Dep	5,000,000	7%
Suncorp	A-1	14-Jun-23	188	4.15	Term Dep	3,540,104	5%
Bank of Queensland	A-2	27-Jul-23	365	4.05	Term Dep	4,011,401	5%
Westpac	AA-	07-Dec-23	365	4.36	Term Dep	4,049,066	5%
Bendigo & Adelaide Bank LTD	A-2	09-Feb-23	365	0.75	Term Dep	1,061,270	1%
Bank of Queensland	A-2	13-Mar-23	1095	1.55	Term Dep	1,057,078	1%
Bendigo & Adelaide Bank LTD	A-2	12-Jul-23	365	3.75	Term Dep	1,331,586	2%
Commonwealth	A-1+	29-Sep-23	365	4.53	Term Dep	2,019,039	3%
ING	A-1	22-Dec-23	365	4.63	Term Dep	1,020,623	1%
						73,761,019	100%

Term Dep = Term Deposit NCD = Negotiable Certificate of Deposit

Council's performance against the industry wide benchmark (Bank Bill Swap Reference Rate – Average Bid which summarises the returns on banks bills over the period chosen) is provided below:

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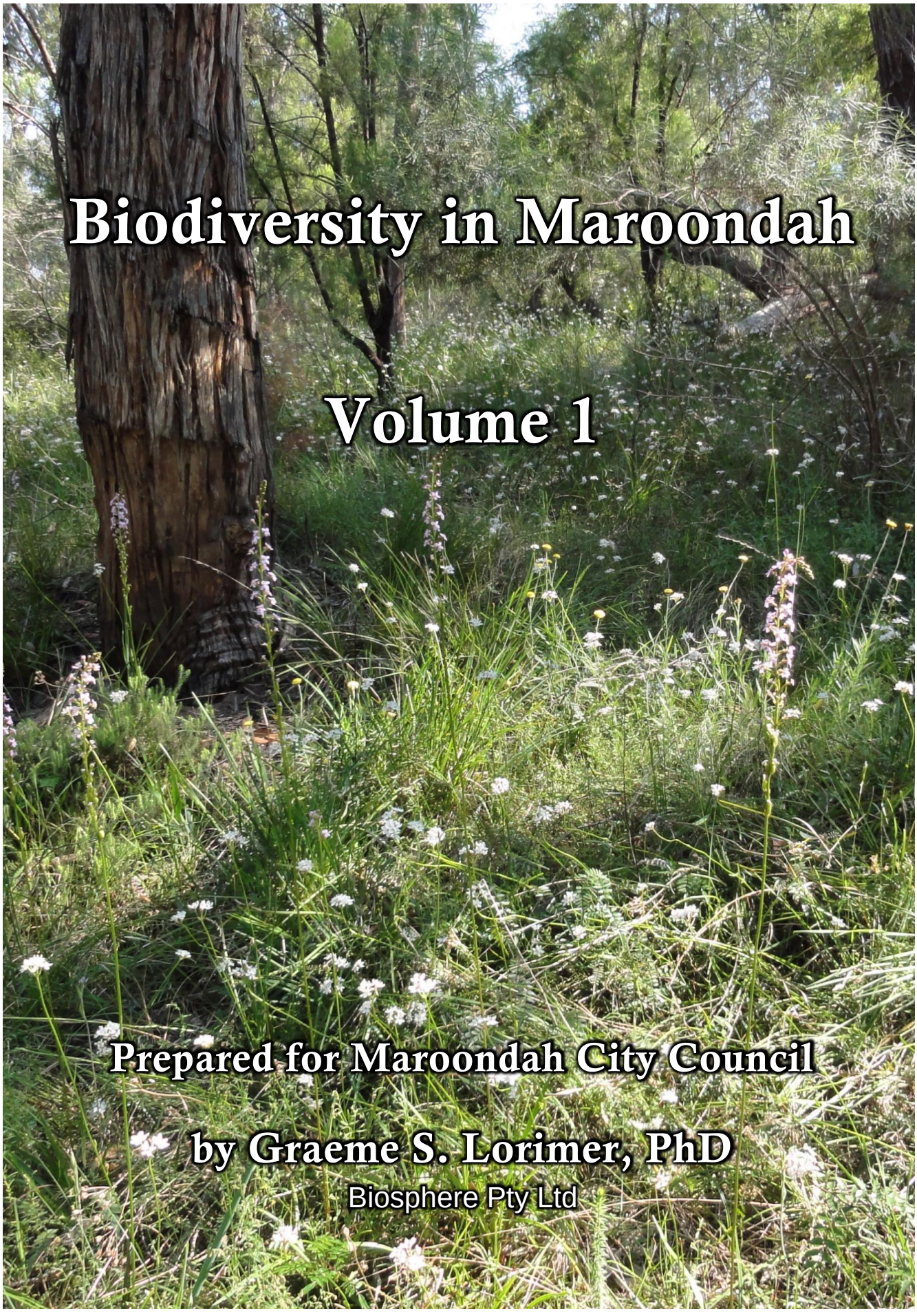
Benchmark: 90 days Bank Bill Swap Reference Rate – Average Bid (Source: Australian Financial Markets Association)	0.19%
Maroondah Investment Portfolio as at 31 December 2022	3.48%


Biodiversity in Maroondah
Volume 1
Prepared for Maroondah City Council
by Graeme S. Lorimer, PhD
Biosphere Pty Ltd

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ABN 28 097 295 504

June 2020

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Preface

The work reported here forms part of a larger investigation by Maroondah City Council called the 'Municipal Wide Vegetation Review'. This report provides information about flora and fauna with a focus on indigenous (locally native) species, communities and habitats. Another consultant's report titled *'Maroondah Canopy & Landscape Analysis 2011 to 2016'* by Kaspar (2018) deals with changes over that period in the municipality's cover of trees, whether indigenous or otherwise. At the time of writing, a team from the University of Melbourne is investigating whether soil-borne *Phytophthora* disease is a cause of a concerningly high rate of eucalypt deaths. There is also a *'Maroondah City Council Vegetation Policy Review'* document by Scott (2018) focused on planning controls.

Maroondah City Council is combining the information from these sources with an internal review of its vegetation-related policies, priorities, practices and planning measures to determine what changes may be desirable. The council has also elicited community views on these matters through the Maroondah Environment Advisory Committee, a public workshop, a stall at the Maroondah Festival and through Council's website.

I would like to thank the following people for assisting the investigation reported here:

- Council officers Peter Newbigin, Doug Evans, Dale Bristow and Luci Johnston, as project managers for Maroondah City Council;
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- Dr Matt Dell for checking my uncertain identifications of mosses and liverworts.

– GSL

Glossary

biodiversity. The diversity of all forms of life, including species, the genetic diversity within each species and the diversity of communities that species form. Biodiversity spans organisms from the smallest virus to the largest trees. Biodiversity cannot be measured simply by the number of distinct species, communities and genetic variants; it takes into account how diverse these things are in size, ecological function, evolutionary origins and other respects.

ecosystem. The combination of a community of living things and the physical features that support it, such as climate, soil and water.

ecosystem services. Practical benefits that flora and fauna provide to humans, such as the shade, wind protection and air purification provided by trees or the pollination of garden plants by insects.

ESO. Environmental Significance Overlay, a mechanism under planning schemes to require a planning permit for specified activities that may have adverse environmental impacts. Unlike a VPO, the ESO can regulate subdivision and works even if vegetation is not involved and even if the impacts are off-site.

herbarium (plural *herbaria*). A collection of plant specimens or a museum where such a collection is housed. Each Australian state and territory has a herbarium and they represent a critical resource for botanical research and studies of the kind reported here.

indigenous. A species of flora or fauna is 'indigenous' to an area if it occurred there prior to European colonisation. A species may be indigenous to one part of Maroondah and not to another.

invertebrate. An animal without a backbone, e.g. an insect, spider, worm or mollusc.

Millennium Drought. The period of record drought in Victoria from c. 2001 to 2010.

SLO. Significant Landscape Overlay, a mechanism under planning schemes to require a planning permit to conduct certain activities such as tree removal that may adversely affect landscape features. An SLO can sometimes provide incidental protection for biodiversity.

taxon (plural *taxa*). Any grouping of organisms in the classification system of living things, particularly a species, subspecies, variety or form. Hybrids can be regarded as taxa even though they combine genes of multiple species.

vertebrate. An animal with a backbone. The vertebrates indigenous to Maroondah include mammals, birds, reptiles, frogs and fish.

VPO. Vegetation Protection Overlay, a mechanism under planning schemes to require a planning permit to remove, lop or destroy specified types of vegetation. It cannot regulate subdivision, land use or works unless vegetation is involved.

wild. A plant or animal is described in this report as 'wild' if it has not been planted or released into the area where it is found. 'Wild' includes descendants of planted plants and descendants of released animals, as long as they are not under direct human control. The species may be indigenous or not.

Executive Summary

This report aims to provide a clear, contemporary understanding of Maroondah's biodiversity: what species and ecosystems it comprises; where it is concentrated; what threatens and sustains it; and what Maroondah City Council and the community can do to protect, restore and improve it.

The report is part of Maroondah City Council's 'Maroondah Vegetation Review'. It also responds to a 'key direction' in the *'Maroondah Sustainability Strategy 2016–2020'* to 'Establish improved monitoring and evaluation of biodiversity in the municipality'.

The meaning and importance of biodiversity

'Biodiversity' means the diversity of all forms of life, including the diversity of species, the genetic diversity within each species and the diversity of communities that species form. This study's primary focus is on flora and vertebrate fauna that are indigenous to Maroondah, particularly those occurring naturally.

The values we place on biodiversity can be divided into five interrelated categories:

- *Practical 'ecosystem services'* such as the shade and wind protection provided by trees;
- *Financial and economic benefits* such as reduction of health expenses;
- *Human attachment to nature*: (a) Fulfilment of humanity's innate desire to engage with nature and feel its inspiration, comfort and restorative powers; and (b) Consequent benefits to human health, wellbeing, childhood development and quality of life;
- *Natural heritage*: Nature's contribution to sense of place and our concepts of who we are, how we fit into history and nature's grand design, and what we should pass on to future generations; and
- *Caring for species other than our own*: Altruistic recognition that humanity should respect nature, independently of any practical benefit that humanity may derive.

Historical changes to biodiversity

Prior to European colonisation, Maroondah's biodiversity changed slowly in response to natural climate change and Aboriginal use and management of the land. Colonisation brought about massive, rapid changes. A few species of indigenous plants and animals have burgeoned but most have declined or died out. Some introduced species have flourished to the detriment of indigenous species, resulting in a net decrease in biodiversity.

Aerial photographs from 1945 show that by then, nearly all of Maroondah had been cleared at least once. The patches of native vegetation left today had few mature trees in 1945, whereas the pre-European tree cover was dominated by large, old eucalypts. The remaining patches of forest today are dominated by eucalypts larger than in 1945 but much smaller than prior to colonisation. The typical density of eucalypts in our forests now is unnaturally high as the result of regrowth from clearing scores of years ago. That appears to be one factor contributing to widespread poor eucalypt health in Maroondah, along with an unnaturally high density of possums due to urbanisation.

The decline in eucalypt health is just one of a number of ecological changes occurring now in Maroondah as a result of actions that occurred scores of years ago. Another is the large change to the way water migrates through soil and down streams, due to drainage works and urbanisation.

Another is fragmentation of habitat, resulting in poor reproduction due to reduced opportunities for pollination or finding unrelated mates.

After these sorts of changes occur, a species or ecological community adapted to the pre-colonisation landscape may persist for scores of years, gradually dwindling until it dies out. Some of Maroondah's species and ecological communities are in such a decline.

Since the turn of the century, the effects of climate change have become increasingly apparent. This study has detected significant changes in flora and fauna over the past quarter-century that appear to be linked to climate change and the resultant drying of the landscape. Extrapolating those changes to the future and having regard to scientific projections about future climate change, nearly all indigenous flora, fauna and ecological communities in Maroondah are under very serious threat.

Current-day species and communities

To determine Maroondah's biodiversity, this study commenced with an exhaustive investigation of past records and documentation of flora, fauna and vegetation communities. This was followed by hundreds of hours of fieldwork over all seasons during 2017–2020, focused on plants but also collecting fauna records incidentally and through spotlighting and frog call surveys. The author's fieldwork produced 14,045 plant records and 1,935 fauna records, each with a species' name, abundance, location and often other information.

Ecological communities

The plants were found to form thirteen recognised communities in the classification system called 'Ecological Vegetation Classes' (EVCs). Stream channels were distinguished as a separate ecological community with their own suite of flora, fauna and ecological processes.

Of the thirteen EVCs, the Victorian Government lists seven as 'endangered' in the region (the highest risk of disappearing), five as 'vulnerable' (the next level of risk) and one as 'Least concern'. A large fraction of Maroondah's total area of native vegetation belongs to 'endangered' EVCs. The presence of a patch of an endangered EVC counts highly under the government's standard criteria for assessing the biological significance of native vegetation. As a result, a high proportion of Maroondah's bushland areas meet the criteria for sites of 'State' significance, meaning they make an important contribution to nature conservation at a state-wide scale.

Plant species

Appendix A (p. 116) provides an inventory of Maroondah's naturally-occurring, indigenous plant species. It includes recent or historical records of:

- 486 flowering species, or 496 if named hybrids and multiple subspecies are included;
- 21 fern species;
- 41 species of moss; and
- 8 species of liverwort.

This makes a total of 556 species, or 566 if named hybrids and multiple subspecies are included.

These species include a surprising number that are listed as threatened with extinction globally or in Victoria. The Kilsyth South Spider-orchid is not known to occur anywhere on Earth except one reserve. An undescribed wallaby-grass species from the same area may also be unique in the world. Maroondah is also one of four municipalities world-wide where the endangered, recently-

described flat-pea, *Platylobium infecundum*, grows. Nine other local species are not quite as rare or threatened but still listed for protection by the state and/or federal government.

Based on this study's fieldwork and research, 78 indigenous species of ferns and flowering plants in Appendix A can be presumed to have died out in Maroondah, leaving 429 that are known or presumed to remain. That represents a 15% rate of local extinction since European settlement. It is inevitable that some additional plant species died out before anyone noticed them or left a record of their former existence. It is also likely that some species are yet to be detected.

On a conservative estimate, 39% of the Maroondah's surviving flowering plant species and 53% of fern species are in the 'critically endangered' category of risk of dying out in Maroondah.

The orchid family is the largest family of plants in the world by numbers of species. It was, and still is, the largest family of indigenous plants in Maroondah. It is also the family with by far the highest incidence of local extinctions. Of the 93 indigenous orchid species recorded in Maroondah, at least 39 (i.e. 42%) have died out. Thirty-four of the remaining 54 orchid species fall into the 'critically endangered' category of risk of dying out in Maroondah.

While orchids are by far the family of plants with the worst prospects of dying out in Maroondah, another category of plants is similarly at risk: species that are confined (or almost so) to floodplain soil that is hard and dry in summer and kept sodden (but not inundated) by seepage throughout the wetter months of the year. This study identified 45 local species that fall into that category. Eleven of them can be presumed to be locally extinct and all the others either could not be found in this study's concerted searches or they fall into the 'critically endangered' category of risk of local extinction. The reasons for the perilous state of the diverse range of plants in this category appear to be climate change, drainage works, urbanisation and the plants' innate sensitivity to multi-year periods of unnaturally dry soil.

Fauna habitat

This study recognised ten types of habitat being used to significant degrees by Maroondah's native fauna. They range from expanses of native vegetation to nature strips and golf courses with mature trees of species that are locally indigenous or native to Australia.

For the purposes of the 'Maroondah Vegetation Review', scientific literature provides the following important guidance about how to support native birds, insects and lizards (aquatic habitats aside):

- The best habitat by a substantial margin is natural vegetation (which is mostly in the sites of biological significance in Volume 2);
- Outside bushland, such as in residential areas, amenity parks and golf courses, the best habitat includes eucalypts (particularly locally indigenous eucalypts) with shrubs, small trees and groundcover – but not too many plants that produce copious nectar;
- Retention of leaf litter and fallen timber is important for invertebrates and lizards;
- Park-like landscapes with eucalypts and little if any understorey (e.g. golf courses) are problematic because they encourage Noisy Miners, which tend to displace other bird species; and
- Predominantly introduced vegetation (or no vegetation at all) displaces native fauna.

There are clear implications for:

- The current tendency to replace native street trees with introduced species such as Crepe Myrtles and ornamental fruit trees;

- The current rapid increase in residential development and consequent reduction in the area available for trees and shrubs;
- The relative level of planning protection that Maroondah City Council provides for indigenous or Australian native vegetation compared with species from abroad; and
- The types of plants that Maroondah City Council encourages in landscape plans for new developments.

Fauna species

This study did not involve trapping, ultrasonic bat detection or other targeted fauna survey methods except spotlighting, frog call surveys and limited bird censuses. Unfortunately, birds and frogs are the only fauna group that have been well-recorded by others. There is a large information gap regarding bats and reptiles – a situation which the author recommends to refer to the Department of Environment, Land, Water and Planning.

Mammals other than bats are fairly easily detected (unlike bats), so there is adequate information to determine their status in Maroondah. The Eastern Grey Kangaroo is increasing in numbers in Maroondah, as are deer (which are not indigenous). The Koala and Spot-tailed Quoll have died out and the Platypus appears to be an occasional visitor from lower in the Yarra catchment. The other eight indigenous mammals other than bats appear to have fairly stable populations.

Birds are the easiest and most popular fauna group to observe and report, so extensive data is available for Maroondah. 'Citizen science' programs such as 'eBird' have contributed greatly. Birds also form the largest group of indigenous vertebrate species: 169 species recorded recently or historically. Fifteen of those species are not indigenous to Maroondah and 22 are presumed to no longer occur there. It is evident that:

- At least fifteen bird species have become markedly less common in Maroondah than three decades ago, e.g. the Bell Miner and Willie Wagtail; and
- Over the same period, at least nine bird species have arrived or greatly increased their presence, e.g. Crested Pigeon and Noisy Miner.

This study could find no satisfying explanation for why so many, disparate bird species changed so much, so quickly – particularly as it has happened in multiple Australian capital cities.

Frogs are readily detected by their calls and the information about them in Maroondah is more complete than any fauna group other than birds. Ten species have been recorded since the earliest records. Two of those have convincingly died out, both of them listed as threatened throughout Victoria. A third frog species appears to have retreated just outside the municipal boundary and a fourth is quite rare, locally. The other six frog species remain fairly abundant.

Butterflies were chosen as the only invertebrate group to be surveyed and analysed in this study, due to difficulty gathering data for other groups. This study's data was compared with data of a similar survey in 1995–1996. A conclusion is that eighteen of the twenty surviving local species are either rare or in decline – often markedly. The other two species now live mainly on planted vegetation and are therefore not affected by declining native vegetation. These observations parallel international research that has demonstrated major declines in the populations of many butterfly species in many countries. If butterflies are at all representative of Maroondah's invertebrate populations, there could be very serious repercussions for life generally.

Sites of biological significance

This study's focus is on flora and vertebrate fauna that are indigenous to Maroondah, particularly those occurring naturally. Places where such species are concentrated or that are important for the species and communities to survive are called 'sites of biological significance'. Most of those sites in Maroondah were identified in the 1995–1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997). Some have since been destroyed and others have been discovered. All known sites of biological significance in Maroondah – current or past – are individually described in detail in Volume 2. Strategic planning responses are recommended for each site.

One hundred and nine sites in Maroondah currently meet the Victorian Government's standard criteria for sites of biological significance. They occupy 12% of Maroondah's area. Colour-coded maps of them can be seen in Figures 7 and 8 on pp. 67 and 68.

Using the Victorian Government's standard criteria for assessing a site's level of biological significance:

- 19 sites are of National significance due to the presence of plant species that are endangered or critically endangered globally;
- 65 sites are of State significance, mainly due to the presence of endangered vegetation types;
- 4 sites are of either State or Regional significance, the uncertainty being due to the need for detailed, formal assessments of the ecological condition of the habitat;
- 6 sites are of Regional significance due to the presence of either a species that is rare throughout Victoria (but not interstate) or a 'vulnerable' vegetation type in poor ecological condition; and
- 20 sites are of Local significance, mainly for either the presence of populations of locally threatened species or the role the sites play as habitat corridors.

This study estimates that 68 hectares of habitat has been destroyed within sites of biological significance since 1997. By far the greatest single loss of habitat – 30 hectares – occurred when the Croydon Golf Club was developed for housing.

Other key statistics about changes within the sites of biological significance since 1997 are:

- 11 sites have been largely or wholly cleared;
- 26 other sites have deteriorated noticeably in ecological condition;
- 26 sites have improved noticeably;
- 10 sites are quite variable between improvements and deterioration;
- 37 sites show no clear change; and
- 27 sites could not be adequately inspected to tell.

However, note that these statistics say nothing about the magnitudes of the improvements or deteriorations.

Focusing now on reserves where Maroondah City Council has actively sought to improve or maintain their ecological condition (or arrest decline), 17 sites have improved, 7 have deteriorated, 13 have not changed noticeably and 5 have had mixed results.

Some of those reserves have seen dramatic ecological improvement in response to Council's efforts, e.g. Proclamation Park and Dublin Road Reserve, both in Ringwood. The most important council reserves, led by Bungalook Conservation Reserves in Kilsyth South, have been kept in good (and often improving) ecological condition.

Two main types of problem have been associated with habitat having deteriorated in council reserves since 1997 despite efforts to stop it: eucalypt deaths and (to a greater degree) drying of floodplains and creeks due to climate change, drainage works and increases in impervious surfaces across catchments.

Looking to the future, this study assessed the threats to biodiversity in each site of biological significance. Most of the identified threats are widespread across the sites. The principal threats are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents. This is by far the greatest threat;
- Drying of floodplains due to drainage works and increasing impermeable surfaces in catchments;
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and possibly further urbanisation of the catchment.
- Water pollution, affecting vegetation, aquatic invertebrates, fish, frogs, waterbirds, Platypus and perhaps Rakali (or Water Rats);
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Displacement of indigenous plants by introduced plants ('environmental weeds');
- Eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Land development.

Biodiversity outside the site of biological significance

There is no clear threshold between the biodiversity of 'sites of biological significance' and areas that have not been so labelled. Most indigenous species of tree, mammal, bird, frog and flying invertebrate occur both inside and outside the sites. Some indigenous species of groundcover and bird occur mainly outside the sites of biological significance. Even animals that occur mainly within the sites often venture out for purposes such as finding mates or foraging for food in lean times.

Importantly, indigenous flora and fauna in suburban gardens, nature strips and small parks greatly increase the contact that people have with nature in their daily lives – e.g. through the presence of birds and birdsong. In addition, the ecosystem services of vegetation are beneficial to more people if the vegetation is located where people are concentrated, rather than in more pristine areas.

The following is an assessment of the values of flora and fauna outside the sites of biological significance:

- Ecosystem services of vegetation, such as shade and natural 'air conditioning', are beneficial to more people if the vegetation is located where people are concentrated, rather than in more pristine areas;
- Economic benefits: The ecosystem services just mentioned provide economic benefits such as reduced costs of air conditioning. Real estate values are increased by vegetation because many Maroondah residents like to live in treed and shrubby neighbourhoods, not just sites of biological significance. By promoting contact with nature, the vegetation reduces costs to the health system and improves productivity. Maintenance of gardens and trees also generates economic activity and jobs;

- Human attachment to nature: For most of the Maroondah community, day-to-day contact with nature comes not from sites of biological significance but from gardens, street trees and local parks. In those areas, the diversity of birds, butterflies, lizards and other wildlife for people to enjoy is enhanced by: (a) proximity to sites of biological significance increases; (b) presence of indigenous trees, or at least Australian native trees; and (c) vegetation with a mixture of trees, shrubs and (ideally) groundcovers to provide a vertical structure that favours wildlife;
- Natural heritage: Overall, Maroondah's pre-colonisation flora and fauna are much better represented inside, rather than outside, the sites of biological significance. Nevertheless, the representation outside the sites provides a sketchy connection with Maroondah's past that pervades most of the municipality. Native birds and old eucalypts are perhaps the best reminders of our natural heritage;
- Caring for species other than our own: Conserving Maroondah's indigenous flora does not rely significantly on habitat outside the sites of biological significance. On the contrary, many properties outside the sites pose threats to indigenous flora, e.g. from spread of environmental weeds. By contrast, many bird species make extensive use of habitat outside the sites, as do some lizards, butterflies and other invertebrates.

These values gain some support and protection from the Maroondah Planning Scheme. The Significant Landscape Overlay provides a level of protection to trees and large shrubs in most of Maroondah. There is also some planning control over removal of Victorian native plants (whatever their size) on properties larger than 0.4 hectares.

Actions for Council's consideration

Chapter 11 provides extensive recommendations for actions that Maroondah City Council could take in support of biodiversity, particularly as part of the 'Maroondah Vegetation Review'.

In regard to provisions of the Maroondah Planning Scheme, the key recommendations can be summarised as follows:

- Amendment of the vegetation-related provisions to recognise the importance of people experiencing nature in their daily lives (Section 11.1.1.1);
- Increasing support for 'Water Sensitive Urban Design' to restore more natural patterns of water runoff, seepage and stream flows (Section 11.1.1.2);
- Amendment of the Local Planning Policy on Waterway Protection to recognise that streams, stream corridors and wetlands are very important for wildlife (Section 11.1.1.3);
- Removal of the Vegetation Protection Overlay and instead creating two new schedules of the Environmental Significance Overlay to apply to two classes of land within sites of biological significance (Section 11.1.2). The proposed new schedules provide different levels and types of protection for habitat. They respond to many of the scientific findings in this study. Some sites currently covered by the Vegetation Protection Overlay would not be covered by the Environmental Significance Overlay and some sites not currently covered by the Vegetation Protection Overlay would become covered by the Environmental Significance Overlay; and
- Continuation of Council's 'Greening the Greyfields' trials, which offer hope that future residential subdivisions may reduce the amount of impervious surface and increase the number of trees, birds and insects (Section 11.1.1).

Other key recommendations are:

- Diversion of stormwater from pipes to rehydrate floodplain habitats that have been suffering from drying of the landscape due to climate change, urbanisation and drainage works (Section 11.3);
- Consideration of how to strengthen the connections between Council's bushland team and environmental planners, aiming to compensate for their physical separation (Section 11.4);
- Review of Council's recent shift toward increased mowing of significant indigenous groundcover vegetation in reserves not managed by the bushland team, recognising that it is having a significant adverse impact on biodiversity (Section 11.5);
- Undertaking a trial of fixing possum-proof banding on the trunks of eucalypts with sickly crowns, to determine whether possums are the main cause of the ill-health (Section 11.6);
- Attention by Council's civil engineers to stormwater-related works that affect the hydrology of streams, wetlands and floodplains, with a view to returning the hydrology to a less unnatural condition (Section 11.7);
- Various changes to Council's planting of trees, shrubs, groundcovers and wetland plants, including the selection of species and the densities of trees (Section 11.8);
- Consideration of increased support for nature conservation on private land through programs such as 'Gardens for Wildlife', grants and rate concessions (Section 11.9);
- Promoting the community's connection with, and understanding of, nature through: (a) 'Get to know your park' tours; (b) events for volunteer groups; (c) a 'citizen science' program; and (d) use of public art (Section 11.10);
- Concerted attention to explaining to the community how Council will use the information in this report and give opportunities for the community to be involved (Section 11.11). This will be particularly important in regard to the recommendation above regarding planning scheme overlays; and
- Expansion of Council's existing efforts to monitor biodiversity-related changes, having regard to many complicated technical matters (Section 11.12).

Issues for other organisations

- There are sites of biological significance within the grounds of eleven schools in Maroondah and in close proximity to some others. The opportunities for environmental education are under-used due to a range of factors. The ecological condition of habitat within schoolgrounds has generally deteriorated due to building construction and strained management resources, including a decline in the availability of volunteers in the school communities.
- Melbourne Water is the manager or landowner of most floodplains in Maroondah, which are also the most threatened, declining habitats. Many highly-threatened flora and fauna species occur there. However, these significant features are often given little weight compared with engineering objectives or the objective of providing neatly mown expanses.
- Some railway verges contain quite significant indigenous plant species. Some of those areas are managed well for biodiversity. However, an apparent recent increase in herbicide use in some areas is promoting the replacement of indigenous vegetation by herbicide-tolerant weeds such as Gorse. In addition, the planned construction of a 'sky rail' section of track west of Mooroolbark poses a serious threat to a small patch of the nationally-listed Matted Flax-lily.
- As mentioned earlier, the lack of data about bats and reptiles represents a significant gap in the information about Maroondah's biodiversity. It is recommended that the Department of Environment, Land, Water and Planning conduct fauna surveys to fill the gap.

- This study found widespread errors in the department's vegetation mapping and biodiversity information. The Victoria Planning Provisions require local government to have regard to that mapping and information when amending and implementing planning schemes. The errors can mislead councils and others and lead to bad planning and unjustified permit conditions. Unless funding is allocated to correct the errors, the requirement for local government to make use of the data should be tempered with a frank disclosure of the errors and limitations.

1 Introduction

1.1 Context

In 2014, Maroondah City Council adopted the *'Maroondah 2040 Community Vision'* policy document, which expressed the local community's consensus about its preferred future. It includes the following vision: 'A green and leafy community that protects and enhances our natural environment will continue to be highly valued, with the built environment respecting the natural landscape'. The associated 'key directions' include:

'4.6 Protect and restore biodiversity and native habitat for local plants and animals on public and private land;

'4.7 Preserve and enhance Maroondah's canopy vegetation;

'4.8 Create and foster a culture within our community that is committed to protecting the unique features of Maroondah's landscape, including our ridgelines, waterways, canopy vegetation, green open space and bushland reserves; …

'4.10 Encourage increased green spaces within activity centres that link the built environment to the natural landscape.'

These objectives are affirmed in the Council's *'Maroondah Sustainability Strategy 2016–2020'* of 2016, along with an additional 'key direction' to 'Establish improved monitoring and evaluation of biodiversity in the municipality'.

The report you are now reading responds to these objectives. It aims to provide a clear, contemporary understanding of Maroondah's biodiversity: what species and ecosystems it comprises; where it is concentrated; what threatens and sustains it; and what Council and the community can do to protect, restore and improve it.

1.2 What Does Maroondah's Biodiversity Encompass?

The term 'biodiversity' is normally taken to mean the diversity of all forms of life, including the diversity of species, the genetic diversity within each species and the diversity of communities that species form. Importantly, 'biodiversity' is not just a word for 'living things'; it refers to how much diversity there is among living things and their communities, e.g. diversity in their evolutionary origins and ecological roles.

Communities may be tiny to extensive, and a large community may have smaller communities within it. An 'ecosystem' is a community of living things together with the associated physical environment, such as the climate, soil and water.

Maroondah's biodiversity includes life forms from viruses and mites to very large trees. For practical reasons, little information is available about the microbes, invertebrates and fungi in Maroondah (or other municipalities, for that matter). Therefore, this report contains limited information about these 'lower' organisms, but we should still recognise that they are critically important to higher organisms, including humans. The fieldwork for this study did include mosses, liverworts and complex algae, laying the groundwork for future investigations of these organisms.

This study has a primary focus on wild flora and fauna rather than domesticated animals and cultivated plants. That is partly because wild flora, fauna and communities contribute much more to biodiversity, and partly because the issues surrounding domesticated animals and cultivated plants are quite different from wild animals and plants. Nevertheless, domesticated animals and

cultivated plants are addressed in this report where they affect wild indigenous species, as in the cases of garden plants that provide habitat for wildlife or go wild and displace indigenous species.

Among Maroondah's wild flora and fauna, this report focuses on indigenous species and natural communities. (A species is here taken to be indigenous to Maroondah if it was present prior to European colonisation.) The focus on indigenous species and natural communities is because they represent the essence of nature and carry the greatest values of biodiversity, as discussed below. Nevertheless, wild non-indigenous species are discussed where they are supporting or threatening indigenous flora or fauna, or where they are expanding their ranges into Maroondah due to climate change or other factors.

1.3 The Importance of Maintaining Biodiversity

Biodiversity and nature more generally are critically important to humanity and the other 8.7 million species on Earth. An understanding of that importance has been an important guide to how the present study has been conducted.

Table 1 provides a classification of the important attributes of nature in Maroondah.

Table 1. Categories of nature's importance.

Category of Nature's Importance	Examples
1. Practical 'ecosystem services'	The role of trees in purifying air and providing shade and wind protection; Stormwater purification by organisms in wetlands.
2. Financial and economic benefits	The premium on home values that a neighbourhood gains from the presence of trees and bushland; The costs that would be incurred to replace the functions of ecosystem services if nature wasn't doing them; The many businesses and employees involved in management of natural assets such as trees, parks and streams.
3. Human attachment to nature: (a) Fulfilment of humanity's innate desire to engage with nature and feel its inspiration, comfort and restorative powers ('biophilia'); and (b) Consequent benefits to human health, wellbeing, childhood development and quality of life	Our attraction to flowers and waterfalls; The popularity of gardens, zoos and 'green & leafy' neighbourhoods; Natural retreats for restoring soul & energy; Greater productivity and faster recovery from illness when people have contact with plants and animals (e.g. Franklin 2012); Benefits to childhood development (concentration, emotional regulation, motor skills, less sickness, …) (e.g. Chawla 2015); The use of natural themes and inspiration in the arts and architecture.

Category of Nature's Importance	Examples
4. Natural heritage: Nature's contribution to sense of place and our concepts of who we are, how we fit into history and nature's grand design, and what we should pass on to future generations	Ancient trees that are conserved to provide a connection with the past; Aboriginal reverence for nature and the associated concept of 'caring for country'.
5. Caring for species other than our own: Altruistic recognition that humanity should respect the existence of the other 8.7 million species on Earth and the ecosystems they form, independently of any practical benefit that humanity may derive from them	Success of the current, local 'Save Our Skinks' crowd-funding project; Campaigns to stop whaling; Governmental measures to save threatened species; The commitment 'To ensure that all species of indigenous flora and fauna remain present in Maroondah' in the Maroondah Planning Scheme.

In Maroondah, the practical ecosystem services of item 1 above fall into the following categories:

Microclimate moderation: Trees provide shade and protection from wind. Their shade and transpiration, along with transpiration by other plants, reduce temperatures on hot days, reducing human's reliance on artificial cooling. Cold, still nights are moderated by the turbulence and radiative effects of tree canopies, reducing frost damage and humans' reliance on heating. Reductions in heating and cooling also reduce energy costs and pollution from power stations. Shade also prevents ultraviolet damage to materials and the skin and eyes of humans and other animals. All these benefits are becoming more important as extremes of weather increase in frequency. See Akbari (2002) and Heisler & Grant (2000) for more details.

Air purification: Leaves are known to absorb gaseous pollutants and trap health-affecting airborne particles (Omasa *et al*. 2002). The turbulence created by vegetation can increase the rate of dilution of air pollution but the associated reduction in windspeed can reduce the dilution of pollution discharged beneath a tree canopy. Green walls and roofs on building envelopes can also be used as effective air pollution abatement measures (Abhijith *et al.* 2017).

Noise reduction: As examples: (a) traffic noise experienced at 1.5 m above ground (ear level) can be halved (3 dB) by a 5 m-wide band of moderately dense vegetation beside a road, compared with no vegetation (Ow and Ghosh 2017); and (b) a 7.5 dB reduction can be achieved by a 50 m-wide wheat crop. The appearance of vegetation can also make noise less annoying.

Stormwater runoff regulation: Rapid runoff from impervious surfaces is recognised in Maroondah City Council's 'Water Sensitive City Strategy' as a problem for flooding and pollution. It is also very ecologically damaging and causes costly erosion. These problems are worsening due to increased impervious surfaces and the trend toward more extreme weather events. Vegetation and the associated soil organisms improve soil porosity and reduce runoff (Bot and Benites 2005). All vegetated ground can contribute to reducing floods and water erosion.

Water purification: Vegetation can trap larger contaminants in water runoff (e.g. dog faeces) and take up nutrient pollution. Silt and other fine particles in runoff become deposited on foliage rather than reaching aquatic environments. Wetland plants and aquatic invertebrates are so effective at removing water pollution that wetlands are now commonly constructed for that

purpose. However, in much of Maroondah, the capacity of vegetated ground to purify water is negated by application of fertiliser and toxic chemicals to promote or inhibit plant growth.

These ecosystem services can be provided by plant species inside or outside their natural ranges, i.e. the species do not have to be locally indigenous. The same is true of some of the financial and economic benefits in item 2 of Table 1.

By contrast, items 3, 4 and 5 are about more direct relationships between humans and nature, so the benefits are largely associated with species in their natural domain. That is one reason why this report has an emphasis on locally indigenous species. The other reason is that so much of Maroondah's natural environment has been lost irreplaceably that the remainder has become precious. The complex web of life that makes up a natural environment cannot be replaced in the way one might replace plants in a garden.

Item 3 in Table 1 – the importance of people having regular contact with nature – has been gaining increasing recognition over recent years. The underlying concept known as 'biophilia' was introduced by Fromm (1964, 1973), then further developed and popularised by Wilson (1984). In essence, biophilia is the innate attraction that humanity feels toward nature, and the dependence we have on connecting with nature for our health, wellbeing, childhood development and quality of life. A good summary of that dependence is given on p. 98 of the 'IPBES Regional Assessment Report on Biodiversity and Ecosystem Services for Asia and the Pacific' (IPBES 2018). Recognition of the importance of connecting people with nature has reached such a level that it occupies a substantial part of the Victorian Government strategy on biodiversity, *'Protecting Victoria's Environment – Biodiversity 2037'*. An outcome of the recognition of biophilia is the 2017 *'Victorian Memorandum for Health and Nature'* created by the Victorian ministers for health and environment. It includes the following commitment:

> *'The Victorian Government is committed to encouraging communities to interact more with nature, both in Victoria's parks and other open spaces, because being in nature is good for our health and is a highly cost effective health improvement strategy. The benefits of being active in nature are recognised in the Government's key health and environment policy platforms: the Victorian Public Health and Wellbeing Plan 2015–19 and in Protecting Victoria's Environment: Biodiversity 2037.'*

Leaving aside direct benefits to humans, the diversity of flora and fauna is ecologically important because it underpins the resilience of ecosystems as conditions change. For example, the more diverse the species present in an ecosystem, the greater the likelihood that as conditions vary (e.g. from drought to wet years), plants of one kind or another will always be able to grow and provide food for herbivores, and so on up the food chain.

By definition, declines in biodiversity occur through the disappearance of species, communities or genetic variants. Loss of species has been happening at varying rates in Maroondah ever since European settlers began clearing the land and introducing foreign plants and animals. It has also been happening on a more localised scale in each of Maroondah's patches of natural and semi-natural habitat. As indigenous species are lost, their communities become less resilient and there can be a vicious cycle of loss of dependent species.

Therefore, loss of species is an ecological problem at all scales from a small patch of habitat right up to the global scale. That is the ecological reason why biodiversity investigations and strategies typically have a strong focus on species or communities that have been assessed as being at high risk of becoming extinct globally, regionally or (less commonly) locally. Another reason for a focus on threatened species and communities is that humans tend to value things more highly – as being more precious – as they become rarer. Section 5.1 and Chapter 7 deal with species that have died out in Maroondah or are at risk of becoming extinct at any scale from local to global.

A simplistic response to loss of biodiversity might be to simply plant more plant species and release more fauna species. That does not work. Reintroducing the species that have been lost is not viable in the medium or long term unless the original causes of those losses are corrected, which is often not practicable even when the causes are known. Ideally, introducing new species to a community might replace some of the ecological roles of the lost species without competing too much with indigenous species. However, it is difficult to predict what the ecological consequences of introducing a species to an ecosystem will be and there can be significant ecological risks. The risks associated with planting of non-indigenous trees to replace declining wild eucalypts are discussed in Section 5.1.5 on p. 46. Australia's history is littered with ecological problems resulting from planting or releasing organisms outside their natural ranges; e.g. rabbits, blackberries and Sweet Pittosporum.

1.4 How is Biodiversity Distributed Across Maroondah?

Because of the focus on wild, and particularly indigenous, species, most of the fieldwork for this report was done in areas where those species were known or suspected to be concentrated. Most of those sites were identified in the 1995–1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997). Some have since been destroyed and others have been discovered since. All known 'sites of biological significance' in Maroondah – current or past – are individually described in detail in Volume 2. Chapter 8 of this volume summarises this study's findings about the sites' importance, observed changes and threats, as well as opportunities for Council and the community to maintain and improve their natural values.

However, there is no clear threshold between the biodiversity of 'sites of biological significance' and areas that have not been so labelled. Most indigenous species of tree, mammal, bird, frog and flying invertebrate occur both inside and outside the sites. Some indigenous species of groundcover and bird occur mainly outside the sites of biological significance. Even animals that occur mainly within the sites often venture out for purposes such as finding mates or foraging for food in lean times.

Importantly, indigenous flora and fauna in suburban gardens, nature strips and small parks greatly increase the contact that people have with nature in their daily lives – e.g. through the presence of birds and birdsong. In addition, the ecosystem services of vegetation are beneficial to more people if the vegetation is located where people are concentrated, rather than in more pristine areas. For these reasons, a distinctive feature of this report is that Chapter 9 considers the role of land outside the 'sites of biological significance' for conserving biodiversity and providing opportunities for people to enjoy nature.

2 The Knowledge Base for this Study

This study has gathered new data and drawn upon pre-existing information from literature, databases, museum specimens and the author's extensive previous fieldwork. (The term, 'museum', is taken to include the herbaria, or plant museums, of the Australian states and territories.)

2.1 Previous Literature, Studies and Maps

To determine Maroondah's natural, pre-settlement biodiversity and how it compares with the present condition, it is important to investigate the earliest possible records of vegetation and fauna.

The oldest documentation of Maroondah's vegetation inspected during this study are maps of the Crown Lands Office from as early as 1848. These historical maps are available online: some from the Public Records Office of Victoria and others from the State Library of Victoria. As discussed in more detail in Chapter 2.4, areas of the maps are labelled with broad vegetation characteristics such as 'Steep Stringybark Ranges', 'Well grassed forest' and 'Scrubby Flat'.

These maps were evidently not consulted for the Department of Environment, Land, Water and Planning's mapping of pre-settlement vegetation communities (Oates and Taranto 2001), which sometimes conflict with the historical maps (Chapter 4.4).

The oldest textual records of the flora and fauna of Maroondah found during this study are in reports of excursions by the Field Naturalists Club of Victoria from 1890 to 1936. The reports are published in their journal, 'The Victorian Naturalist' and have recently been made available online as scanned images (www.biodiversitylibrary.org/bibliography/43746#). These reports provide useful and interesting information about how many more plant species there were in Maroondah over a century ago, as discussed in Chapter 2.4.

Excursions of the Field Naturalists Club of Victoria to Maroondah reduced in frequency through the early decades of the twentieth century as reports of clearing and blackberries increased and reports of interesting flora and fauna reduced. The last excursion reported in *The Victorian Naturalist* appears to have been in 1936, but there have been infrequent, unreported excursions in recent decades.

This study found no documents with useful descriptions of Maroondah's flora and fauna between 1936 and 1987, when a period of intense study of the local flora began. In 1987, Andrew Paget prepared a vegetation management plan for Birts Hill Reserve on behalf of the Croydon Conservation Society. The society then produced the booklet, 'Trees and Wildflowers of Croydon 1988', with the assistance of botanist, David Cameron. The booklet lists the indigenous flora of ten reserves and gives a very brief summary of each reserve's history and ecological condition. Around the same time, local naturalist and (then) Council officer, Helen Moss, began compiling descriptions and lists of indigenous plants for various pieces of land belonging to the Croydon City Council, then for Maroondah City Council when councils amalgamated in 1994. Ms Moss produced a series of booklets about local flora and fauna for the council and was a contributor (along with the present author) to the Croydon Conservation Society's updated and expanded booklet, 'Trees and Wildflowers of Croydon 1995'.

The present author's previous report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997) and the associated flora and fauna data provides an unusually extensive basis for deter–mining ecological changes since that time. That study produced copious observational data about flora and fauna at 132 'sites of biological significance', including (in part) species lists, timed bird

censuses, mapping of ecological communities and site-by-site estimates of how much of each vegetation community was in each of four categories of ecological condition. Each plant species' level of risk of becoming locally extinct was assessed using objective criteria, but that method has since been made obsolete by the international standard 'Red List' categories, criteria and guidelines of the International Union for the Conservation of Nature (see www.iucnredlist.org/about/publication/assessment-process). Similarly, the method used in 1997 to assess each site's level of biological significance was made obsolete in 2005 when the Victorian Government published *Standard Criteria for Sites of Biological Significance in Victoria*' (Amos 2004).

Many of Maroondah City Council's bushland reserves have been the subject of bushland management plans prepared since 1997, mostly by the present author – see the Bibliography (p. 148). These have mostly included more detailed information than the 1997 'Sites of Biological Significance' report, such as the population sizes and exact locations of plant species that are scarce in each reserve or more widely. These management plans and the associated observational data have provided useful opportunities for detecting ecological change through comparison against observations taken in the present study.

Planning permit applications involving removal of vegetation are sometimes accompanied by information about flora or fauna that is not otherwise available, particularly on private land. That information can be quite useful for detecting removal (and potentially local extinction) of plant species and fauna habitat, which is important for assessing changes in biodiversity. The present author has assisted Council to assess a few of these planning permit applications in the past two decades but information from other permit applications could not be accessed due to privacy constraints.

The *'Maroondah Habitat Corridors Study'* (Context 2005) was consulted for this study but its usefulness was limited. The corridors mapped in that study were surmised on the basis of factors such as linear continuity of tree canopy with little evidence about the importance of those factors for wildlife movement. No evidence was presented that wildlife actually moves preferentially along the presumed corridors. The present study therefore investigated habitat corridor research beyond Maroondah, such as that of Beier and Noss (1998), Braaker *et al*. (2014) and Lorimer *et al*. (2009).

Other documents that were used in this report appear in the Bibliography (p. 148).

2.2 Past Observational Records

An important input to any analysis of an area's biodiversity is prior observational data about the presence and abundance of as many species as possible. In the present study, the main source of prior records was the author's own observational records from Maroondah: 465 plant specimens, over 18,500 other plant records and 5,500 fauna records. (For these purposes, a 'record' indicates the presence of a particular taxon (i.e. species, subspecies etc.) at a particular location at a particular time or period, with or without additional information such as numbers of individuals, life stages or reproductive success.) These records are stored in the author's field notes and databases along with 11 plant specimens, 3,853 other plant records and 718 fauna records by the author's co-workers, plus 117 plant records and 129 fauna records provided by others. Among the author's own records are monthly lists of mammals, birds, reptiles, frogs and butterflies during his residency in Bayswater North for fourteen years and Ringwood North for 2½ years.

Another important source of prior data for this study comes from the collections of plant specimens at the herbaria, or plant museums, of the Australian states and territories. Details of most specimens are now available online via the 'Australasia's Virtual Herbarium' website (avh.ala.org.au), and all 1,844 records of wild plants with mapped locations in Maroondah were

downloaded for this study on 25th July 2018. They date back as far as 1885. Due to mapping inaccuracy, some of the downloaded records were actually from outside Maroondah. Equally, some records mapped outside Maroondah may actually belong inside, so a wider search was made for rare plant species. A small number of specimens were examined at the National Herbarium of Victoria.

'Australasia's Virtual Herbarium' is part of the 'Atlas of Living Australia', which is Australia's central repository of observational data about flora and fauna. Records of fauna specimens were obtained from that source, similarly to the plant specimen data.

In principle, specimens provide quite reliable records of what species occurred at specific locations at the times they were collected. They are identified by experts in the relevant group of plants or animals, unlike most records without specimens. Whenever doubt is raised about the identification of a specimen, the accuracy can be tested by an expert inspecting the specimen and making any necessary corrections. Whenever new species are described to split up what had previously been regarded as a single, variable species, experts inspect the affected specimens to determine which new species is represented by each specimen. Updated identifications of specimens find their way into the Atlas of Living Australia.

These are substantial advantages of specimen records over other types of records. The most significant botanical discoveries that I have made in Maroondah are backed up by specimens that have been, or will soon be, lodged at the National Herbarium of Victoria.

However, even experts sometimes misidentify specimens, particularly if the specimens are poor (e.g. missing important parts). Also, specimen collectors sometimes mix up which specimen came from where. These problems can occur whether or not a record is backed up by a specimen.

Modern technology is providing substitutes for specimens of plants and animals, although the substitutes are still somewhat inferior. A recording of a frog call can be extremely diagnostic, and Melbourne Water's 'Frog Census' mobile phone app allows people to record calls and automatically send them and the phone's location to a frog call expert for identification and storage. The resulting records up to 2018 were analysed in the present study.

The Atlas of Living Australia contains records of flora and fauna with and without specimens to back them up, as does the state government's Victorian Biodiversity Atlas (VBA), the 'eBird' database (www.ebird.org) and BirdLife Australia's database. The vast majority of these records simply support the direct observations made during this study. The author sought to authenticate most of the remaining records by consulting the observer and/or seeking to observe the same species. Clearly unreliable records were discounted.

In and adjacent to Maroondah, the VBA currently contains 6,902 fauna records and 7,424 flora records that are not duplicates of the author's records or the herbarium specimens mentioned above. The oldest of the flora records are from 1978 but 99% are dated 1986–2015. The fauna data go back as far as 1883 museum specimens. Most VBA records are duplicated in the Atlas of Living Australia.

Most of the VBA flora records from Maroondah other than the present author's have an identifier code beginning with a 'T', indicating a list of species thought to occur within an area. The VBA only records the location of each area as the coordinates of a point within the area, without any indication of the area's extent or boundaries. Some lists with coordinates in Maroondah may well be for large areas extending beyond Maroondah. The lists often include (in part) third-party recollections of species. Therefore, despite the date on a list, some of the records may be much older. Recollections are sometimes inaccurate in species or location and they may have been based on (or confused by) obsolete taxonomy.

A common error in the VBA's records of flora and fauna is that their locations have been wrongly mapped – most of them on the wrong properties where the habitat is quite different from the correct location. The most extreme case in Maroondah is a list of plants headed '180 Morrison Rd-Longwarry North' that is mapped to be in Heathmont, over 50 km away – far more than the claimed accuracy of 5 m.

While it is easy to tell in this case that the mapped location does not match the location in the heading, most plant lists in the VBA are headed only with code numbers rather than addresses. Often, the only way one can recognise a mapping error is that a list contains species that could not have occurred at the mapped location. An example is list E13503, which is mapped in Bayswater North with a claimed accuracy of 15 m but it contains *Banksia spinulosa* and *Melaleuca squarrosa*, whose natural ranges extend no closer than Montrose. By chance, I happened to have a 20-year-old paper copy of the original field data sheet with the code number on it, which revealed that the list was actually for Eastfield Park, Croydon. My fieldwork there revealed that *Banksia spinulosa* and *Melaleuca squarrosa* were planted, not wild. On its own, the list in the VBA would have been quite misleading.

Unfortunately, the VBA provides its contributors no way to indicate whether a recorded plant or animal is wild. For example, a list in the VBA headed 'Ringwood Aquatic Centre' (but mapped at Maroondah Federation Estate) provides no warning that most of the species on the list are garden plants, including the listed 'rare or threatened' species, Southern Blue-gum and Spotted Gum. A false impression is thereby created that Aquanation provides habitat for rare species. A good botanist will realise that these species do not occur naturally anywhere near Ringwood, but only someone with a good knowledge of the local flora and the particular site would realise that some other species on the list, such as Red Box, do not occur naturally in the area but were planted.

One also needs to be wary of the substantial number of misidentifications that appear in the VBA. The VBA has no capacity for a contributor to indicate their confidence in their identifications, so 'best guesses' are indistinguishable from expert, confident identifications. Most unusual plant records from the VBA were discounted in this study after visiting the mapped locations and finding that a similar but different species occurs there.

Because of all the problems just discussed, readers are advised to be very discriminating about records of flora and fauna.

However, special mention should be made about eBird, which is a wonderful resource for up-to-date, frequent lists of birds from large numbers of locations. Although it is not immune from the problems just described for other online resources, there is so much data that unreliable records tend to stand out compared with numerous other records from the same vicinity around the same time. Unusual records are often corroborated by multiple observers, and it is often possible to contact the observers to check reliability.

'Fungimap' is another 'citizen science' project that plays an important role in providing biodiversity information. Naturalists led by fungus experts have gathered extensive data about the distribution of fungi, including in Maroondah. Their data are lodged with the Atlas of Living Australia, from where they were accessed for the present study.

Outside the realm of reports and databases, a number of important observations of flora and fauna were provided to this study verbally or in correspondence by members of the Maroondah community. Contributions were sought through Council publications and by direct approaches to local naturalists and organisations such as Maroondah Bushlinks. The most prolific contributors were Council staff who manage reserves, followed by local naturalists. The major contributors are listed in the Preface. In nearly all cases, the author was able to visit the sites of the contributed observations to ensure accuracy in identification and gain further details such as current population sizes.

2.3 Fieldwork

To update, augment and verify the pre-existing biodiversity information discussed above, this study conducted hundreds of hours of fieldwork between June 2017 and May 2020. Some of the fieldwork was in recognised sites of biological significance and some was to investigate biodiversity across the remainder of Maroondah, such as nature strips, gardens and wasteland.

With a finite budget and time, one has a choice between inspecting fewer sites in fine detail or more sites in less detail. It was decided to intensively survey the biodiversity of a broad, representative selection of the recognised sites of biological significance and to survey the remaining sites in less detail. A similar approach was taken for the 1997 'Sites of Biological Significance' study and subsequent management plans, except that the present study had less permission to access private land and the 1997 study collected no data about vegetation condition or the abundance of each plant species. For sites where detailed fieldwork was undertaken in this study and the 1990s, it has been possible to determine changes in the flora. Changes if fauna are more difficult to assess. That is because a fauna survey of a few hours or days at one time of year captures only a fraction of the total fauna using a site. Nevertheless, some fauna changes have been detected.

Although the budget did not allow an intensive ecological survey of all recognised sites of biological significance, every site was inspected with at least enough detail to determine any readily discernible changes and to update site boundaries for the Maroondah Planning Scheme.

The intensively surveyed sites were chosen to be representative of all sites, covering combinations of:

- The largest, most natural and highly significant sites through to a stand of less than two dozen remnant eucalypts with no native understorey;
- Nature reserves, amenity reserves, stream reserves, road reserves, schoolgrounds, a church's grounds, private residential properties and vacant industrial land;
- All major types of indigenous vegetation ('Ecological Vegetation Classes');
- Lakes, streams, floodplains, lower to upper slopes, ridges and hilltops; and
- Sites scattered around the whole municipality, including sites in areas experiencing rapid urban development (e.g. Ringwood Lake Park) through to some outside the Urban Growth Boundary.

The following tasks were conducted at the most intensively surveyed sites:

- Mapping and describing the types of vegetation or habitat present;
- For each type of habitat, compiling a full list of indigenous and non-indigenous plant species, whether wild or planted, as well as categorising the abundance of each species;
- Recording population sizes and precise locations of plant species that are in precariously small numbers either in the site or more widely;
- Recording indigenous and introduced vertebrates, butterflies and wildlife habitat whenever observed during the fieldwork;
- Noting matters that are threatening or supporting the site's biodiversity, or opportunities for restoration or enhancement, with particular emphasis on the rarer species; and
- Considering the appropriateness of the site's current planning controls, from the perspective of biodiversity.

This study's inclusion of mosses, liverworts and complex algae (charophytes) in the fieldwork is a very uncommon feature for a municipal-wide biodiversity study.

Some of the most biodiverse sites were each surveyed during multiple seasons, particularly late autumn (for rare orchids), spring and early summer (particularly for grasses and wetland plants).

At some sites, not all of the tasks listed above were undertaken; e.g. introduced plant species were not surveyed at all sites with extensive gardens and lawns. Spotlighting and owl-call playback surveys were conducted at very few sites. In Volume 2, the detailed information about each site includes a description of the data gathered.

Some indigenous species of flora and fauna that are rare in Maroondah could not be found in any of the intensively surveyed sites, so searches were conducted in other locations that displayed appropriate habitat or where the species had been recorded in the past.

The detection rate for reptiles and bats was inevitably poor due to the lack of a targeted survey. In addition, because animals were not caught, some skinks and bats that were observed could not be identified. More generally, there has been little effort to determine the diversity of Maroondah's reptiles and bats throughout history. Therefore, Section 12.4.1 (p. 115) includes a recommendation that the Department of Environment, Land, Water and Planning conduct a survey of reptiles and bats.

Altogether, the fieldwork in this study produced 14,045 plant records and 1,935 fauna records, each with the species' name, abundance, location and often other information. Herbarium specimens were collected from approximately seventy of the more unusual or scientifically interesting plants to validate their existence and/or facilitate future research.

2.4 State Government Computer Modelling

Only a small fraction of 1% of Victoria is as well-served as Maroondah for observational data about biodiversity. To fill the information gaps that affect most of Victoria, the Department of Environment, Land, Water and Planning has used computer modelling.

2.4.1 Habitat Distribution Models

Part of the computer modelling has predicted where suitable habitat may occur for a wide range of flora and fauna species. The method begins with observational data of where the species have been recorded, combined with a range of habitat attributes (e.g. soil type, elevation and climate) at the same locations. A computer then seeks additional locations with similar habitat attributes. The result is called a Habitat Distribution Model.

There are various reasons why a species may not actually occur where the Habitat Distribution Model predicts it to occur, and *vice versa*. For example, the modelling may not take into account a critical attribute for the species, e.g. the presence of a specific pollinating insect or symbiotic fungus. As a consequence:

- A substantial number of species that definitely do occur naturally in Maroondah are predicted not to occur, e.g. the threatened plant species *Austrostipa rudis* subsp. *australis* and *Dianella amoena*; and
- Some species that the computer modelling predicts to occur in Maroondah definitely do not, or only as planted specimens, e.g. the Spotted Gum, *Corymbia maculata*. Others do occur but not near the predicted locations, e.g. the Yarra Gum *Eucalyptus yarraensis*.

There appear to be no statistics available about how reliable the modelled locations are relative to actual occurrences of the species, or with what spatial precision.

Because of the shortcomings in the reliability of Habitat Distribution Models, this study does not rely on them at all; rather, it relies on detailed fieldwork.

2.4.2 'NaturePrint Strategic Biodiversity Values'

Another computer modelling exercise by the Victorian Government has been to produce a map that predicts the importance for biodiversity of any location in Victoria – called 'NaturePrint Strategic Biodiversity Values'. The spatial resolution (or 'pixel size') of the map is 225 m across the whole state. Details of the method for producing the map have not been published but there are outlines for the now-obsolete version 2.0 (DSE c. 2013, Lorimer 2017). The resulting map can be viewed using the Department of Environment, Land, Water and Planning's online tools called 'Nature Kit' and 'Native Vegetation Information Management'.

In principle, a map that shows the importance for biodiversity of any location would be a very valuable input to Maroondah City Council and its community. However, Lorimer (2017) explains that questions arise about the method's scientific validity, lack of transparency and performance in practice.

To demonstrate the concern about the results, take the example of Loughies Bushland in Ringwood North (Site 3 in Volume 2). Loughies Bushland is a site of State biodiversity significance, according to the Victorian Government's 'Standard Criteria for Sites of Biological Significance in Victoria' (Amos 2004). It has NaturePrint Strategic Biodiversity Values (SBVs) in the range 14–17. For comparison, Croydon Oval has an SBV of 25, and Arndale shopping centre and its carpark have an SBV of 23. Neither the oval nor Arndale contain any indigenous plants or any records of significant fauna. The highest SBV in Maroondah is 100, on residential properties in Kilsyth South where the only natural assets are some remnant eucalypts over mown lawn, with no records of threatened flora or fauna. An SBV of 100 is as high as anywhere in Victoria.

Clearly, it would be a travesty to give less priority to protecting biodiversity at a site of State biodiversity significance like Loughies Bushland than Croydon Oval, Arndale shopping centre or even the residential properties in Kilsyth South.

Because of many examples such as this in Maroondah, NaturePrint is deemed too unreliable for use in this study. Other measures of importance for biodiversity are used instead, including the Victorian Government's 'Standard Criteria for Sites of Biological Significance in Victoria' (Amos 2004) and actual observations of flora, fauna and biological communities.

3 Maroondah's Original Vegetation

Land uses since colonisation have not only destroyed most of Maroondah's natural habitat but they have substantially altered the ecological composition, structure and functioning of the remaining habitat.

Aboriginal burning practices prior to colonisation had major effects on Australia's landscape, flora and fauna (Bowman 2008), Maroondah being no exception. Aborigines also harvested many plants for food, fibre, tools and other uses (Gott 2008), which must have significantly favoured some of Maroondah's plant species over others. That, along with Aboriginal egg harvesting and the killing of animals for meat, fur, sinews etc., would have affected Maroondah's pre-colonisation fauna.

Importantly, Aborigines did not historically cut down whole, mature trees. Consequently, Maroondah's pre-colonisation forests were dominated by very large eucalypts well over a century old. Those trees' dominance in capturing sunlight, soil moisture and nutrients would have restricted the resources available to other plants beneath their crowns, including young eucalypts. Competing understorey plants would have been thinned out during droughts until the remaining plants were left with enough resources to survive.

Since colonisation, few eucalypts have been allowed to reach even one century old, as evidenced by their trunk diameters. The forests of Maroondah today are regrowth from repeated tree removal for timber, firewood and land clearing. Young eucalypts need less space to obtain their required resources, so they have grown up closer together than was possible prior to colonisation.

For these reasons (and others too complicated to cover here), we can conclude that Maroondah's forests prior to colonisation would have been dominated by larger, less dense eucalypts than today.

The early settlers would have had different standards about forest density than today. Maps of the area by the government offices in the mid-nineteenth century label most of Maroondah with annotations such as 'thickly wooded' and 'steep scrubby stringybark ranges', interrupted by 'scrubby flats' and swamps on floodplains. District Surveyor, Mr C. Hodgkinson, remarked on an 1855 map of the area from Ringwood to Mitcham and Wantirna, 'The land comprised in this survey is of inferior quality, moderately undulating and thickly wooded'. By contrast, the part of Croydon that lies eastwards from Dorset Rd and north of Hull Rd is marked on an 1858 map as 'well grassed forest', consistent with the Yellow Box and Candlebark forest that can still be seen along Lincoln Rd today.

Preserved plant specimens and reports of excursions by the Field Naturalists Club of Victoria provide useful historical information about Maroondah's biodiversity. They show that there were once many more orchid species and probably many more other plant species than remain today. For example, a report of an excursion between Ringwood and Dandenong Ck in 1890[*] states, 'The orchid *Caladenia deformis, with its pretty blue flowers, was very conspicuous in many places'*, whereas there have been no records of that species from anywhere in Maroondah since 1926 (a specimen of Elizabeth Coleman at the NSW Herbarium). The historical record is quite skewed toward orchids, which have always gained the greatest attention from plant enthusiasts. Section 5.1 provides evidence of which species are known to have occurred in Maroondah historically and which ones remain today.

[*] *The Victorian Naturalist,* Volume VII (1890), p. 85.

3.1 Questionably Indigenous Species

There are also a few plant species that occur in Maroondah today and are commonly regarded as indigenous but were probably not present at the time of colonisation. The clearest example is the Drooping Cassinia or Sifton Bush. In his paper segregating the species from *Cassinia arcuata* and giving it the new name *Cassinia sifton*, Orchard (2017) notes the lack of early records of the species from Victoria and he documents its rapid expansion from New South Wales in the wake of early mining and land clearing. However, the same traits that allowed the species to expand so effectively from New South Wales following European settlement may have also allowed the species to periodically colonise Maroondah between ice ages or in the wake of major bushfires. Orchard also acknowledges that the species may have originally reached New South Wales from Victoria prior to it dying out in Victoria before European settlement.

There are also several cases of plant and animal species expanding their ranges into Maroondah from natural populations that lived nearby prior to colonisation. Two vine species – the Wonga Vine (*Pandorea pandorana*) and Twining Silkpod (*Parsonsia brownii*) – are extreme examples, having expanded out of their previous habitat of rainforests and wet forests in the Dandenong Ranges and elsewhere, now acting as serious environmental weeds in Maroondah.

Of course, such examples are few compared with the number of plant species from further afield (particularly overseas, e.g. ivy, blackberry and pines) that have become established in Maroondah's native vegetation. These are discussed in Section 5.3 (p. 50).

4 Ecological Communities

4.1 'Bioregions' and the EVC System

The Department of Environment, Land, Water and Planning's standard, state-wide classification scheme for vegetation types in Victoria is called 'Ecological Vegetation Classes', or EVCs. An EVC consists of vegetation with a fairly consistent set of principal factors that drive the ecological processes that govern the types of plants present. Typical examples of those factors include climate, soil, topography and fire frequency. In practice, identification of a site's EVCs normally relies substantially on visible features of the vegetation itself, such as the height and density of different vegetation strata and the presence of 'indicator species' of plants.

Two stands of vegetation may be classified as the same EVC even if many of the plant species are different, as long as the different species reflect similar ecological adaptations – e.g. adaptation to frequent, fast floodwaters on the banks of major streams. Conversely, vegetation with similar mixtures of species may be classified into different EVCs if there are signs of different ecological processes at work; e.g. different canopy heights and densities of shrubs and ground flora.

In 2001, a predecessor of the Department of Environment, Land, Water and Planning produced two maps of EVCs in the Port Phillip and Western Port region: one for the EVCs of current-day native vegetation and the other of EVCs that were inferred to have been present in 1750. These maps and the characteristics of the EVCs are described by Oates & Taranto (2001), who described them as 'first drafts'. They also contain substantial errors in some places. However, there has been negligible subsequent revision affecting Maroondah. The polygons that represent the EVCs on the maps are available for download from the Victorian Government's 'Data.Vic' website.

The present author's rendering of the polygons for the year 1750 appears in Figure 1. Despite inaccuracies (particularly in Croydon North, Heathmont and Kilsyth South), the map broadly accords with nineteenth century maps (Chapter 2.4) and a substantial fraction of Maroondah's remaining native vegetation.

Much of Figure 1 is occupied by an expanse of yellow (Valley Heathy Forest) interrupted mainly by bands of blue along creeks and their floodplains. North of the Valley Heathy Forest, the colours (EVCs) are different and they form a more complex pattern. The area dominated by Valley Heathy Forest and its enclosed creeks and floodplains is part of the 'Gippsland Plain' biogeographic subregion, or 'bioregion'. The area to the north and a small part of the Dandenong Ranges in the southeastern corner are parts of the 'Highlands – Southern Fall' bioregion. Topography is the main factor determining the difference between bioregions in Maroondah: the Gippsland Plain area has gently undulating topography and broad, well-spaced floodplains, whereas the Highlands – Southern Fall has generally steeper, less weathered terrain with gullies close together.

The Department of Environment, Land, Water and Planning's delineation of the boundary between the two bioregions is shown as a red line on Figure 1. It is obviously a rather rough approximation but the EVC mapping is an approximation, anyway.

Figure 1 does not show Maroondah's original wetlands. Nor does it distinguish the vegetation of stream channels, because no EVC has even been described by the Department for these habitats with their unique vegetation, fauna and hydrology. The present report does recognise these communities.

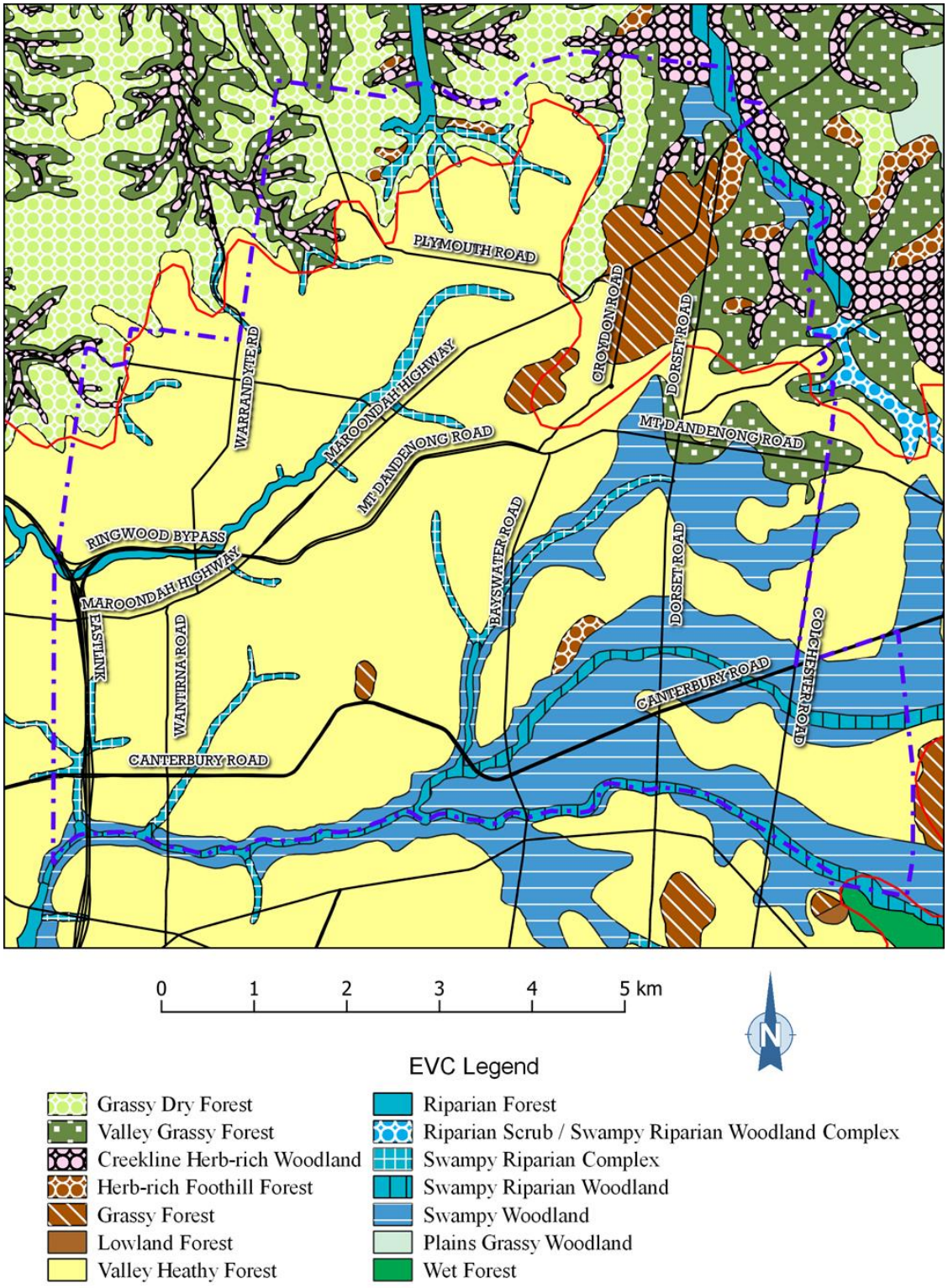

Figure 1. Map of Ecological Vegetation Classes (EVCs) in 1750.
Maroondah's boundary is the purple dash-dot line. The red line is the approximate boundary between two biogeographic regions. The polygons representing the EVCs are copyright © The State of Victoria, Department of Environment, Land, Water & Planning 2018.

4.2 Relationship of EVCs to Lorimer's (1997) Communities

Table 2 is provided to allow translation between the habitat types described in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and the EVC system.

Table 2. Relationship between the habitat types of Lorimer *et al.* (1997) and EVCs, with their associated code numbers.

Habitat type of Lorimer et al. 1997	Ecological Vegetation Class (EVC)
1 Wetlands – still water	74 Wetland Formation
1 Stream channels	none – see Section 4.3
2 Herb-rich Plains Grassy Wetland	653 Aquatic Herbland, which falls within EVC 74 – Wetland Formation.
3 Swamp Scrub	53 Swamp Scrub
4 Manna Gum Riparian Forest	18 Riparian Forest
5a Swamp Gum Forest of hilly country	164 Creekline Herb-rich Woodland
5b Swamp Gum Forest of broad valleys	On stream banks: 83 Swampy Riparian Woodland; Elsewhere: part of 937 Swampy Woodland
6 Silver-leafed Stringybark forest of poorly drained alluvium	part of 937 Swampy Woodland
7 Messmate Subriparian Forest	part of 23 Herb-rich Foothill Forest
8 Mixed eucalypt forest with Silver-leafed Stringybarks	16 Lowland Forest and most forms of 127 Valley Heathy Forest
9 Mixed eucalypt forest without Silver-leafed Stringybarks	In Highlands Southern Fall: 47 Valley Grassy Forest; In Gippsland Plain: 128 Grassy Forest and occasional forms of 127 Valley Heathy Forest
10 Messmate and Peppermint Forest	part of 23 Herb-rich Foothill Forest
11 Yellow Box – Candlebark Forest	part of 47 Valley Grassy Forest
12 Peppermint and Bundy Woodland	part of 47 Valley Grassy Forest
13 Box-Stringybark Woodland	22 Grassy Dry Forest

4.3 Identification and Distribution of EVCs Today

The following sections describe the EVCs of current-day native vegetation in Maroondah, including some EVCs that have been overlooked in the Department of Environment, Land, Water and Planning's vegetation maps. Subheadings include the code numbers given to the EVCs by the Department of Environment, Land, Water and Planning except that no EVC has been described for stream channels. Additional details about EVCs are provided by Oates and Taranto (2001).

4.3.1 Stream Channels

Stream channels are subject to frequent floodwater at high speed, which removes almost all tree seedlings that germinate except the introduced Desert Ash (*Fraxinus angustifolia*) and willows (*Salix* species). The vegetation is quite distinctive. The brow and slopes of a channel are dominated by creeping and scrambling species, most of which are now introduced (e.g. Kikuyu

Cenchrus clandestinus, Creeping Buttercup *Ranunculus repens* and the hybrid bindweed, *Calystegia sepium* × *silvatica*). The introduced Seaside Daisy (*Erigeron karvinskianus*) and Angled Onion (*Allium triquetrum*) are very common. The ferns, Tender Brake (*Pteris tremula*) and Bracken (*Pteridium esculentum*), are commonly present at intervals along the stream – the former species being questionably indigenous. Indigenous rushes, sedges and grasses are concentrated close to low water level, particularly Clustered Rush (*Juncus gregiflorus*), Loose-flower Rush (*Juncus pauciflorus*), Swamp Club-rush (*Isolepis inundatus*), Nodding Club-rush (*Isolepis cernua*), Australian Sweet-grass (*Glyceria australis*) and Clustered Wallaby-grass (*Rytidosperma racemosum*). Angled Lobelia (*Lobelia anceps*), Slender Knotweed (*Persicaria decipiens*), Water Plantain (*Alisma plantago-aquatica*), the moss *Rhynchostegium tenuifolium* and the liverwort *Lunularia cruciata* are also usually present near low water level. Common Pondweed (*Potamogeton ochreatus*) is usually present in the water, increasingly accompanied in recent years by Dense Waterweed (*Egeria densa*), which has been released from aquariums.

Stream channels also support a distinctive collection of fauna, including Platypus, Rakali (or Australian Water Rat), yabbies, fish, freshwater mussels and many other invertebrate species totally dependent on streams.

The characteristics of stream channels just described seem to vary very little within Maroondah, regardless of the EVC of the adjacent vegetation outside the channels. The main variation is that the most natural channels within Creekline Herb-rich Woodland have more fern species, particularly Soft Water-fern (*Blechnum minus*) and Mother Shield-fern (*Polystichum proliferum*). However, that distinction is being lost, as those fern species have declined badly over the past two decades due to the Millennium Drought and hydrological changes from urban development.

4.3.2 EVC 74 – Wetland Formation

Wetlands were abundant on Maroondah's floodplains prior to colonisation, as evidenced by nineteenth century maps, but drainage work seems to have destroyed all of them. There are, however, artificial wetlands: (a) lakes and ponds; (b) wet depressions created incidentally by excavations; and (c) two wetlands beside Dandenong Creek formed by meanders of the original creek channel that were cut off when the creek was straightened and piped.

'EVC 74 – Wetland Formation' represents an aggregate of various kinds of wetlands. Maroondah's current-day wetlands vary greatly in character between drought and wet years, making the selection of a single EVC difficult or arbitrary. In this report, wetlands are not classified more finely than 'Wetland Formation'.

4.3.3 EVCs 18 & 83 – Riparian Forest and Swampy Riparian Woodland

The banks of Maroondah's larger, perennial streams support either Swampy Riparian Woodland or Riparian Forest, depending on whether the valleys have broad or narrow floodplains, respectively. Swamp Gum (*Eucalyptus ovata*) is overwhelmingly the dominant eucalypt species in natural Swampy Riparian Woodland, whereas Manna Gum (*Eucalyptus viminalis* subspecies *viminalis*) dominates natural Riparian Forest, sometimes with other species of tall eucalypts. In natural stands, Swampy Riparian Forest differs from Riparian Forest in having fewer broad-leafed species such as Hazel Pomaderris (*Pomaderris aspera*), Victorian Christmas Bush (*Prostanthera lasianthos*) and Hemp Bush (*Gynatrix pulchella*); However, these can rarely be used as indicators in Maroondah today because so many have been planted without regard to their natural habitats.

Swampy Riparian Woodland is confined to a rather narrow band (~ 10–30 m) each side of a stream, flanked by Swampy Woodland. Riparian Forest usually extends the full width of the alluvium that defines a floodplain. It is not uncommon for it to extend beyond the floodplain on

the sheltered side, where it manifests as the 'Messmate Subriparian Forest' of Lorimer *et al*. (1997).

Both Mullum Mullum Creek and Dandenong Creek have segments of Riparian Forest alternating with segments of Swampy Riparian Woodland, contrary to the much simpler pattern depicted on Figure 1.

The 'Swampy Riparian Complex' (EVC 126) that once occurred in Maroondah along minor tributaries and the upper reaches of the major streams has effectively vanished, having been reduced to occasional Swamp Gums or Swamp Paperbarks (*Melaleuca ericifolia*), e.g. at Ringwood Lake Park.

4.3.4 EVCs 937 & 53 – Swampy Woodland and Swamp Scrub

Swampy Woodland occurs in the Gippsland Plain bioregion on poorly drained soil that is sodden in winter and dry in summer, not exposed to fast-moving floodwater. It once covered most of the floodplains of the Gippsland Plain in Maroondah, as depicted on Figure 1. However, only a small fraction of it remains and many of its distinctive plant species died out (or almost so) during the Millennium Drought and most of those species have not recovered. Swampy Woodland has deteriorated worse than any other EVC in Maroondah over the past two decades, followed by the related Creekline Herb-rich Woodland (Section 4.3.5).

Most surviving examples of Swampy Woodland are now identifiable only by the presence of Swamp Gums (*Eucalyptus ovata*) and/or Swamp Paperbark (*Melaleuca ericifolia*) on poorly drained ground (but not stream banks) accompanied by a few hardy species of winter-sodden soils, e.g. Centella (*Centella cordifolia*), Common Bog-rush (*Schoenus apogon*), Common Love-grass (*Eragrostis brownii*), Mat Grass (*Hemarthria uncinata*) and club-rushes (*Isolepis* species). Among the many species that were fairly common up to the 1990s but are now very rare or locally extinct in Maroondah are Woolly Tea-tree (*Leptospermum lanigerum*), Rosemary Everlasting (*Ozothamnus rosmarinifolius*), Glandular Daisy-bush (*Olearia glandulosa*), Red-fruit Saw-sedge (*Gahnia sieberiana*), water-ferns (*Blechnum* species), Spreading Rope-rush (*Empodisma minus*), Square-stem Twig-rush (*Baumea tetragona*), Long Purple-flag (*Patersonia occidentalis*), Short Purple-flag (*Patersonia fragilis*), Tufted Blue-lily (*Thelionema caespitosum*), Swamp Daisy (*Allittia cardiocarpa*), Running Marsh-flower (*Ornduffia reniformis*), Swamp Goodenia (*Goodenia humilis*), Common Rapier-sedge (*Lepidosperma filiforme*), Hooker's Fescue (*Hookerochloa hookeriana*), Swamp Wallaby-grasses (*Amphibromus* species), Glandular Brooklime (*Gratiola pubescens*), *Centrolepis* species and Pygmy Sundew (*Drosera pygmaea*). The only examples of Swampy Woodland that retain any of the species just mentioned are Dexter's Bush in Heathmont, Dorset Recreation Reserve in Croydon, the Healesville Freeway Reservation in Bayswater North, Bungalook Conservation Reserves in Kilsyth South and Appletree Hill Reserve in Kilsyth South.

In Maroondah and surrounding areas, Swamp Scrub can be regarded as the swampiest part of Swampy Woodland where Swamp Gums are sparse and Swamp Paperbark forms a dense thicket over ferns and sedges. The paperbark thickets at Eastfield Park in Croydon and Appletree Hill Reserve in Kilsyth South have a structure that matches Swamp Scrub and also the expected abundance of sedges. Perhaps they also once had the expected ferns. It is also possible that these areas have come to look like modified Swamp Scrub as a result of historical clearing of more typical Swampy Woodland. This is a quite likely explanation of the paperbark thickets at the Healesville Freeway Reservation in Bayswater North.

4.3.5 EVC 164 – Creekline Herb-rich Woodland

The dissected terrain of the Highlands – Southern Fall bioregion in Maroondah's north means that gullies and small creeks have narrower floodplains than the Gippsland Plain and they experience less seepage and runoff from the adjacent slopes. The native vegetation of those valleys comprises Creekline Herb-rich Woodland on the alluvium of the narrow valley floors and Valley Grassy Forest on the slopes, or occasionally Herb-rich Foothill Forest on the most sheltered slopes.

The eucalypts of Creekline Herb-rich Woodland are Swamp Gums (*Eucalyptus ovata*) and occasional outliers from the flanking EVCs, particularly Candlebark (*Eucalyptus rubida*). Up to the 1990s, most stands were distinguishable from Swampy Riparian Woodland by a substantial density of ferns, particularly Rough Tree-fern (*Cyathea australis*), Mother Shield-fern (*Polystichum proliferum*), Soft Water-fern (*Blechnum minus*) and Common Maidenhair (*Adiantum aethiopicum*), but these have since become extremely scarce. The same is true of Shining Buttercup (*Ranunculus glabrifolius*). Hooker's Fescue (*Hookerochloa hookeriana*) was once quite common but appears to have completely died out from Maroondah's Creekline Herb-rich Woodland since 2000.

The combined effects of the Millennium Drought and gully erosion from urban development can explain why so many plant species declined or died out in Creekline Herb-rich Woodland since the 1990s.

Now that so many distinguishing species of Creekline Herb-rich Woodland are so scarce, the most reliable way of identifying what is left of the EVC today is often by the presence of alluvium on a gully floor or beside a minor creek, with signs of Valley Grassy Forest or Grassy Dry Forest on the slopes, ridges or hills that drain into the valley.

4.3.6 EVC 22 – Grassy Dry Forest

Grassy Dry Forest occurs in Maroondah's north and northwest, on the tops of ridges and hills with shallow, stony soil. It extends for typically 10–30 m from crests down slopes with northerly or westerly aspects but scarcely at all in opposite directions. In Croydon North, Figure 1 shows Grassy Dry Forest extending too far south to the intersection of Yarra Rd and Maroondah Hwy, where Valley Heathy Forest actually occurs.

Apart from the topographic position and the character of the soil, the easiest way of recognising most stands of Grassy Dry Forest is by noting the combination of wild eucalypts. Red Stringybark (*Eucalyptus macrorhyncha*) and Bundy (*Eucalyptus goniocalyx*) are always present and Red Box (*Eucalyptus polyanthemos*) is the only other wild eucalypt that may be present (other than rare outliers). If the understorey is not too modified from a natural state, the ground flora is sparser than other EVCs in Maroondah, with plenty of exposed leaf litter. Grey Tussock-grass (*Poa sieberiana* variety *sieberiana*) and Red-anther Wallaby-grass (*Rytidosperma pallidum*) are the dominant grasses and the first of these is uncommon in Maroondah's other EVCs.

4.3.7 EVC 47 – Valley Grassy Forest

Valley Grassy Forest can occur from near the crests of ridges and hills right down slopes to the edge of the floors of gullies and creek valleys, where Creekline Herb-rich Woodland is the naturally-occurring EVC. Patches of it can still be found scattered across all of its natural distribution in Maroondah, which includes the northeast, Warranwood and northwest of Kubis Dr, Ringwood North. On Figure 1, the Ringwood North area is wrongly mapped as Grassy Dry Forest and the areas mapped as Valley Grassy Forest along Mt Dandenong Rd should be Valley Heathy Forest.

Valley Grassy Forest often includes the eucalypt species of Grassy Dry Forest (i.e. Red Stringybark, Bundy and sometimes Red Box) but additional species are present, particularly Yellow Box (*Eucalyptus melliodora*), Candlebark (*Eucalyptus rubida*) and Narrow-leaved Peppermint (*Eucalyptus radiata*). Candlebark is extremely uncommon in other EVCs in Maroondah but it has been particularly subject to clearing and it does not regenerate well from seed. Valley Grassy Forest never contains Silver-leafed Stringybark (*Eucalyptus cephalocarpa*), which would suggest Valley Heathy Forest. Also, it rarely contains Messmate Stringybark (*Eucalyptus obliqua*), which would suggest Valley Heathy Forest, Grassy Forest or Herb-rich Foothill Forest. Those last two EVCs very rarely contain Yellow Box in Maroondah.

The eucalypts of Valley Grassy Forest largely overlap with other EVCs so it is often important to consider the understorey, if there are enough wild indigenous plants to be diagnostic. Valley Grassy Forest's ground flora are mostly dominated by grass species but Spiny-headed Mat-rush (*Lomandra longifolia* subspecies *longifolia*) is often very dense on lower slopes due to seepage from uphill. By comparison, Valley Heathy Forest has a higher density of small shrubs (e.g. the Common Flat-pea, *Platylobium obtusangulum*) and the Small Grass-tree (*Xanthorrhoea minor*).

Grey Tussock-grass (*Poa sieberiana*) and the Beaked Fireweed (*Senecio prenanthoides*) are common in Valley Grassy Forest (as in Grassy Dry Forest) whereas those species tend to be replaced by Soft Tussock-grass (*Poa morrisii*) and Rough Fireweed (*Senecio hispidulus*) in similar EVCs. Small-leafed Bramble (*Rubus parvifolius*) is more abundant in Valley Grassy Forest than similar EVCs whereas Bracken (*Pteridium esculentum*) and Thatch Saw-sedge (*Gahnia radula*) tend to be less abundant.

In the somewhat modified state of Maroondah's surviving native vegetation, it is often very difficult or impossible to find plant species to identify Valley Grassy Forest as distinct from Grassy Forest, Herb-rich Foothill Forest or Valley Heathy Forest, particularly near the interface between two EVCs. Valley Grassy Forest is the most common EVC downslope of Grassy Dry Forest but Grassy Forest occupies that position on the west-facing slope of Hochkins Ridge Nature Conservation Reserve and beside Glenvale Rd north of Barnsdale Way, Ringwood North (contrary to Figure 1).

4.3.8 EVC 23 – Herb-rich Foothill Forest

In Maroondah, Herb-rich Foothill Forest is confined to lower slopes with southerly to easterly aspect. Herb-rich Foothill Forest does not occur at or near Woodland Park in Croydon South, contrary to Figure 1.

Herb-rich Foothill Forest is dominated by Messmate Stringybark (*Eucalyptus obliqua*) and (to a lesser degree) Narrow-leaved Peppermint (*Eucalyptus radiata*). Manna Gum (*E. viminalis*) is also prominent on steeper slopes near Mullum Mullum Creek and Dandenong Creek. There are usually smaller numbers of other eucalypt species but not Silver-leafed Stringybark (*Eucalyptus cephalocarpa*). Yellow Box (*Eucalyptus melliodora*) and Candlebark (*Eucalyptus rubida*) are normally absent but might occur as rare outliers from an adjacent stand of Valley Grassy Forest. Because of the southerly to easterly aspect and the position low in the landscape, there are more ferns, macrofungi and broad-leafed shrubs than Maroondah's other EVCs of hillsides. Tasman Flax-lily (*Dianella tasmanica*) is often abundant in the ground flora.

Lowland Forest has a similar overstorey but can be distinguished in more natural stands by its more dissected, undulating terrain with wiry grasses (particularly Forest Wire-grass, *Tetrarrhena juncea*) and species reflecting lower fertility, e.g. Red-fruit Saw-sedge (*Gahnia sieberiana*), Screw fern (*Lindsaea linearis*), Cut-leaf Xanthosia (*Xanthosia dissecta*) and members of the Protea family (Proteaceae).

4.3.9 EVC 128 – Grassy Forest

Grassy Forest in and near Maroondah has a canopy of Red Stringybark (*Eucalyptus macrorhyncha*), Messmate Stringybark (*Eucalyptus obliqua*), Narrow-leaved Peppermint (*Eucalyptus radiata*) and Bundy (*Eucalyptus goniocalyx*). White Stringybark (*Eucalyptus globoidea*) is also present at Grandfill Reserve, Croydon. A useful distinction from similar EVCs that contain these eucalypts is that Grassy Forest hardly ever contains any of the box eucalypts or Silver-leafed Stringybark (*Eucalyptus cephalocarpa*) or Candlebark (*Eucalyptus rubida*). The ground flora is quite dense with grasses and often Thatch Saw-sedge (*Gahnia radula*). Bracken (*Pteridium esculentum*) forms dense patches.

Figure 1 depicts a patch of Grassy Forest to the west and southwest of Croydon Rd, Croydon. That corresponds to Wicklow Hill, which is higher and stonier than the surrounding terrain. Grassy Forest remains there at Grandfill Reserve. The larger patch of Grassy Forest mapped just to the northeast (e.g. along Croydon Rd) is wrongly mapped as that area contains an abundance of Silver-leafed Stringybark (*Eucalyptus cephalocarpa*), which indicates Valley Heathy Forest rather than Grassy Forest. As a result, the bioregional boundary on Figure 1 is also wrongly mapped by about 1 km. However, there is Grassy Forest 700 m further north at Hochkins Ridge Nature Conservation Reserve, where the Department of Environment, Land, Water and Planning's map shows Grassy Dry Forest. The patch of Grassy Forest mapped on Figure 1 north of Canterbury Rd in Ringwood East appears unreliable, as the remaining vegetation there (in Wombolano Park) is consistent with Valley Heathy Forest.

In many parts of Victoria, Grassy Forest has not been distinguished from Herb-rich Foothill Forest. Oates and Taranto (2001) state that 'Further sampling and analysis are required to clarify the relationship s of drier forest types', including Grassy Forest.

4.3.10 EVC 127 – Valley Heathy Forest

Valley Heathy Forest is the dominant EVC of native vegetation on the gently undulating terrain that occupies most of the Gippsland Plain in Maroondah. It occurs from hilltops to the edges of floodplains, despite the term 'Valley' in its name. Today, it is represented by small, widely-scattered patches and vestiges along roads and railway lines.

Valley Heathy Forest is quite variable, reflecting the diversity of soil moisture and aspect across the undulating topography where it occurs. Silver-leafed Stringybark (*Eucalyptus cephalocarpa*) is usually present and it distinguishes Valley Heathy Forest from Maroondah's other EVCs except for those of floodplains and stream banks. Bundy (*Eucalyptus goniocalyx*), Messmate Stringybark (*Eucalyptus obliqua*), Red Stringybark (*Eucalyptus macrorhyncha*) and/or Narrow-leaved Peppermint (*Eucalyptus radiata*) are also usually present. Yellow Box (*Eucalyptus melliodora*) occurs in some stands, particularly on Loughnan Hill, Ringwood.

The ground flora of the more natural stands is rich in small shrubs and wildflowers, particularly orchids and lilies. Like Lowland Forest, it often combines species of poorly drained ground (e.g. Common Bog-rush (*Schoenus apogon*) and Cut-leaf Xanthosia (*Xanthosia dissecta*) with Red-anther Wallaby-grass (*Rytidosperma pallidum*), which typically occurs in soils that become very dry in summer. Some other diagnostic species that tend to be more abundant than similar EVCs other than Lowland Forest include Honeypots (*Acrotriche serrulata*), Common Flat-pea (*Platylobium obtusangulum*), Small Grass-tree (*Xanthorrhoea minor*), Slender Sword-sedge (*Lepidosperma gunnii*), Nodding Greenhood (*Pterostylis nutans*) and Milkmaids (*Burchardia umbellata*). Compared with Lowland Forest, Valley Heathy Forest has more herbaceous plants and species that retreat to underground organs each summer ('geophytes'), e.g. Chocolate Lily (*Arthropodium strictum*) is often one of the dominant ground flora species in spring. Lowland Forest is further distinguished by its taller trees, the common presence of Red-fruit Saw-sedge

(*Gahnia sieberiana*) and greater abundance of Forest Wire-grass (*Tetrarrhena juncea*) and plants in the Protea family (Proteaceae) such as *Hakea* species, Silver Banksia (*Banksia marginata*) and Prickly Geebung (*Persoonia juniperina*).

4.3.11 EVC 16 – Lowland Forest

Lowland Forest is most similar to Valley Heathy Forest, from which it can be distinguished by the features described in the previous paragraph. Messmate Stringybark (*Eucalyptus obliqua*) is the dominant species, followed by Narrow-leaved Peppermint (*Eucalyptus radiata*). Smaller numbers of other eucalypts may be present but not Candlebark (*Eucalyptus rubida*) or species in the box group. The ground flora is often so dense, deep and tangled as to impede walking.

Lowland Forest is not shown in Maroondah on Figure 1 but it occurs in Kilsyth South at Eastwood Golf Course and Bungalook Conservation Reserves, and as a remarkable western outlier in Heathmont from Uambi (on Allens Rd) to H.E. Parker Reserve.

4.4 Conservation Status of the EVCs

The conservation status of a species or community states its likelihood of becoming extinct or whether it is already extinct. The Department of Environment, Land, Water and Planning has expanded the usual use of that term so that an EVC can be classified as 'Endangered' or 'Vulnerable' in a bioregion solely on the basis of its current extent relative to its presumed pre-colonisation extent, regardless of any known threats. The criteria used by the Department were published in *'Native Vegetation – A Framework for Action'* (NRE 2002), adopting the following categories (in order): Presumed extinct; Endangered; Vulnerable; Depleted; Rare; and Least Concern.

The Department's assessment of the bioregional conservation status of EVCs in Maroondah appears in Table 3.

Table 3. Bioregional conservation status of EVCs in Maroondah.

EVC No.	EVC Name	Bioregional Conservation Status	
		Gippsland Plain	Highlands – Southern Fall
16	Lowland Forest	Vulnerable	–
18	Riparian Forest	Vulnerable	Least Concern
22	Grassy Dry Forest	–	Least Concern
23	Herb-rich Foothill Forest	Vulnerable	Least Concern
47	Valley Grassy Forest	Vulnerable	Vulnerable
53	Swamp Scrub	Endangered	–
74	Wetland Formation	Endangered	Endangered
83	Swampy Riparian Woodland	Endangered	Vulnerable
126	Swampy Riparian Complex	Endangered	Endangered
127	Valley Heathy Forest	Endangered	Vulnerable
128	Grassy Forest	Endangered	Vulnerable
164	Creekline Herb-rich Woodland	–	Vulnerable
937	Swampy Woodland	Endangered	Endangered

The greater prevalence of 'Endangered' EVCs in the Gippsland Plain bioregion compared with the Highlands – Southern Fall is due to the greater retention of forests in hillier parts of Victoria. The Highland – Southern Fall bioregion extends to Wallan, Morwell North, north of Buchan and near Mt Hotham.

The conservation status of EVCs was a major determinant of the level of planning protection given to vegetation under the state-wide 'Native Vegetation Framework' between 2003 and 2013. The 'Framework' was then replaced. Now, conservation status plays no role in most cases of vegetation clearing. To be precise, it appears only in the 'decision guidelines' and then only in cases involving clearing of 'endangered' EVCs under the 'Intermediate' or 'Detailed' Assessment Pathways.

While the conservation statuses above have been determined separately within each bioregion, it would be possible to apply the same assessment procedure on the basis of current and past vegetation within Maroondah. That has not been done but it seems clear that if it was, all EVCs would fit the 'endangered' category on the local scale.

5 Wild Plant Species

5.1 Indigenous Plants

Appendix A (p. 116) provides an inventory of Maroondah's wild, indigenous plant species for which valid records were found in this study. ('Wild' means excluding planted plants.) The inventory includes recent or historical records of:

- 486 flowering species, or 496 if named hybrids and multiple subspecies are included;
- 21 fern species;
- 41 species of moss; and
- 8 species of liverwort.

This makes a total of 556 species, or 566 if named hybrids and multiple subspecies are included.

As described in Chapter 10 (p. 81), one cannot be sure whether some species are indigenous to Maroondah. Appendix A includes such species, with a comment.

Algae are not included in Appendix A because there is too little data to provide a meaningful representation of Maroondah's algal diversity. Most alga species are aquatic and microscopic or filamentous, requiring specialised surveying and microscopic analysis by an expert. The only species large enough to be detected in the present study was the stonewort, *Chara corallina*, of which a single plant was found at Hochkins Ridge Drainage Reserve in Croydon North. *Chara* species are of considerable scientific interest because they represent the ancestors of vascular plants such as flowering plants. *Chara corallina* must be quite rare in Maroondah or else it would have been detected more often during this study or in a previous botanical survey. The solitary plant that was found is at high risk from gully erosion, which is occurring due to urbanisation of the catchment and lack of effective stream stabilisation.

5.1.1 Mosses and Liverworts

Mosses and liverworts (bryophytes) are not often included in botanical surveys or studies of biodiversity. This is probably due to a combination of scarcity of expertise, the high investment in time and effort required to find and identify these tiny plants, and the self-perpetuating problem of limited prior data with which to compare newly acquired data. The present study is the first to aim to provide a baseline inventory of mosses and liverworts in Maroondah. It relies mostly on the fieldwork of this study, augmented mainly by herbarium specimens.

Most mosses and liverworts produce spores that can be carried high into the atmosphere, regularly travelling very large distances. The minute fraction of spores that land in a suitable place for the species is all it takes to perpetuate the species. Consequently, many species are naturally widespread around much of the world and others are likely to have established in Victoria so soon after European settlement that no-one can tell whether they are indigenous in Maroondah or not. These factors are unlike flowering plants and (to a lesser degree) ferns.

Another feature that distinguishes mosses and liverworts from flowering plants and ferns is their adaptability to the built environment, due to their habitat requirements and tolerances. Different species have different requirements for climate, shade, lack of competition and various characteristics of the surface on which they grow (the substrate), e.g. pH, moisture retention, nutrient availability, roughness and inclination to vertical. A few square centimetres are all it takes for spores of a suitable moss or liverwort to establish. A typical house and garden provide a wider range of habitat characteristics than in local forests; e.g. alkaline and acid surfaces, dry and damp

spots, fertile and infertile areas, and surfaces with various frequencies of cultivation or cleaning. Some species are adapted well to lawns, others to potting mix, others to roof tiles. Consequently, the author found more species of moss and liverwort around home than in even the largest and most natural of Maroondah's conservation reserves. While the spores of many of the urban species may have been continually landing in Maroondah long before European settlement, many would not have previously been able to reach maturity due to the lack of suitable habitat and substrates.

This study did not search much for mosses and liverworts in the built environment, so that part of Maroondah's biodiversity remains incompletely understood, as it is in urban Australia generally.

5.1.2 Plant Species that have Died Out

Appendix A indicates with red text the species that can be presumed to have died out in Maroondah. The criteria used are that these species have not been recorded for over thirty years despite surveys, or not for at least ten years despite targeted searching at the previously known sites under good conditions for detection. Mosses and liverworts that have not been recorded for many years are not deemed here to have died out because the absence of recent records could be simply due to the scarcity of searches for them.

Seventy-eight indigenous species of ferns and flowering plants in Appendix A can be presumed to have died out in Maroondah, plus one named hybrid. (In the rest of this section of the report, statistics about 'species' include named hybrids and multiple subspecies within a species.) That represents a 15% rate of local extinction since European settlement. It is inevitable that some additional plant species died out before anyone noticed them or left a record of their former existence. It is also likely that some species of ferns or flowering plants are yet to be detected, and that is almost certainly the case for the 'lower' (or non-vascular) flora. New discoveries are made at least every few years, and particularly when a study like the present one is conducted.

The orchid family (Orchidaceae) is the largest family of plants in the world by numbers of species. Analysis of the information in Appendix A indicates that the orchid family was, and still is, the largest family of indigenous plants in Maroondah. There are 93 indigenous orchid species and named hybrids in Appendix A, of which 54 cannot be presumed to have died out. Today, we can be confident that at least 39 out of Maroondah's 93 orchid species and hybrids (i.e. 42%) have died out in Maroondah and are unlikely to reappear. Many of them have not been recorded for more than eighty years; some others much more recently.

The orchid family is the family that has suffered the highest percentage loss of species in Maroondah, by far. Table 4 provides statistics for flowering plants more generally, for ferns and for the fifteen families with the largest numbers of species. (The last column is discussed in Section 5.1.3.)

The variability among families in the local extinction rate is remarkable. Whereas 43% of orchid species can be presumed to have died out in Maroondah, no wattles, eucalypts or Apiaceae species appear to have died out, and only one out of 50 grass species. Lilies in Asparagaceae and Asphodelaceae have also proved themselves to be good survivors.

The high rate of loss of orchid species is similar to the rest of Victoria, Australia and the world. It can be partially explained by the strong dependence of most orchids on highly specific conditions being met for their survival and reproduction, particularly the presence of specific fungi and insect pollinator species. However, this study found no explanation why some groups of orchids, such as the leek-orchids of genus *Prasophyllum*, have suffered many sudden extinctions or population collapses over the past two decades, even in areas where there has been no evident change in their habitats.

Table 4. Statistics about survival of species in Maroondah.
'Critically endangered' in the last column refers to the risk of dying out in Maroondah.

Plant group	Number of species		Local extinction rate	Number of critically endangered species
	Historically	Presumed still present		
Flowering plants	496	420	15%	165
Ferns and fern allies	21	17	14%	10
By family:				
Orchidaceae – orchids	93	54	42%	34
Poaceae – grasses	50	49	2%	15
Asteraceae – daisies	49	43	12%	16
Cyperaceae – sedges	29	28	3%	11
Fabaceae (excl. *Acacia*) – peas	23	20	13%	9
Fabaceae – *Acacia*	16	16	0%	3
Myrtaceae	19	19	0%	6
Juncaceae – rushes	17	15	12%	3
Asparagaceae	10	9	10%	0
Apiaceae	9	9	0%	3
Asphodelaceae	9	9	0%	2
Campanulaceae	9	8	11%	5
Plantaginaceae	8	7	13%	4
Proteaceae	7	6	14%	6
Haloragaceae	6	5	17%	4
Polygonaceae	6	6	0%	3

For example, countless thousands of *Prasophyllum brevilabre* and *P. odoratum* flowered on the west face of Mt Dandenong after any fire in the 1980s and early 1990s but the author has been unable to find any in the past decade or more. Loss or displacement of the underground fungus on which the orchids depend is one plausible explanation why the collapse of these species occurs without visible signs of habitat change. The only one of the seven species of *Prasophyllum* historically recorded in Maroondah that may not have died out is *Prasophyllum brevilabre*, but it has not been recorded since 1999.

Given that so many plant species have died out in Maroondah, it is important to investigate the potential for more species to do so.

5.1.3 Species Facing Local Extinction

The most rigorous way of assessing the risk of each remaining plant species dying out of an area such as Maroondah is to apply the international standard 'Red List' categories, criteria and guidelines of the International Union for the Conservation of Nature (see Lorimer (2011) and www.iucnredlist.org/about/publication/assessment-process). The present study's budget did not extend to a full analysis of all Maroondah's surviving plant species but some species can be confidently placed in the category of 'critically endangered' for their likelihood of dying out in Maroondah. That category is the most serious one, notionally equivalent to at least a 50% chance of dying out within ten years or three generations of the species, whichever is longer. The criteria

and guidelines involve consideration of subpopulation sizes, population declines and rate of natural immigration from outside the area under consideration (e.g. seeds blowing into Maroondah). The criteria based on geographic range do not apply to an area as small as Maroondah.

The fieldwork for this study paid particular attention to searching for species believed to be candidates for the 'critically endangered' category. Population details were taken whenever such species were found. In many cases, information was also sought from local naturalists and ecologists. While a full, formal assessment under the Red List criteria and guidelines could not be undertaken, many candidate species were assessed to the level where one can be confident that they are in the 'critically endangered' category. For example, quite a few species easily meet the criteria because they are only known to be represented by substantially less than fifty mature, wild individuals despite searching in all the previously known locations. Note that planted individuals do not count toward population sizes.

It is important to note that there are quite a few species that may well meet the criteria for 'critically endangered' but that have not been categorised as such here because further investigation is needed.

Despite the resultant bias toward under-reporting, it is remarkable that 39% of the extant flowering plant species in Appendix A, and 53% of the extant fern species, are clearly or very probably in the 'critically endangered' category of risk of dying out in Maroondah. A dissection of the number of species in this category within each of the largest families of plants appears in the last column of Table 4.

In nearly all groups of plants, Table 4 suggests that more species may die out in Maroondah within a decade than have died out since European settlement.

There is only a weak correlation between the percentage loss of species up to today and the percentage loss predicted by the 'critically endangered' ratings in Table 4.

It may ultimately be found that the IUCN Red List criteria and guidelines overestimate the risk of a species dying out in an area like Maroondah. For example, the criteria do not take into account the measures taken by Maroondah City Council and its citizens to prevent species becoming extinct. (Some species have already been saved from dying out, e.g. the Kilsyth South Spider-orchid.) Conversely, there are numerous species that are only known to have less than five mature individuals in the whole municipality, making them undoubtedly deserve the tag of 'critically endangered'. It should also be understood that major droughts will probably finish off many species facing local extinction. Therefore, there may be fewer local extinctions among the 'critically endangered' species over the coming decade if no major drought occurs, or more if one does occur.

It should be expected that a more extensive analysis would find substantial numbers of additional plant species falling into the lower IUCN Red List categories, 'endangered' and 'vulnerable'. Conducting such an analysis is beyond the scope of the present study.

While orchids are by far the family of plants with the worst prospects of dying out in Maroondah, there is another category of plants that is similarly at risk. Table 5 lists all Maroondah's plant species that are confined (or almost so) to floodplain soil that is hard and dry in summer and kept sodden (but not inundated) by seepage throughout the wetter months of the year.

Table 5. Species specially adapted to winter-sodden / summer-dry floodplains.
For species unable to be found in the present study, the 'Missing since' column shows the year of the most recent record. Population estimates in the last column are based on this study's fieldwork.

Scientific name	Common name	Missing since	Pop'n. estimate
Presumed to have died out in Maroondah			
Burnettia cuneata	Lizard Orchid	1921	–
Centrolepis fascicularis	Tufted Centrolepis	2001	–
Chorizandra cymbaria	Heron Bristle-rush	c. 1998	–
Cycnogeton alcockiae	Water-ribbons	1996	–
Drosera binata	Forked Sundew	1945	–
Mazus pumilio	Swamp Mazus	2000	–
Microtis atrata	Yellow Onion-orchid	1926	–
Pultenaea sericea	Heathland Bush-pea	1902	–
Ranunculus inundatus	River Buttercup	1992	–
Utricularia tenella	Pink Bladderwort	1897	–
Xerochrysum palustre	Swamp Everlasting	1996	–
Critically endangered with dying out in Maroondah			
Allittia cardiocarpa	Swamp Daisy	2016	0–10
Almaleea subumbellata	Wiry Bush-pea		20–40
Amphibromus archeri	Pointed Swamp Wallaby-grass		2–5
Aphelia gracilis	Slender Aphelia		~1,000
Baumea rubiginosa	Soft Twig-rush	2012	0–2
Baumea tetragona	Square Twig-rush		1–2
Centrolepis aristata	Pointed Centrolepis		~100
Centrolepis strigosa	Hairy Centrolepis		~100
Drosera pygmaea	Tiny Sundew	2015	0–10
Epacris gunnii	Ace of Spades	1995	–
Eryngium vesiculosum	Prickfoot		10–50
Gonocarpus micranthus	Creeping Raspwort		0–40
Goodenia elongata	Lanky Goodenia		0–10
Goodenia humilis	Swamp Goodenia		~100
Gratiola pubescens	Glandular Brooklime		~500
Hookerochloa hookeriana	Hooker Fescue		~50
Isolepis fluitans	Floating Club-rush		15–50
Juncus filicaulis	Thread Rush		1
Lepidosperma filiforme	Common Rapier-sedge		20–50
Lepidosperma longitudinale	Pithy Sword-sedge		1
Leptospermum lanigerum	Woolly Tea-tree		1–5
Olearia glandulosa	Swamp Daisy-bush		1
Ozothamnus rosmarinifolius	Rosemary Everlasting		1
Patersonia fragilis	Short Purple-flag		30–50
Ranunculus glabrifolius	Shining Buttercup		20–50
Rytidosperma aff. *caespitosum* (South-west Swamps)	Porphyry Wallaby-grass		80–100
Schoenus lepidosperma	Slender Bog-rush		5–10
Schoenus maschalinus	Leafy Bog-rush	2000	0–5
Schoenus tesquorum	Soft Bog-rush		10–100
Selaginella uliginosa	Swamp Selaginella	2012	0–5
Stylidium despectum	Hundreds and Thousands		300–400
Thelionema caespitosum	Tufted Blue-lily		50–100
Utricularia dichotoma	Purple Bladderwort	2001	0–10
Viminaria juncea	Golden Spray	2012	–

Of the 45 species in Table 5, eleven can be confidently presumed to have died out in Maroondah and seventeen others either could not be found in this study or had fewer than five individuals. Every surviving species in Table 5 is classified as critically endangered. The species in Table 5

come from a wide range of plant families, habits and life histories, indicating that the problem is associated with the habitat, unlike the situation with the orchid family.

Until c. 2000, most of the species listed in Table 5 were fairly common or abundant, contributing a great deal of distinctiveness to the Swampy Woodland where they occurred. The loss or imminent loss of so many species from a vegetation community is a significant problem for biodiversity not only at the level of species but also at the level of a community. In addition, the loss is not only important within Maroondah but also more widely, because Swampy Woodland is a regionally endangered EVC. The author has observed the same phenomenon in Knox and it seems inevitable that it is more widespread, as the factors that appear to be responsible are also widespread.

For these reasons, the loss of plant species specially adapted to winter-sodden floodplains represents the single greatest contribution to species dying out in Maroondah for the foreseeable future.

The cause of this collapse of species can be inferred from the trajectory during and since the Millennium Drought. The species all require soil that is sodden in winter, so it is perhaps not surprising that so many suffered during the drought. However, only *Aphelia gracilis* recovered when the drought broke. By contrast, nearly all wetland plant species recovered remarkably quickly and fully.

The species in Table 5 demonstrably survived the countless droughts that must have occurred through pre-history. One likely reason why recovery was so poor following the Millennium Drought is the unnaturally long duration of the drought, exhausting nature's capacity to recover. Until this millennium, the habitat occupied by the species in Table 5 has been reliably sodden during the crucial winter establishment phase of their seedlings, so those species have not needed to be adapted to winter dryness, as those of drier places must. Seeds were able to germinate during less dry parts of the Millennium Drought, only for most of the germinants to die from subsequent dryness before they produced seeds for the next generation. For that reason as well as natural attrition, the soil-stored seeds of most plants must have dwindled in numbers over the decade of drought. The observed lack of regeneration following the drought suggests that the soil-borne seed bank became exhausted.

The severity and long duration of the Millennium Drought have been attributed to human-induced climate change.

Another apparent cause for the loss or decline of species in Table 5 was urban development and drainage works causing permanent lowering of water tables and reduction of the seepage on which the community relies.

A related but less direct cause can be seen on the floodplain in the southwest of Hochkins Ridge Nature Conservation Reserve (Site 51 in Volume 2). The catchment of the creek there has become so covered with impervious surfaces that the creek is now dry most of the time and experiences highly erosive, gushing flows during rainfall events. The resulting gully erosion has gouged a trench up to about 2 m deep in places, thereby draining the water table to a similar depth. In 2000, there were approximately one dozen of the locally rare Hooker's Fescue (*Hookerochloa hookeriana*) among other plants of swampy ground. Today, those plants have been replaced by introduced pasture species adapted to drier conditions.

It is appropriate to introduce at this stage the concept of 'extinction debt', which refers to future loss of species resulting from the delayed impacts of past actions. A good example is provided by the Heron Bristle-rush, *Chorizandra cymbaria*, at Bungalook Conservation Reserves in Kilsyth South. The species is regionally rare and has never been recorded any closer than Macclesfield, on the other side of the Dandenong Ranges. It was found in 1988 in regrowth where a creek had

recently been filled in to facilitate residential development along Tereddan Drive. Despite concerted efforts to save the species, it died out 10–15 years later. In retrospect, the reason was that the species requires swampy conditions and the creek destruction was part of efforts to drain the land. There are other examples in Maroondah where species have become locally extinct decades after the events that precipitated the extinctions.

'Extinction debt' is sometimes used as an excuse for doing nothing to prevent local extinctions, on the presumption that extinction is inevitable. Instead, the concept can prompt us to consider what threatening processes have been set in train by past events and what action can be taken to reverse those processes. To take the example of the Heron Bristle-rush, if the drying of the land by the drainage works had been identified as the threatening process, it may have been possible to rehydrate the land by bringing water from stormwater pipes to the surface.

5.1.4 Legally Protected Species

There are three main legal instruments that confer a level of protection to certain rare or threatened plant species in Victoria:

- The federal *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- The Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act); and
- The *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*, which has a role through the Victoria Planning Provisions in all planning schemes in Victoria.

Appendix A (p. 116) identifies all rare or threatened species affected by any of these documents. A more detailed assessment of Maroondah's surviving populations of those species follows. Note first that some of the species are locally common and fairly secure.

Acacia stictophylla – Dandenong Range Cinnamon Wattle

> 'Rare' (but not threatened) in the 'Advisory List', because despite the species' large population size and apparent security, its geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. This species appears to be secure in Maroondah.

Austrostipa rudis subsp. *australis* – a subspecies of the Veined Spear-grass

> 'Rare' (but not threatened) in the 'Advisory List', because despite substantial populations, it has a relatively small known geographic distribution in Victoria. Maroondah and Knox appear to be the species' heartland in Victoria, each with at least hundreds of plants, including conservation reserves.

Caladenia sp. aff. *venusta* (Kilsyth South) – Kilsyth South Spider-orchid

> 'Critically Endangered' under the EPBC Act; 'Threatened' under the FFG Act; 'Endangered' in the 'Advisory List'; critically endangered in Maroondah.
>
> This is one of the most threatened species in the world, with a global population of two wild plants (one of which appears unable to flower) and three potted plants raised from seed of one of the wild plants. Both wild plants are in Kilsyth South. A management plan is in place to bring the species back from the brink of extinction. The main short-term threat to the species is from orchid enthusiasts trampling seedlings or removing the wild plants. Inbreeding is a longer-term threat. There are very high penalties under the EPBC Act for any action that may threaten the orchids.

Dianella amoena – Matted Flax-lily

'Endangered' under the EPBC Act; 'Threatened' under the FFG Act; 'Endangered' in the 'Advisory List'; critically endangered in Maroondah.

This species has turned out to be more common and widespread than when it was given legal protection, which was soon after it was first described as a species. However, most plants are found as one or two isolated individuals, raising serious concerns about inbreeding. A patch that grew at the Croydon District Golf Club was dug up and put into cultivation by Candlebark Indigenous Nursery when the course was sold for residential development. The only known wild plants in Maroondah now were discovered during the present study: one plant at Croydon Primary School and 1 patch beside the Lilydale Railway Line in Croydon, east of Dorset Rd. The principal and management staff now of Croydon Primary School know about the school's plant and its rarity and have expressed keenness to look after it. The Biodiversity Manager of Metro Trains is aware of the patch on the rail reservation and is taking steps to protect it. It would be desirable to exchange pollen between the wild plants and a cultivated plant from the former golf course.

Diuris behrii – Golden Cowslips

'Vulnerable' in the 'Advisory List'; critically endangered in Maroondah. (The Department of Environment, Land, Water and Planning use only two categories of extinct risk: 'Endangered' and 'Vulnerable'. The latter is the lower of the two.)

Dozens of this species were discovered on the Healesville Freeway Reservation in 1996, along with many other regionally rare species. VicRoads and Department of Environment, Land, Water and Planning fenced the area and stopped it being slashed. As a result, the area has mostly become a dense thicket of paperbark and tea-tree. Like the other rare species, Golden Cowslips cannot survive in a thicket and it has not been seen since c. 2000 despite the author searching in several subsequent years during flowering time. It may reappear if the vegetation is returned to its previous state, with summer slashing.

Eucalyptus × *brevirostris* – a hybrid eucalypt

'Rare' (but not threatened) in the 'Advisory List'. Under the international Red List criteria, hybrids are excluded from all threat categories on the basis that as a general rule, even if all individuals die out, more can be created by artificial hybridisation and others may occur spontaneously in the wild as long as both parent species occur in proximity to each other. In this case, the parent species are Red Stringybark (*Eucalyptus macrorhyncha*) and Messmate Stringybark (*Eucalyptus obliqua*), which commonly grow together in Maroondah. The hybrids are moderately common but generally overlooked. This particular hybrid is of no greater importance than the many other eucalypt hybrids in Maroondah, but it differs in that it is the only one that has been scientifically named.

Eucalyptus yarraensis – Yarra Gum

'Rare' (but not threatened) in the 'Advisory List'; 'critically endangered' in Maroondah. Three trees of this species occur at H.E. Parker Reserve in Heathmont (where threatened by current engineering work along Dandenong Creek); another few a few hundred metres further east, and a few at Ringwood Golf Course. No young plants could be located in this study and some of the mature trees are in poor condition.

Kunzea leptospermoides **–** Yarra Burgan

> 'Poorly known' (but suspected to be rare or threatened), in the 'Advisory List'. The 'poorly known' designation results from lack of clarity about how this species differs from '*Kunzea* sp. (Upright form)'. The Royal Botanic Gardens' provisional guidelines for distinguishing the two species often fail in Maroondah, as the leaf width is generally consistent with *K. leptospermoides* but the leaf shape and/or pedicel length often point to '*K.* sp. (Upright form)'. Regardless of how the taxonomy is ultimately resolved, the local plants proliferate greatly following land clearing and they are under no threat in Maroondah or more widely; in fact, they can become so dense as to threaten other indigenous species of flora and fauna.

Platylobium infecundum – a flat-pea

> 'Endangered' in the 'Advisory List'. This species was only recognised as such in 2011, having formerly been regarded as part of *Platylobium formosum*. Its type locality (i.e. the location from which a specimen was taken to define the species) is H.E. Parker Reserve in Heathmont. This species is not uncommon from central and southern Maroondah to Wantirna South and Ferntree Gully, and abundant in the Dandenong Ranges. It does not occur far beyond that area. The 'infecund' in the name reflects the absence of any records of seeds being produced by the species; i.e. when plants die, they are unlikely to be replaced.

Pterostylis clivosa – Red-tip Greenhood (formerly *Pterostylis* sp. aff. *parviflora*)

> 'Rare' (but not threatened) in the 'Advisory List'; 'critically endangered' in Maroondah. As at autumn 2018, nine individuals were found at FJC Rogers Reserve and a few dozen at Bungalook Conservation Reserves. These numbers have not changed significantly over the past twenty years or more.

Pterostylis × *ingens* – Sharp Greenhood (a hybrid)

> 'Rare' (but not threatened) in the 'Advisory List'. As explained above, the international Red List criteria exclude hybrids from all threat categories. However, in this case, the hybrid is unlikely to occur spontaneously or with human assistance because the two parent species (*Pterostylis falcata* and *Pterostylis nutans*) hardly ever flower at the same time. In addition, *Pterostylis falcata* has died out from Maroondah and for many kilometres beyond. There is a single, thriving colony of *Pterostylis* × *ingens* at Bungalook Conservation Reserves, showing no decline since its discovery in c. 1990.

Rytidosperma aff. *caespitosum* (South-West Swamps) – Porphyry Wallaby-grass

> 'Poorly known' (but suspected to be rare or threatened), in the 'Advisory List'; 'critically endangered' in Maroondah.
>
> The present author is researching the plants that currently go under this name, and has discovered that they belong to three distinct species. One of those species appears to occur only at one place on Earth: Bungalook Conservation Reserves in Kilsyth South. (There is also a 19th Century specimen of Baron Sir Ferdinand von Mueller's at the National Herbarium of Victoria with the locality recorded as 'Dandenong Range', which would have been taken to include Kilsyth South at that time.) The species at Bungalook Conservation Reserves is at extreme risk of global extinction. Melbourne Water destroyed over half the population during 2017–2018 by herbicide, badly timed mowing and installation of a drain to dry out the swampy habitat on which the species depends. At the time of writing, steps have been proposed to avoid repetition of herbicide spraying and harmful mowing but not the drying out of the species' habitat.

Senecio campylocarpus – Floodplain Groundsel

> 'Rare' (but not threatened) in the 'Advisory List'. This is another species that was declared 'Rare' soon after it was described (in 2004) and then discovered to be more common than initially thought. Its copious windblown seeds can travel large distances and germinate in large numbers on bare mud where water levels recede around wetlands. It probably dies out in Maroondah during droughts and recolonises when conditions improve. This has probably occurred for millennia. During this study, it was found at Bungalook Conservation Reserves and beside Ringwood Lake. It is likely to occur sometimes at other waterbodies.

The *Flora and Fauna Guarantee Act 1988* provides a level of protection not only for threatened species but also for certain, more common classes of wild plants that are popular as cut flowers or garden specimens. Examples include all ferns except Bracken, all grass-trees and all members of the orchid and daisy families. The Act also protects all plants living in listed threatened ecological communities, none of which occurs in Maroondah.

It is quite likely that no more rare or threatened plant species with current legal protection remain to be discovered in Maroondah. One may gain a different impression from the regular reports of additional species (e.g. Green Scentbark, *Eucalyptus fulgens*) but my checks of such reports over the past two decades have always resulted in their dismissal as misidentifications.

At the time of writing, the Department of Environment, Land, Water and Planning advises that it has a new, substantially changed edition of the *'Advisory List or Rare or Threatened Plants in Victoria'* ready for publication. When that happens, more of Maroondah's plant species are likely to be listed and many currently listed species are likely to be placed in higher threat categories.

5.1.5 Eucalypt Deaths

Certain species of eucalypt have suffered extensive population reduction and ill-health in peri-urban Melbourne during and since the Millennium Drought (i.e. since the turn of the millennium). The most seriously affected species observed in this study were Red Stringybarks and White Stringybarks (*Eucalyptus macrorhyncha* and *Eucalyptus globoidea*), followed by Messmate Stringybark (*Eucalyptus obliqua*). The prevalence of dead and dying trees is quite patchy. Even within a small area that has been affected, there can be quite healthy trees among badly affected trees of the same species.

Figure 2 depicts a moderately severe example of affected eucalypt crowns, at Birts Hill Reserve in Croydon North.

One factor that seems to be an inevitable contributor to the death or decline of some trees is excessive tree density. The eucalypt species in Maroondah are 'crown shy', i.e. they do not tolerate overlapping crowns. Consequently, their trunks must be spaced apart at distances similar to their crown diameters. A typical crown diameter of a mature eucalypt in Maroondah is 12 m but most local forests have trunks less than 5 m apart as a result of regeneration following past clearing. At these densities, trees (and understorey) suffer from over-competition and the weaker trees die – mostly during times of stress such as midsummer during drought. It may seem that the stress factors such as drought are the causes of the tree deaths or decline but they are just the *coup de grâce* for trees that cannot survive to maturity, anyway. The surviving trees benefit from the reduced competition.

However, excessive tree density cannot be the cause of eucalypt decline and deaths at some sites where trees are not unnaturally dense, e.g. at Birts Hill Reserve (Site 45).



Figure 2. The crowns of dying eucalypts in Birts Hill Reserve, Croydon North.

Therefore, when areas of seriously defoliated eucalypts were encountered during the fieldwork for the present study, an effort was made to check for visible signs of causes. Leaves were inspected from ground level, often with binoculars, to check for yellowing, insect attack or possum damage. Attention was paid to whether the worst-affected leaves were toward the tips of the branches or further back. The density of possum faeces was checked beneath dying trees to gauge the amount of possum browsing. Trunks were checked for exudate from borer holes ('kino'). The health of any neighbouring grass-trees or heath plants was checked because those species act as bellwethers for harmful Cinnamon Fungus. No attempt was made to analyse the content of soil or leaves to check for fungal disease or nutrient problems.

The yellowing of leaves that accompanies some causes of eucalypt decline was not observed. Insect damage did not seem abnormal.

Many eucalypts showed the following signs consistent with excessive possum damage:

- Bite-marked or torn leaves, which are principally toward the tips of the branches in the case of Common Ringtail Possum damage or further back in the case of Common Brushtail Possums;
- A high density of possum faeces beneath affected trees that still have a reasonable amount of foliage;
- Tree decline is greatest in the species most palatable to possums, e.g. stringybarks and Swamp Gums (*Eucalyptus ovata*) rather than Red Box (*Eucalyptus polyanthemos*); and
- The least damage is found in trees that cannot be accessed by possums without going to the ground, which possums avoid doing because of the risk of being eaten by a fox.

In addition, in the few cases where crown health was recorded in winter and checked again in summer, there was a marked improvement. That would be consistent with possum damage (among other things) because eucalypt leaf growth may exceed consumption by possums during the active growth season in late spring and summer but the possums may gradually deplete the foliage during the low growth phase leading into winter. One year's observations at a small

number of sites is inconclusive. However, the observed seasonality does not seem consistent with some potential causes such as certain fungal diseases.

Recent studies in Manningham (abutting Maroondah) and the Mornington Peninsula (Yugovic 2015) have shown that possum browsing is a major cause of eucalypt deaths in those areas. A simple test was found to be ringing trunks with plastic bands that possums cannot climb (Yugovic 2015). This was done to five trees in 2016 at the 100 Acres Reserve in Park Orchards, 1½ km outside Maroondah, as reported by Luke Dragonetti of Manningham City Council. The trees had no leaves at the time of banding but showed new growth within a few weeks, clearly indicating an excessive possum population in the reserve. Of course, banding only works if possums cannot access the trees from adjacent trees or shrubs, above the plastic bands. Even if only one tree in a reserve is banded and seen to recover, that would indicate an excessive possum population which could explain foliage loss throughout the area. Corrective measures could then be considered, such as reducing connectivity between trees.

Banding of eucalypt trunks would be an easy, quick way to determine the severity of possum browsing in Maroondah.

A study by the University of Melbourne, funded by Maroondah City Council, is investigating whether Cinnamon Fungus (*Phytophthora cinnamomi*) or a related organism is killing trees by rotting their roots. The outward signs of Cinnamon Fungus disease are that:

- Trees show greatest symptoms (and often sudden death) during times of water stress, when Cinnamon Fungus is most active and the affected root system is unable to supply the tree's peak water needs (Jones *et al.* 2015); and
- Adjacent sensitive species die or become very sickly, particularly grass-trees and the Common Heath *Epacris impressa* (Cahill *et al.* 2008).

The fieldwork of the present study observed that debilitated eucalypts were often surrounded by healthy grass-trees and heaths, indicating against Cinnamon Fungus as a problem. No signs of affected grass-trees or Common Heath were found anywhere. In sites visited in both summer and winter of 2017, the symptoms of eucalypt decline were markedly worse in winter, contrary to the expectations of Cinnamon Fungus.

Whatever may be found to be the direct cause(s) of eucalypt decline in a particular area, it should be kept in mind that excessive tree density may be an underlying cause if trunks are much closer than 10 m apart.

In nature, whenever one type of organism declines or disappears, others take its place. That can be desirable or undesirable. At Birts Hill Reserve (Site 45) in 2017, the area beneath the dead and dying eucalypt crowns in Figure 2 put on a better wildflower display than perhaps anywhere else in Maroondah that year – see Figure 3. The reduced competition from trees for sunlight, soil moisture and nutrients appears to have favoured the wildflowers, as one might expect. Shrubs and trees can be expected to increase in coming years as part of ecological succession. Eucalypts may re-establish, depending on the cause of the recent decline and whether it abates.

This example is not to diminish the importance of eucalypt decline but to demonstrate that natural processes are responding and they offer hope in cases like Birts Hill Reserve. In vegetation that is less natural, reduced competition from dying eucalypts allows introduced species such as Sweet Pittosporums to thrive and displace indigenous flora and fauna, including any regenerating eucalypts.



Figure 3. Wildflowers thriving beneath the dying eucalypt crowns of Figure 2 at Birts Hill Reserve.

It is tempting to think that where indigenous eucalypts are dying out, perhaps we should plant different species that might be more robust and replace some of the dwindling ecological functions of the dying trees. The planted trees might be from other parts of Maroondah or further afield. This idea is being called 'support planting' within Maroondah City Council.

In cases like Birts Hill where natural processes are favouring indigenous plants, 'support planting' runs the risk of disrupting the natural regeneration. It may also upset complex, unknown ecological interactions. These risks would only be worth taking if the cause of eucalypt decline at a particular site has been well investigated and it is clear that the cause cannot be corrected and will not abate naturally.

There are far less ecological risks from 'support planting' in areas with little if any natural understorey. The risks may be less than those of doing nothing and completely losing a eucalypt canopy. However, it would still be sensible to first investigate the cause of the eucalypt decline at each site and see if it is a temporary phase or can be corrected.

If 'support planting' is undertaken in response to eucalypt deaths, it may be best to do it in conjunction with planting the species that have died. Once the planted trees are large enough to start competing with each other, an assessment could be made about whether the original species are healthy, in which case the 'support planting' can be thinned out.

It may be salutary to consider the history of past episodes of eucalypt decline in the local district and southeastern Australia more generally. Jurskis and Turner (2002) recounted episodes in Victoria between the 1940s and 2002 that had been variously attributed to salt, thirteen types of insects, five types of fungi, five kinds of vertebrate animals, four climatic perturbations and a parasitic plant. Many of these factors may have played a role in past episodes in Maroondah. One such factor involved Bell Miners. Loyn *et al*. (1983) demonstrated that abundant Bell Miners were indirectly causing eucalypt decline in Olinda. The same phenomenon was readily seen in

Maroondah in the 1970s to the 1990s (Lorimer *et al.* 1997). Like most other factors that might have caused past episodes of eucalypt decline in Maroondah, Bell Miners are no longer active; The present study could find no Bell Miners in Maroondah despite searching for them.

The history of past episodes of eucalypt decline suggest that we may find the current decline to be a temporary (albeit possibly serious) episode. Nature may heal itself. We may also be able to facilitate healing with a little more investigation.

5.1.6 Hybridisation of Common Correa

The Common Correa (*Correa reflexa* variety *reflexa*) is indigenous to Maroondah and this study found it in at least sixteen sites. However, in most sites, the offspring of wild plants are predominantly hybrids, crossed with garden plants in the same genus. Figure 4 shows a dense patch of the hybrids and a comparative view of the natural vegetation 25 m away to show the natural state of the vegetation.

Hybridisation appears to have arisen from pollen carried from ornamental Correas in neighbouring gardens, including *Correa alba*, *Correa baeuerlenii*, *Correa glabra*, *Correa reflexa* variety *speciosa* and probably cultivars such as *Correa* 'dusky bells'. Hybridisation is so prevalent that it appears likely that the indigenous form of Common Correa may die out in Maroondah within a decade or two.

Some of the hybrids exhibit the phenomenon of 'hybrid vigour', giving rise to dense patches that currently reach many tens of square metres like the one in Figure 4. The dense wildflowers that once occupied such areas have been killed or heavily suppressed by the Correas.

We therefore have the unusual situation in which the conservation of a species and its habitat requires the destruction of some of its own offspring (i.e. the hybrids). Knox City Council has been doing so in its jurisdiction since May 2012. There is an urgent need to do the same in Maroondah.

Selective removal of hybrids is confounded by the similarity of some of them to the natural Correas. The following features of the natural Correas help to distinguish them from the hybrids:

- The upper surfaces of the leaves are dull, fairly light green and at least slightly rough or mealy;
- Two leaves clasp the base of each flower. ('Base' means the end closest to the stalk);
- Flowers are probably never red or reddish; and
- The calyx (the cup surrounding the flower where it attaches to the stalk) is usually quite mealy, never smooth.

Indigenous nurseries in the region generally sell a mixture of the natural Common Correa and hybrids. Some of those nurseries particularly promote red-flowered hybrids because of the attractiveness of the flowers, thereby potentially worsening the spread of hybrids. Notably, the author found no hybrids in the stock at CRISP nursery in Ringwood.

Unfortunately, non-indigenous Correas are so common in gardens near nature reserves that hybridisation is probably impossible to stop. Nevertheless, it would be prudent for Maroondah City Council to not exacerbate the problem by planting Correas within (say) 200 m of nature reserves where wild Correas grow.



Figure 4. Top: A dense thicket of hybrid Correas in Birts Hill Reserve; Bottom: A representative view of other vegetation in the reserve.

5.2 Range Expansions into Maroondah

The past twenty-five years have seen some remarkable cases of species that previously occurred in forests of the nearby hills and have extended their range into Maroondah.

The first species observed to expand its range into Maroondah was the Wonga Vine, *Pandorea pandorana*. It occurred naturally in wet forests of the Dandenong Ranges, a few kilometres east of Maroondah, at the time of colonisation. The earliest record of it in Maroondah appears to be in 1990, on the western edge of Hochkins Ridge Nature Conservation Reserve. It presumably arrived via its windborne seeds. Since then, Wonga Vine has spread through Maroondah and beyond, often smothering large numbers of plants in native vegetation and substantially transforming habitat for flora and fauna. Figure 5 depicts an example in Ringwood North, where the vegetation was grassy and open when I surveyed it in 1997.

The aggressive spread of Wonga Vine represents a significant threat of local extinction of other species of flora and fauna.

Interestingly, the most rapid phase of spread of this species occurred during the Millennium Drought – the driest period in the history of the region – even though the species' previous range was in wet forests and rainforests.



Figure 5. Wonga Vine smothering all indigenous understorey in Ringwood North.

Twining Silkpod (*Parsonsia brownii*) is taking a very similar trajectory to Wonga Vine. The first record in Maroondah appears to have been in 2001 at 'Uambi', where it was absent in thorough surveys in 1997 and 1998. It appeared in Appletree Hill Reserve, Kilsyth South (Site 70 of Volume 2) in the past few years and is behaving similarly to the Wonga Vine in Figure 5.

The matted form of Nodding Saltbush (*Einadia nutans*) was common in drier parts of Victoria but has been spreading towards Maroondah. It has become common in Manningham municipality, immediately north of Maroondah, and it was first found in Maroondah during this study. In Manningham, it often smothers ground flora and is now the target of control efforts.

River Club-rush (*Schoenoplectus tabernaemontani*) occurs naturally in the Melbourne region, on the edge of the water of major streams (principally, the Yarra River). Before it began being used in planting about fifteen years ago, it was not recorded any closer to Maroondah than the Yarra River, and not in any wetland within at least 20 km of Maroondah. However, since it has been

planted in artificial wetlands, it has spread (presumably by waterbirds) into at least four natural wetlands in Maroondah, and many others in the region. In some cases, such as wetlands near the corner of Canterbury and Dorset Roads (Site 72 of Volume 2), it is aggressively displacing the natural plant and animal species. It is significantly reducing biodiversity in the affected wetlands.

It is therefore recommended that River Club-rush should not be planted in Maroondah.

Not all plant species that behave like Wonga Vine, Twining Silkpod, Nodding Saltbush and River Club-rush come from outside Maroondah. In this study, Small-leafed Clematis (*Clematis decipiens*) was found in many locations where it was absent during the surveys of the 1997 *'Sites of Biological Significance in Maroondah'* study. The new environments appear to have become drier in the interim, perhaps due to a combination of climate change, drainage works and increased impervious surfaces in the landscape. In some of the new locations, the clematis is smothering and displacing shrubs and ground flora, and perhaps displacing fauna.

Shiny Cassinia (*Cassinia longifolia*) is another plant species spreading within Maroondah but it has not shown a tendency to aggressively displace other plant species.

5.3 Naturalised Plants

Hundreds of non-indigenous plant species have become naturalised in Maroondah, from overseas or from other parts of Australia. ('Naturalised' means they persist and reproduce without deliberate assistance.) Many of the naturalised species are confined to gardens and wasteland where they have negligible, or no, impact on indigenous flora or fauna. This study did not attempt to document such plants.

Appendix B lists plant species that are naturalised in Maroondah's natural and semi-natural habitats.

It is common for people to regard any non-indigenous plant species within native vegetation as 'environmental weeds'. However, it is more helpful to reserve that term for species that are causing the loss of indigenous plants or preventing them from establishing, sometimes called 'drivers' of environmental change. Some other naturalised plants are better regarded as symptoms or 'passengers' of environmental change, not drivers (MacDougall and Turkington 2005). Removing 'passengers' from a site usually results in rapid recolonisation by the same, or similar, species unless one changes the underlying unnatural conditions that led to their presence.

Species that the present author regards as being major 'drivers' are highlighted with underlining in Appendix B.

Interestingly, Sweet Pittosporum is arguably the most serious environmental weed in Maroondah despite occurring naturally in warm temperate rainforest in Gippsland. It was evidently a popular garden plant in decades past, often under the name 'Mock Orange'.

5.4 Climate Change

Maroondah's climate is changing. The state government's booklet, *'Climate-ready Victoria: Greater Melbourne'* (dated November 2015) outlines the expected consequences for flora, fauna and humans. For flora and fauna, the consequences are listed as:

- 'Amplification of existing threats to flora and fauna;
- 'Changes to habitat;
- 'Altered disturbance regimes; and

- 'Changing dynamics of invasive species'.

Section 5.1.3 (p. 37) indicates that the most severe threats to Maroondah's flora involve species adapted to floodplain soils that are sodden in winter and dry in summer, the cause being drier winter conditions. Climate change is predicted to be a substantial and increasing contributor to those drying conditions.

Conversely, plants of ridges and hilltops survived the Millennium Drought much better and appear to be more tolerant of our drying climate.

These observations suggest that in general, vegetation of drier soils will be less affected by climate change than vegetation of damper soils. Wetland plants have shown themselves to be very adaptable to drying conditions, being able to regenerate when water returns following drought.

Mistletoes are a special case worthy of note. I estimate that approximately 95% of mistletoes on Maroondah's eucalypts died during the Millennium Drought and none of them has been replaced. Those mistletoe species were common across most of Maroondah prior to the drought but are now scarce and highly localised. Mistletoes have very rarely been propagated in Australia. The seeds are dispersed solely by Mistletoebirds, which rarely venture into areas that have lost their mistletoes because the birds' diet requires mistletoe fruits. We have lost both a beautiful, fascinating bird and an ecologically important group of plants from most of Maroondah for the long term; perhaps forever. Maroondah may also have already lost the Imperial Jezebel butterfly, whose larvae only eat mistletoes.

Climate change is predicted to cause worse droughts than the Millennium Drought in future.

The only place in Maroondah where mistletoes are surviving well is Bungalook Conservation Reserves in Kilsyth South. That site has many mistletoes of a species – Grey Mistletoe – that grows only on wattles and survived the Millennium Drought well. The Grey Mistletoes are supporting a population of Mistletoebirds, which may disperse seeds from the few remaining eucalypt mistletoes in the vicinity. However, Melbourne Water has proposed to remove the mistletoe-bearing wattles, which are regarded as a threat to the stability of the levee on which they grow. This highlights how the threats of climate change are often compounded by other stresses.

As some plant species die out from climate change and other causes, the vacated ecological niches in native vegetation will be taken by other species. Some of those species will be indigenous to Maroondah; some may grow naturally nearby and expand into Maroondah; some will come from gardens; and some will arrive from far away. The new arrivals will compete with some of the surviving indigenous species, thereby raising the likelihood of further local extinctions.

On the other hand, some introduced plants that already occur in Maroondah's native vegetation will suffer from climate change. For example, blackberries and Sweet Vernal-grass diminished greatly during the Millennium Drought (as demonstrated in nearby Knox by Lorimer 2007), to the benefit of some indigenous species.

Some of Maroondah's indigenous plant species are likely to benefit from climate change. Shiny Cassinia (*Cassinia longifolia*) may be an example, as it has expanded into historically moister habitats during and since the Millennium Drought.

6 Fungi and Lichens

Appendix C (p. 138) contains an inventory of 119 species of fungi and lichens that have been reported in Maroondah. Almost all the records were downloaded from the Atlas of Living Australia. Many species have not been recorded for over a century, probably due to the greater interest in fungi long ago. Fortunately, the Field Naturalists Club of Victoria and the National Herbarium of Victoria have created the FungiMap project in recent years and are starting to fill a large gap in our understanding of Victoria's fungi. That is important because fungi play vital roles in the environment. Some of them can be harmful to humans or other organisms. They are vital for nutrient cycling and the food chain. Most plants rely to a substantial degree on soil fungi to make nutrients available to their roots. Changes in fungi may be the cause of the collapse of some populations of orchids, which are vitally dependent on particular species of fungi.

Unfortunately, due to the shortage of information about local fungi and the limited scope of this study, no further analysis can be provided here. It is important to recognise this gap when considering this report's assessment of Maroondah's biodiversity.

7 Fauna and Wildlife Habitat

7.1 Habitat Features

This study found the following types of habitat being used to significant degrees by Maroondah's native fauna:

1. Expanses of natural and semi-natural forest and woodland, which provide habitat for the broadest range of fauna, from microorganisms and tiny invertebrates to Powerful Owls and Kangaroos;
2. Bushland residential areas with natural and semi-natural forest interspersed with homes and associated constructions. These areas support a subset of the fauna found in larger, less interrupted patches of forest;
3. Fragmented strips and small patches of semi-natural forest and revegetation beside roads and railway lines, supporting a subset of the fauna found in bushland residential areas (principally birds, insects and possums, and probably bats);
4. Fragmented strips and small patches of semi-natural forest and revegetation beside streams, supporting similar fauna to the last category as well as birds that move regularly along stream corridors, such as ibis and the White-faced Heron;
5. Streams, which provide habitat for microorganisms, worms, molluscs, yabbies, many insect larvae, fish, waterbirds, Buff-banded Rail, Rakali (or Australian Water Rat) and Platypus;
6. Wetlands, which provide habitat for microorganisms, aquatic invertebrates, birds, Shortfin Eel, Flathead Gudgeon, frogs and lizards;
7. Nature strips with mature street trees of species that are locally indigenous or Australian native. The trees provide food, nest sites, protective cover and movement corridors for birds and insects;
8. Open expanses such as ovals and wasteland, which provide habitat for a small number of bird species such as swallows, Black-shouldered Kites and Masked Lapwings;
9. The municipality's three golf courses, which combine artificial wetlands like item 6 (albeit polluted), strips of trees like item 7 and open expanses like item 8;
10. Public parks and residential gardens not falling into the previous categories, where one finds predominantly introduced fauna but also common urban wildlife such as possums, Rainbow Lorikeets, Magpies and Marbled Geckoes.

The first six categories above account for most of Maroondah's native wildlife (as well as indigenous flora) and they form the 'sites of biological significance' in Volume 2.

The following sections provide more details about the habitat in wetlands and non-aquatic habitats.

7.1.1 Wetlands

Wetlands are taken here to encompass all still bodies of water, even if they dry out regularly. As mentioned in Section 4.3.2 (p. 27), historical maps show extensive wetlands prior to colonisation but drainage work seems to have destroyed all of them. There are, however, artificial wetlands: (a) lakes and ponds; (b) wet depressions created incidentally by excavations; and (c) two wetlands beside Dandenong Creek formed by meanders of the original creek channel that were cut off when the creek was straightened and piped.

The fauna and flora of wetlands depend substantially on depth, frequency of dry periods and the slope of the ground around the wetland edges.

The presence of fringing rushes or sedges at most of the waterbodies provides cover and a food source for a range of wetland fauna such as tadpoles and Australian Reed Warblers. Shallow water supports a wide range of birds such as dabbling ducks, coots, moorhens, swamphens, herons, egrets and spoonbills. Deeper water with underwater plants supports diving waterbirds such as grebes, cormorants and Blue-billed Ducks.

Steep banks of wetlands minimise the area available for shallow water with rushes or sedges. That is very counterproductive for wetland fauna (not to mention flora). Most of Ringwood Lake and most waterbodies in golf courses suffer from this problem. By contrast, the lake at Bungalook Conservation Reserves in Kilsyth South has become so full of sediment that it is now all shallow and dense with wetland plants. The ducks and cormorants that once abounded there are now scarce. A combination of open water and vegetated shallow water is ideal.

Trees adjacent to wetlands are important for some waterbirds. The near-threatened Nankeen Night Heron relies on dense tree cover next to water for roosting. Australian Wood Ducks nest in tree hollows near water.

Many of Maroondah's wetlands are in poor ecological condition and contain excessive nutrients but they still provide important waterbird habitat. For example, Ringwood Lake is rather polluted but it still supports a range of wildlife including the Nankeen Night Heron, which is listed as 'near threatened' in Victoria. All lakes in Maroondah with permanent water are likely to provide refuges for waterbirds when rural wetlands dry up during droughts. For example, the pond outside the Croydon Library is small and has nutrient pollution but threatened waterbird species such as Blue-billed Duck and Great Egret took up residence there during the Millennium Drought.

The main cause of nutrient pollution at Ringwood Lake and the Croydon Library pond appears to be feeding of ducks.

7.1.2 Non-aquatic Habitat

With the exception of aquatic environments, the most important determinants of habitat value for Maroondah's wildlife are the naturalness, density, type and structural complexity of vegetation.

For birds, the most relevant evidence comes from research in Maroondah and nearby municipalities by White *et al*. (2005). They collected data about birds and vegetation in nature reserves and the following three types of residential streetscapes: (a) areas with predominantly indigenous or Australian native trees; (b) areas with predominantly mature, introduced trees; and (c) recently developed areas.

White *et al*. found that nature reserves had the largest number of species of native birds and the largest number of 'foraging guilds' of native birds. There were almost as many native bird species and slightly fewer foraging guilds in streetscapes dominated by indigenous or Australian native plants. Streetscapes of mature, introduced trees had markedly fewer native birds and higher incidence of a few introduced species, particularly Common Myna, Common Blackbird and Spotted Dove. The only significant difference in recently developed streetscapes was that the abundant introduced species were Common Myna, Common Starling and House Sparrow.

The number of native bird species was also found to be correlated with the number of indigenous or Australian native shrubs and the presence of leaf litter. The presence of more insect-eating bird species in the nature reserves and indigenous / Australian native streetscapes was inferred to reflect a greater abundance and diversity of insects in those environments.

The authors concluded:

> *'Remnants of native vegetation act as vital refugia of indigenous fauna in the urban landscape. …the retention and establishment of* [Australian] *native vegetation within streetscapes can complement existing remnant vegetation and the bird communities contained therein. Native streetscapes can potentially benefit native birds by:*
>
> - *'Facilitating the movement of species throughout the urban landscape;*
> - *'Providing habitat that is advantageous to native birds over introduced species; and*
> - *'Enhancing remnant vegetation in parks by diffusing abrupt edges between remnants and the built environment and reducing levels of isolation between parks (e.g. Catterall et al. 1991).*
>
> *'Many of the benefits of native streetscapes for native birds, as outlined above, are not realised in exotic streetscapes, as evidenced by the findings of this study. Considering the benefits of native streetscapes for bird communities, the implementation of effective strategies and incentives that encourage the planting of native vegetation in streetscapes and gardens should be paramount. This should include the full complement of vegetation life-forms from ground covers to trees. Furthermore, it is likely that the planting of indigenous vegetation would be more beneficial for bird communities by providing resources more closely resembling those of park remnants. Recher (2003) suggests that retaining all remaining native vegetation should be paramount for future restoration actions.'*

These findings are reflected in the sites of biological significance in Volume 2, which contain remnant native vegetation. (Some also contain wetland habitat.)

A comparable study of birds in suburban Canberra by Ikin *et al*. (2013) drew the following similar conclusion:

> *'Native street trees provide foraging resources for birds that would be reduced or absent in exotic streetscapes* [i.e. dominated by introduced plants], *enabling native streetscapes to support a rich community of birds. Furthermore, native streetscapes increase bird richness and diversity in adjacent reserves. This result has important conservation implications for suburb and reserve management practices. Our study provides evidence that the establishment and retention of native suburban streetscapes is an important management strategy for improved bird conservation.'*

There is therefore good evidence that in residential areas like those of Maroondah, native birds are strongly associated with neighbourhoods dominated by locally indigenous or Australian native trees and shrubs.

A large part of the reason why trees, alone, are not enough to support diverse native birds is that many native bird species need shrubs and small trees for food, nest sites and cover from predators.

Another reason that has become quite important in Maroondah involves the Noisy Miner. Since this study's precursor in 1996–1997, Noisy Miners have become more abundant and widespread in Maroondah. Their aggressiveness in evicting small birds from their territories is so notorious that federal legislation[*] recognises that overabundance of the species is a 'key threatening process' for biodiversity. The syndrome of abundant Noisy Miners displacing other birds tends to be associated with landscapes having eucalypts and little if any understorey, as is common in parks

[*] 'Aggressive exclusion of birds from potential woodland and forest habitat by over-abundant noisy miners (*Manorina melanocephala*)' was listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999* on 9th May 2014.

and golf courses. Conversely, shrubs and small trees disfavour Noisy Miners and allow smaller birds to take cover from Noisy Miner attack (Ashley *et al.* 2007; Hastings and Beattie 2006).

However, not all shrubs favour diverse bird communities. Shrub species that produce copious nectar tend to cause an increase in aggressive Red Wattlebirds, which then displace a range of small, insect-eating birds. Prolific berry-producers such as cotoneasters, privets and ivy also favour a few (mainly introduced) bird species so much that many other species become displaced.

Now, let us return to the local study by White *et al*. (2005) discussed above. They inferred that part of the reason for finding fewer native bird species in landscapes dominated by introduced plant species is that those landscapes harbour fewer insects that birds eat. In other words, insect biodiversity is suppressed where introduced plant species dominate. Support for that conclusion comes from suburban Perth, where Bhullar and Majer (2000) investigated arthropods (principally, insects and spiders.) Those authors found that indigenous eucalypt species encouraged greater arthropod biomass than planted non-indigenous eucalypts or tree species from overseas. One only needs to turn over a fallen branch or disturb eucalypt leaf litter to see the abundance of invertebrates that rely on such habitat. The invertebrates are also an important part of nutrient cycling and putting organic material into soil.

Lizards are another fauna group affected by the type of vegetation, as evidenced by research by Jellinek *et al.* (2004) in bushland remnants of suburban Hobart. Those authors found that the number of lizard species per site increased significantly as the ratio of native plant species to introduced plant species increased. They confirmed the finding of other investigations that leaf litter is an important factor. Lizards appear to respond to the character of leaf litter from native plant species and also the seasons in which the leaves are shed. Wood litter was also concluded to be important to lizards. These are not surprising findings, given that lizards feed on invertebrates and require cover from predators.

Therefore, to support and encourage diverse communities of native birds, insects and lizards in Maroondah (aquatic habitats aside):

- The best habitat by a substantial margin is natural vegetation (which is mostly in the sites of biological significance in Volume 2);
- Outside bushland, such as in residential areas, amenity parks and golf courses, the best habitat includes eucalypts (particularly locally indigenous eucalypts) with shrubs, small trees and groundcover – but not too many plants that produce copious nectar;
- Retention of leaf litter and fallen timber is important for invertebrates and lizards;
- Park-like landscapes with eucalypts and little if any understorey (e.g. golf courses) are problematic because they encourage Noisy Miners; and
- Predominantly introduced vegetation (or no vegetation at all) displaces native fauna.

There are clear implications for:

- The current tendency to replace native street trees with introduced species such as Crepe Myrtles and ornamental fruit trees;
- The current rapid increase in residential development and consequent reduction in the area available for trees and shrubs;
- The relative level of planning protection that Maroondah City Council provides for indigenous or Australian native vegetation compared with species from abroad (Section 11.1); and
- The types of plants that Maroondah City Council encourages in landscape plans for new developments (Section 11.2.1).

7.2 Mammals

This study found records of twenty-one indigenous species of mammals and seven introduced species. They are listed in Appendix D (p. 141).

7.2.1 Bats

The largest group of mammals are bats, represented by nine indigenous microbats plus the Grey-headed Flying-fox. The flying-fox is not indigenous to the Melbourne region but can now be seen regularly in large numbers over the whole region, despite the species being listed as 'vulnerable'.

The Common Bent-wing Bat is somewhat misnamed as it is now listed as threatened under the *Flora and Fauna Guarantee Act 1988*. It was last recorded in Maroondah in 1974 and may well have died out.

There appears to have been no survey of bats anywhere in Maroondah since 2002, and that survey was of a very small part of Maroondah. There are no records of any microbat species since 2014 but some can occasionally be heard or seen against the sky at dusk. A future survey of bats in Maroondah would fill a substantial gap in knowledge about the municipality's biodiversity. Such a survey is recommended in Section 12.4.1 (p. 115).

7.2.2 Other Indigenous Mammals

The author's sightings of Eastern Grey Kangaroo, Black Wallaby and Echidna have increased in numbers and spatial distribution since the 1997 *Sites of Biological Significance in Maroondah* study. Those species appear to be in no short or medium-term danger of local extinction.

Kangaroos are now even resident at Ringwood Lake Park. Kangaroo numbers have increased so much just to the north of Maroondah that they pose a significant threat to the local survival of some species of flora and possibly fauna. This study found no sign of a similar problem in Maroondah; in fact, the current low levels of grazing are favourable to maximising the diversity of flora species.

The population and distribution of Sugar Gliders appears not to have declined since 1997. They remain present at a number of locations north of a line through central Ringwood and central Croydon.

The Swamp Rat was first observed in Maroondah in 2016. It is now abundant at Bungalook Conservation Reserves in Kilsyth South (Site 66) and was also discovered during this study at nearby Appletree Hill Reserve (Site 70) and Dandenong Creek to the south. The species appears to have arrived from the east. The rats dig extensive networks of tunnels, making them 'ecosystem engineers'. They appear to be diminishing the unnaturally dense growth of Thatch Saw-sedge (*Gahnia radula*) in the areas they have colonised. They do this by chewing the rhizomes underground.

An Australian Water Rat or Rakali was reported during this study on Mullum Mullum Creek near Oliver St, Ringwood, where it was killed by a dog off-lead. The only other record of the species in Maroondah was in 1996 at Yanggai Barring Reserve in Warranwood. The other indigenous rat species, the Bush Rat, is similarly rare and has not been recorded since 1992. However, both these species might be found to be more common if a targeted survey were conducted.

This study found only two confirmed records of Platypus in Maroondah's history, both of which involved animals that had been mauled (apparently by dogs). One of those animals was found dead beside Mullum Mullum Creek at Yarra Valley Grammar School in 2015. The other was found injured in Brushy Creek near Brushy Park, Croydon North in 2013. It is possible that young

Platypus disperse up Mullum Mullum Creek and Brushy Creek when they are evicted from their parents' ranges. Dogs off-lead and possibly foxes make it hard for Platypus to survive in Maroondah.

Until the 1990s, Koalas were observed to move through parts of Maroondah in most years, without persisting for long in any one area. This was consistent with dispersal from the resident population to Maroondah's north, particularly Warrandyte and Wonga Park. Observations in Maroondah declined during the 1990s and the last record found in this study was 1999. The presumed source population to the north has also plummeted, based on observations by wildlife carers in Warrandyte. In fact, the Koala has now died out or become severely reduced in numbers in nearly all of its global range. It is therefore unlikely that Koalas will return to Maroondah in the foreseeable future.

The Spot-tailed Quoll records from North Ringwood in 1980 and Warranwood in 1978 are the last two records of that now-endangered species in the whole Port Phillip and Western Port region.

The only other indigenous mammals in Maroondah are the Common Brushtail Possum and Common Ringtail Possum. Those species are most abundant in residential areas, where they feed on garden plants and sometimes food hand-outs by residents. They mostly eat eucalypt leaves but also other leaves, fruit, flowers and, in the case of the brushtail possum, sometimes birds. They are in such large numbers in some residential areas that they appear to be causing significant harm to the tree canopy (see Section 11.6) and possibly to bird populations. Possums in these residential areas also feed in adjacent sites of biological significance, where they can do maximum ecological harm.

7.2.3 Introduced Mammals

Sambar (a species of deer) are rapidly expanding into northern Maroondah and beginning to cause environmental problems and a traffic hazard. This is part of a problem affecting a large part of Victoria. Sambar browse on plant foliage and small branches. They create wallows on floodplains, thereby damaging vegetation and aquatic ecosystems. Stags damage vegetation in rutting season by ringbarking with their antlers and breaking off branches to 2 m above ground during 'preaching' displays. Warranwood Reserve is currently part of a program to monitor Sambar (and potentially other deer species) in the Jumping Creek catchment.

On the current trajectory, Sambar will present a significant problem that Maroondah City Council will soon have to address, as Manningham City Council has done.

The European Rabbit is another introduced herbivore that can do substantial ecological damage. However, this study's incidental observations of rabbits and their impacts did not reveal significant damage or any apparent change since the 1997 *Sites of Biological Significance in Maroondah* study. Local natural ecosystems are well adapted to the moderate amount of grazing that was once done by larger numbers of indigenous herbivores.

Similarly, local ecosystems are adapted to indigenous predators such as quolls and goannas that died out approximately forty years ago. It has been proposed by Yugovic (2015) and others that the Red Fox is partly replacing the role of the lost predators, limiting the adverse impact that excessive possum populations are now having. Foxes were also observed in this study to be eating native and domestic birds. They probably also reduce the numbers of the introduced Black Rat, Brown Rat and House Mouse, which appear to be quite sparse in native vegetation but abundant around houses.

7.3 Birds

Appendix D (p. 142) lists 154 indigenous bird species and 15 naturalised bird species recorded in Maroondah. Some of the species have not been recorded for many years.

When interpreting bird lists, it is important to draw a distinction between birds that make use of habitat in Maroondah and those which are just seen flying over on their way toward habitat beyond. For example, a Grey Goshawk very occasionally appears in Maroondah (mainly during drought) but the transits are fleeting. Sightings of a Grey Goshawk do not mean that Maroondah plays any material role in the survival of that vulnerable species. Even some migratory wader birds must fly over Maroondah on their way from the northern hemisphere to coastal wetlands such as Western Port but such fly-overs mean nothing for conservation of Maroondah's biodiversity.

Those sorts of visits must be distinguished from more prolonged stays that some bird species make during periods of drought. For example, in the latter years of the Millennium Drought, several waterbird species listed as threatened in Victoria took up temporary residence at the pond outside the Croydon Library. The endangered Blue-billed Duck and the near-threatened Nankeen Night Heron could be seen there any day, and often the vulnerable Eastern Great Egret. The pond acted as a refuge during a time of great stress for waterbirds, so the records of those species at the pond are important even though the species are absent most of the time.

A Powerful Owl that currently has a home range spanning Ringwood North and Donvale is significant because the species is listed as vulnerable in Victoria. Equally importantly, an endangered Barking Owl has been observed in the same area over the past two years.

The Eastern Barn Owl was previously scattered through the outer eastern suburbs of Melbourne but there appears to have been very few records of the species in Maroondah in the past decade – one by the author in Ringwood North in 2017 and a few in Bayswater North in 2018. The Eastern Barn Owl appears to be one of a large number of bird species whose local populations have changed greatly over the past three decades.

Records of the following species have dramatically reduced over that period:

White-necked Heron	Striated Thornbill	Willie Wagtail
Eastern Barn Owl	Bell Miner	House Sparrow
Black-shouldered Kite	White-plumed Honeyeater	European Goldfinch
Silver Gull	Crested Shrike-tit	Mistletoebird
White-throated Needletail	Grey Shrike-thrush	Bassian Thrush

Over the same period, the following species have arrived or dramatically increased:

Crested Pigeon	Rainbow Lorikeet	Noisy Miner
Little Corella	Australian King-Parrot	Scarlet Honeyeater
Sulphur-crested Cockatoo	Pacific (or Eastern) Koel	Pied Currawong

There is a wide diversity of species in each of these two lists, considering their diets, feeding strategies, habitats, body sizes and families. A few of the declines, such as that of the Bell Miner and White-plumed Honeyeater, may be associated with the rise of the Noisy Miner, whose aggressive displacement of other species is discussed in Section 7.1.2 (p. 55). The Rainbow Lorikeet is also aggressive and probably displaces some species. Many of the same increases and declines have occurred in Adelaide, Canberra and Sydney over the same period. However, this study could find no satisfying explanation for why so many, disparate species changed so much, so quickly in multiple cities.

The high mobility of many bird species and the unpredictable, decade-by-decade changes in the species present in Maroondah make it hard to predict which species will never be seen in the

municipality again, even if they have not been seen for many years. Species whose names appear in red in Appendix D are those for which there is a reasonable presumption that they were once resident or at least regular visitors but unlikely to return in the foreseeable future, except perhaps as transients or rare visitors. Twenty-two indigenous species and one introduced species are in that category. However, some of these species may never have been more than vagrants or rare visitors in the first place and some others may return unexpectedly, as the White-winged Triller did in 2019 after 101 years of no records.

7.4 Reptiles

Appendix D (p. 145) lists seventeen indigenous reptile species in Maroondah. It also includes two species that were present in northern Victoria at the time of settlement and have since become naturalised in Maroondah.

Some of the reptile species that have not been recorded in Maroondah for many years may be still present but undetected. There appears to have been no targeted survey of reptiles in Maroondah for decades, other than at two proposed development sites.

Nevertheless, the Lace Monitor or Tree Goanna is so large and conspicuous that it can be confidently presumed to have died out in Maroondah. The Black Rock Skink is much smaller but still conspicuous enough that if it remains, it is odd that it has not been recorded since 1908. Three of the four snake species in Appendix D are also quite likely to have died out in Maroondah, taking into account when they were last reported and, in the case of the White-lipped Snake, the loss of habitat in the area where it was last seen in 1994. The absence of Tiger Snake from the list is surprising as that species has been reported in recent years on the southern bank of Dandenong Creek, just outside Maroondah.

In the author's experience, the indigenous Garden Skink and naturalised Marbled Gecko are common around houses, sometimes accompanied by Weasel Skinks, Blotched Blue-tongue Lizard and Common Blue-tongue Lizard. The Lowland Copperhead is strongly concentrated near streams and wetlands, possibly in part because snake handlers are inclined to release captured animals there.

7.5 Frogs

Appendix D (p. 146) lists ten frog species that have been recorded in Maroondah.

Peron's Tree Frog has been spreading down the Yarra River corridor and up tributaries over the past three decades. It reached Hochkins Ridge Nature Conservation Reserve by 1996 and Warranwood about a decade ago. All other frog species in Maroondah are indigenous.

The Southern Toadlet and Growling Grass Frog appear to have died out in Maroondah, as they have in most of their Victorian ranges. However, the Southern Toadlet persists in Donvale, 1½ km west of Maroondah.

Only one record of the Victorian Smooth Froglet was found (from 1988), but the location is so imprecisely recorded that it could refer to the sizeable population that remains at The 100 Acres Reserve in Park Orchards, just outside Maroondah. That species also occurs at Winton Wetlands in Wantirna, approximately 50 m outside Maroondah, so it is quite possible that it will be detected in Maroondah.

Verraux's Tree Frog is rare in Maroondah, the only record being the author's, from Ringwood North in 2017. The species may have gone undetected elsewhere because the calls can be hard to distinguish from those of young Southern Brown Tree Frogs.

The Striped Marsh Frog is rare in Maroondah, being on the edge of its range. All other frogs in Maroondah appear to be fairly common, though less abundant than during the wetter period prior to the Millennium Drought.

Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*) is causing the collapse of numerous frog species around the world. Maroondah's commonest frog species, the Common Froglet, has been shown to be a carrier of the fungus and to thereby threaten the survival of other, more sensitive frog species (Branelly *et al*. 2017). Future substantial declines in local frog species may result.

7.6 Fish

Appendix D (p. 146) lists twelve fish species that have been recorded in Maroondah, of which only four are indigenous. The Short-headed Lamprey has not been recorded since 1968 but might conceivably reappear now that a 'fish ladder' has been built around the artificial 'Dight's Falls' weir in Collingwood. The other three indigenous fish species are likely to remain present in Maroondah, as are most or all of the introduced species.

It is very likely that a number of other fish species occurred in Maroondah's major streams and wetlands prior to European colonisation. The Dwarf Galaxias and River Blackfish are two examples, both of them having died out or severely declined in most streams in the region. The construction of weirs at Dight's Falls and Pillars Landing were serious problems for the survival of most indigenous fish species, followed by stream realignments and the consequent destruction of riparian habitat.

Shortfin Eels deserve special mention. They are born in the Coral Sea near New Caledonia and migrate to Maroondah, often travelling substantial distances over wet ground. They must then return to the Coral Sea to spawn. This must be one of the most amazing migrations of any species in our region. The species was once so abundant as to be a major food source for Aborigines.

The Short-headed Lamprey was recorded in Ringwood in 1968 – the only record of the species in the history of the Mullum Mullum catchment. It seems unlikely that the Short-headed Lamprey will reappear in Maroondah in the foreseeable future.

7.7 Butterflies

Appendix D (p. 147) lists twenty-seven butterfly species that have been recorded in Maroondah. Twenty-two species are indigenous to Maroondah and none of them is subject to any listing as a rare or threatened species. One other species – the Cabbage White – was inadvertently introduced to Australia and is now the most abundant butterfly species in Maroondah. Four other butterfly species are native to Australia and have spread into Maroondah due to planting of species that are required as food for the butterfly larvae (caterpillars). Citrus are the larval food for the Orchard Swallowtail and Dainty Swallowtail; Swan Plant for the Monarch Butterfly and palms for the Orange Palm-dart.

Larval food plants are critical determinants of the location and abundance of most of Maroondah's butterfly species. The exceptions are the Caper White (which just blows into Maroondah from its inland home during strong northerly winds) and some of the Browns, whose larvae can eat a range of grass species.

The Moonlight (or Blue) Jewel has not been recorded since the 1950s and the Bright Copper was last seen in 2009 as a solitary individual, probably in transit. Both species can be presumed to be locally extinct.

The Varied Swordgrass Brown is a conspicuous species but has not been recorded for over twenty years. Its larval food plant is the Red-fruit Saw-sedge (*Gahnia sieberiana*), which declined during the Millennium Drought and has not recovered. The Varied Swordgrass Brown is therefore presumed to be locally extinct.

The Spotted Skipper is a fairly conspicuous species, yet this study could find only two records of it in Maroondah: 1995 and 2004 (a single individual in each case). It is therefore probably locally extinct.

The Shouldered Brown has not been recorded since 1996 but it is possible that it has gone undetected due to similarity to the Common Brown.

The Imperial Jezebel (formerly known as the Imperial White) needs mistletoe as its larval food plant. As discussed in Section 5.4 (p. 50), Maroondah's mistletoe population dropped by about 95% during the Millennium Drought and cannot recover. As a result, the Imperial Jezebel is also unable to recover. To make matters worse, the Imperial Jezebel favours the species of mistletoe that have suffered the worst decline. The Imperial Jezebel may have already died out in Maroondah.

The White-banded Grass-dart has been recorded only once in Maroondah, by Dr Ross Field in Heathmont in 2013.

The Silky Hairstreak has also been recorded only once, by the author at Bungalook Conservation Reserves in 2016. It has a symbiosis with a particular species of ant and it requires specific food plants.

The related Imperial Hairstreak (Figure 6) needs particular species of wattles to eat and its larvae must be attended by one of several species of ants. Three colonies were found during this study: beside Dandenong Creek in Heathmont, beside Mullum Mullum Creek in Ringwood and beside Brushy Creek in Croydon. There is circumstantial evidence of a decline in numbers in Maroondah.



Figure 6. Silver Wattle with Imperial Hairstreak adult (left) and larva attended by ants (right).

The Ringed Xenica was recorded widely and in substantial numbers during the 1997 *Sites of Biological Significance in Maroondah* study. In the present study, it was only found at four locations, in much smaller numbers than in the 1997 study. To a lesser degree, the Klug's (or Marbled) Xenica also appears to have declined substantially in numbers and distribution.

The only indigenous species that are not rare and have shown no signs of decline are the Yellow-banded Dart (or Greenish Grass-dart) and the Common Grass-blue. Both species now live mainly on planted vegetation and are therefore not affected by declining native vegetation.

The qualitative impression from this study that butterfly populations in Maroondah are generally in decline is consistent with some new global research. Sánchez-Bayoa and Wyckhuys (2019) have demonstrated major declines in the populations of many butterfly species in many countries, though they found no relevant data from Australia to analyse.

7.8 Other Invertebrates

Butterflies were chosen in this study as convenient proxies for the much larger range of local insects. The substantial decline of so many butterfly species should be taken as a warning of comparable declines in large numbers of other insect species. The abovementioned research by Sánchez-Bayoa and Wyckhuys (2019) showed that not only butterflies but perhaps as much as 40% of the world's insect species are threatened with extinction, with habitat loss the single greatest cause. Insects are such a large part of biodiversity, and play such a critical role in the natural and human domains, that the declines should raise considerable concern.

It is beyond this study to more fully research the decline of insects locally or more widely. Therefore, no solutions or implications can be provided here.

It should be kept in mind that this study has not included large numbers of invertebrate species other than insects, such as spiders, worms, yabbies and slugs.

7.9 Habitat Corridors

Habitat corridors are routes favoured by one or more fauna species in their daily, annual or occasional movements around the landscape. These movements sometimes carry pollen, seeds or plant fragments that allow plants to reproduce, disperse or exchange genes. The movements can help native species to survive and/or allow introduced species to spread and potentially displace indigenous species (Bennett 2003). Most flora species and many fauna species of low mobility receive no benefit from corridors; on the contrary, those species may be displaced by other species moving into their habitat via corridors.

The *'Maroondah Habitat Corridors Study'* (Context 2005) mapped what the authors surmised to be habitat corridors on the basis of factors such as linear continuity of tree canopy. However, they presented little evidence about the importance of those factors and no evidence that wildlife actually moves preferentially along the presumed corridors.

The present study did not seek observational evidence of the locations or effectiveness of habitat corridors, either. Instead, we turn to pre-existing studies.

Lorimer *et al*. (2009) documented extensive observations of bird trajectories in Manningham, immediately north of Maroondah. They concluded that streams are the main corridors for birds and 'All streams and gullies, from the most natural to the most modified, function as wildlife corridors, regardless of the width of native vegetation on either side of the stream or gully'. They also found that birds are more numerous, and in a wider range of species, along a semi-natural section of Mullum Mullum Creek than in an adjacent area of much more natural forest. No

evidence was found that birds moved along a strip of revegetation even though the strip had been planted to create a wildlife corridor.

A plausible explanation for so many birds favouring stream corridors is that soil moisture and nutrients are concentrated there, supporting maximum photosynthesis that forms the base of the food chain.

Birds in Maroondah are very unlikely to behave differently than in Manningham. We should presume that stream corridors are important for native birds, regardless of how natural they are.

Lorimer *et al*. (2009) did not investigate the effectiveness of vegetated roadsides as corridors but Bennett (2003, Table 5-1) cites evidence from various countries. In that study, the roadside-using species most relevant to Maroondah are kangaroos, echidnas, two non-local parrot species, White-naped Honeyeater, Sugar Glider, Rufous Whistler and the introduced Common Myna.

This study found no research involving railway reserves as potential habitat corridors but one could reasonably presume that a railway reserve would function like a similarly-vegetated road reserve.

8 Summary of Findings re Sites of Biological Significance

8.1 Criteria and Boundaries

'Sites of biological significance' are areas that best embody the things that make nature important, which were summarised in Section 1.3 (p. 11). Within the spectrum from the most important areas to the least, an area must exceed a threshold before it can be classified as a site of biological significance.

The threshold adopted here is based on the state government's criteria titled *'Standard Criteria for Sites of Biological Significance in Victoria'* (Amos 2004). The criteria are detailed and objective, and fall under the following headings:

- *Ecological integrity and viability*: Naturalness and importance in maintaining natural processes such as wildlife migrations;
- *Richness and diversity* of flora, fauna or ecological communities;
- *Rarity or conservation status* of flora, fauna or ecological communities;
- *Representativeness*: The best examples of an ecological community and its range of variability; and
- *Scientific and educational value*.

There are multiple criteria under each heading, totalling 104 in all. The criteria relevant to Maroondah are discussed in more detail in the introduction to Volume 2. They result in sites being rated on a scale of 'Local', 'Regional', 'State' or 'National'. These ratings are intended to reflect the spatial scale over which a site 'makes a substantial contribution to the conservation' of nature. The overall significance rating of a site as a whole is the highest rating under any one criterion.

At the low end of the significance scale, any patch of native vegetation occupying at least 0.25 ha and with 10% or more native understorey cover[*] is rated as 'Local' significance or higher.

In this study, nearly all areas rated as 'Local' significance or above are treated as sites of biological significance. However, at the margin, there is an additional consideration: how appropriate it would be for each site to come under a planning policy in the Maroondah Planning Scheme. The policy in mind here is described in Section 11.1.2.5 on p. 89. There are a few small areas that might barely rate as 'Local' significance but are not classed here as sites of biological significance because they do not warrant any specific recognition in the Maroondah Planning Scheme. Vegetation in those areas already has adequate planning protection through the Significant Landscape Overlay and/or the state-wide regulations regarding native vegetation.

All 109 areas of Maroondah that have been accepted here as sites of biological significance are individually documented in Volume 2. A boundary is given for each site, encompassing all the features that are significant about the site, sometimes rounded out slightly to match clearly defined features such as a fence. For a few sites, a separate boundary is given for the area recommended for protection under a planning overlay. As discussed in Section 11.1.2.3 (p. 88), the overlay area may be larger or smaller than the area containing the biologically significant attributes, for a range of reasons.

[*] The 'patch' definition adopted by the standard criteria came from the 'Operation Guidelines': 'A patch is a continuous area of native vegetation that is at least 0.25 hectares in extent and indigenous native understorey cover is 10% or greater'. Understorey includes trees other than canopy species.

8.2 Spatial Distribution and General Features

Figure 7 is an overview map of the 109 sites of biological significance detailed in Volume 2, colour-coded by land use. In this report, the land use category 'nature reserve' refers to land managed principally for nature conservation by Maroondah City Council, Parks Victoria or the Trust for Nature.

Figure 8 is similar to Figure 7 but with the sites colour-coded by their levels of biological significance.

The sites of biological significance occupy 12% of Maroondah's area. Classified according to their biological significance level under the Victorian Government's standard criteria:

- 19 sites are of National significance due to the presence of plant species that are endangered or critically endangered globally;
- 65 sites are of State significance, mainly due to the presence of endangered vegetation types;
- 4 sites are of either State or Regional significance, the uncertainty being due to the need for a detailed, formal assessment of the ecological condition of the habitat;
- 6 sites are of Regional significance due to the presence of either a species that is rare throughout Victoria (but not interstate) or a 'vulnerable' vegetation type in poor ecological condition; and
- 20 sites are of Local significance, mainly for either the presence of locally rare species or the role the sites play as habitat corridors.

As discussed in Section 11.1.2.1 (p. 85), a range of planning provisions are recommended to apply to different sites, varying according to the level of significance and other factors. As discussed in Chapter 9 (p. 77), biodiversity values of the remaining 88% of Maroondah should not be ignored.

The sites of biological significance:

- Contain patches of native vegetation and/or aquatic habitat, sometimes along with adjacent treed areas that act as an ecological buffer zone;
- Collectively, include all wetlands and above-ground sections of streams;
- Collectively contain all species of flora and fauna that are believed or suspected to be at risk of dying out in Maroondah. Many of those species do not occur outside the sites;
- Vary in significance level but even those at the low end of the spectrum often contain species that are poorly represented in the higher-rated sites. The 'tree reserve' at the corner of Maroondah Hwy and Dublin Rd is a good example. It was heavily mown and treated as an amenity park for many decades, leading it to be not even rated as 'Local' significance in the 1997 forerunner of the present report. However, with cessation of mowing, it has been found to reach 'State' significance. It contains plant species that are rare throughout Maroondah, of which the Sharp Midge-orchid (*Corunastylis despectans*) is only known to persist in Maroondah at one other site.

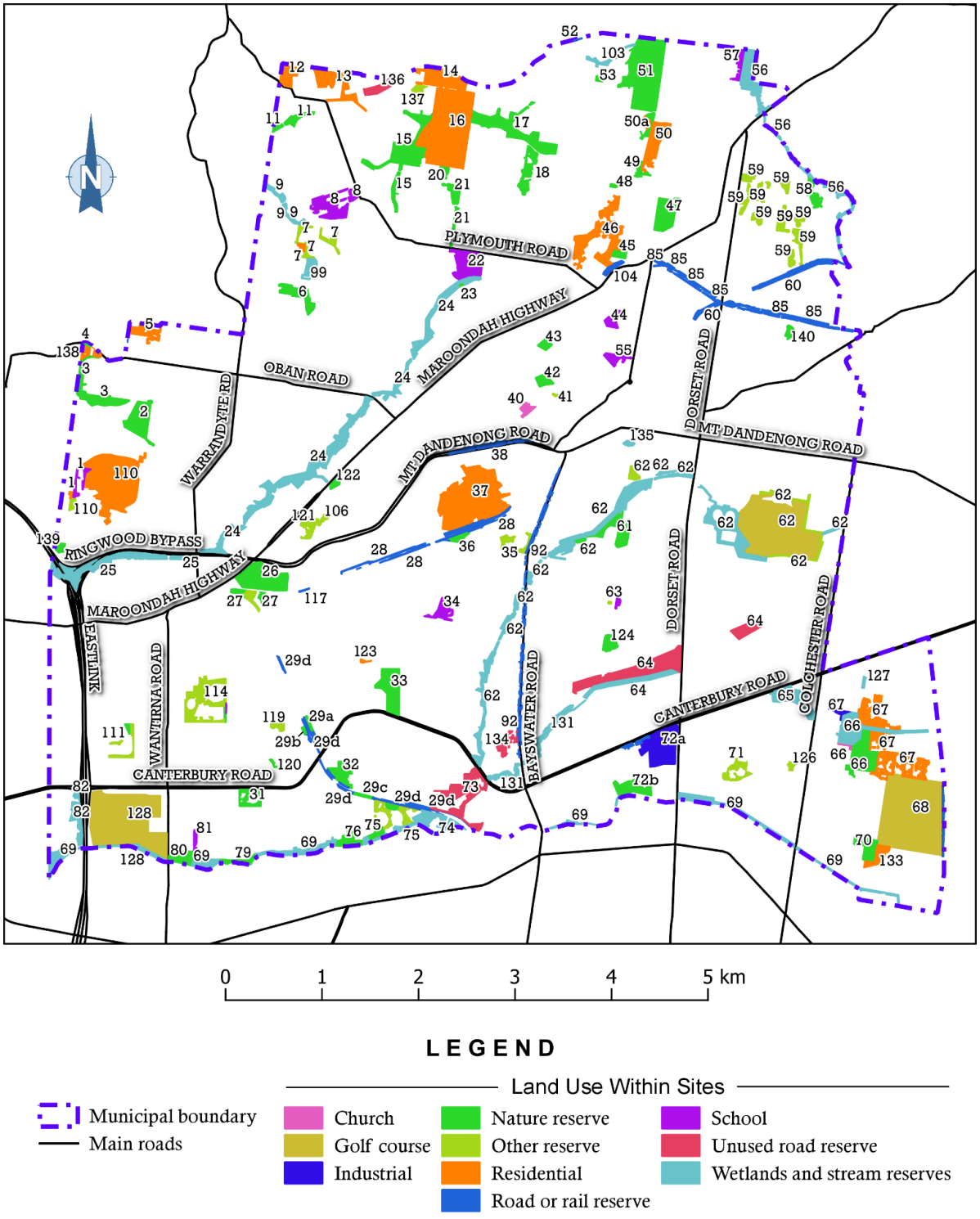

Figure 7. Overview map of the sites of biological significance detailed in Volume 2, colour-coded by land use and labelled by site number.

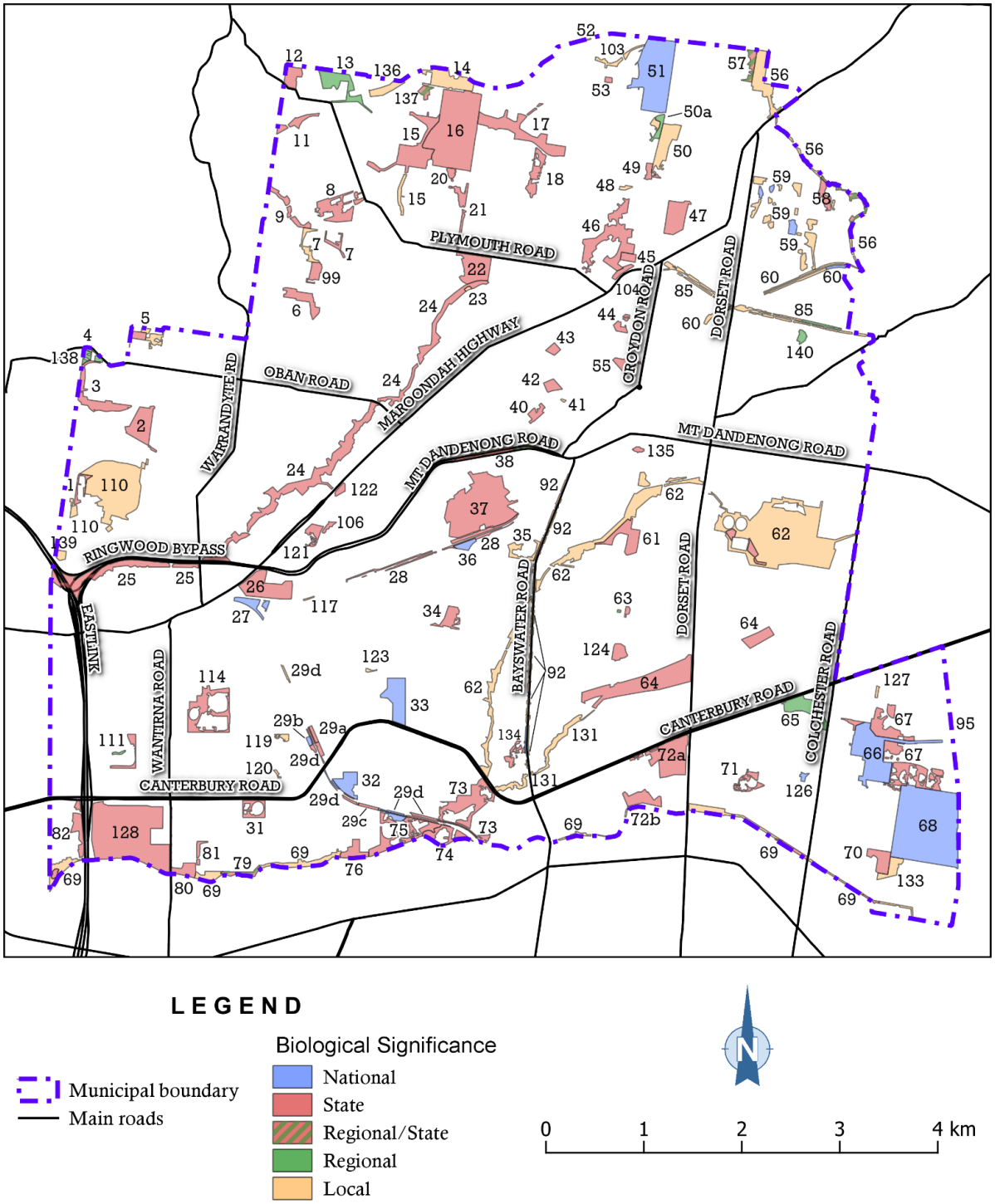

Figure 8. Overview map of the sites of biological significance detailed in Volume 2, colour-coded by significance level and labelled by site number.

8.3 Significant Attributes

The attribute that most commonly determines the significance of sites in Maroondah is the presence of a patch of an Ecological Vegetation Class (EVC) listed as endangered. Under the state government's 'standard criteria', any site containing such a patch is rated as State significance, even if the patch is as small as 2,500 m² and has lost most of its original species. 'State significance' does not necessarily mean that the site stands out across Victoria; Rather, endangered EVCs are so scarce that all surviving examples are deemed to make a substantial contribution to the state-wide conservation effort (Amos 2004).

As discussed in Section 4.4 (p. 32), most Ecological Vegetation Classes in Maroondah are listed as endangered. Some of the others are listed as vulnerable. A site that includes a vulnerable EVC in all but very poor ecological condition ('habitat score' less than 0.3) rates as State significance.

The standard criteria for assessing sites of biological significance, just discussed, are rather academic in outlook. They do not consider some of the values that nature offers, which were discussed in Section 1.3 and Table 1 (p. 11). In particular, they do not consider practical 'ecosystem services' or benefits to the economy or human health, wellbeing, childhood development and quality of life. (The state-wide planning controls over vegetation removal also ignore these benefits.) Let us now consider these broader values of nature, as follows:

1. Practical 'ecosystem services'

The wetlands in sites of biological significance reduce water pollution. They also reduce the pulsing of stormwater runoff by detaining water and allowing it to infiltrate the ground. These benefits help the whole catchments of Maroondah and downstream, to a degree that varies from wetland to wetland. On the other hand, feeding of ducks adds so much nutrient to some waterbodies that it can negate the benefits of water purification.

The other local ecosystem services – microclimate moderation, air purification and noise reduction – are much more localised in their benefits. People living, working or recreating in or near sites of biological significance receive these benefits from the sites, but these people are in the minority. Most of the Maroondah community probably receive less benefits of microclimate moderation, air purification and noise reduction from sites of biological significance than from street trees and plants in gardens and small local parks.

2. Financial and economic benefits

In Maroondah, the main economic benefits of vegetation and fauna in sites of biological significance identified in this study relate to property values and employment in vegetation maintenance. However, such considerations are quite peripheral to this study, so no details are provided here.

3. Human attachment to nature

The sites of biological significance are Maroondah's most natural places. Wildflower displays, wildlife and natural landscapes are more abundant and authentically natural in the sites than elsewhere. In these respects, the sites of biological significance offer people the most intense benefits to health, wellbeing, childhood development and quality of life that can be gained through experiencing nature.

However, most of the Maroondah community do not enter sites of biological significance on a daily basis. Those people may get a substantial part of their contact with nature through things around their homes or workplaces, such as their gardens and birds in street trees. The relative roles

of the sites of biological significance and the rest of Maroondah are discussed further in Chapter 9.

Although the Department of Environment, Land, Water and Planning's standard criteria for sites of biological significance do not consider such matters, they act to some degree as a proxy. They place weight on naturalness for ecological reasons and they place weight on threatened flora and fauna, which are concentrated in the most natural environments. The standard criteria take no account of sites' accessibility for people to experience the benefits that the sites offer.

4. Natural heritage

Natural heritage is clearly best embodied by the most natural environments. Most of Maroondah's pre-European plant species are only found in the sites of biological significance. Many fauna species range more widely but most of them could not persist in Maroondah without their core habitat in sites of biological significance.

Therefore, Maroondah's natural heritage relies critically on the sites of biological significance.

For at least part of the Maroondah community, our natural heritage is part of what makes Maroondah 'home'; part of what we have been handed down by earlier generations and what we hope future generations will experience and enjoy.

Sites of biological significance on public land allow all of the community to experience our natural heritage. Sites on private land allow the landowners to feel more intimately involved with their natural heritage.

The Department of Environment, Land, Water and Planning's standard criteria for sites of biological significance act to some degree as a proxy for valuing natural heritage.

5. Caring for species other than our own

This is the focus of the Department of Environment, Land, Water and Planning's standard criteria for sites of biological significance and therefore well reflected in the sites' significance ratings.

In most of Maroondah, the original species of flora and fauna have been permanently exterminated to create agricultural or urban environments. That process continues in parts of Maroondah. There is an ethical view that the hundreds of surviving species deserve not to be completely exterminated; that a small part of Maroondah should be left for them to inhabit. For most of those species, the sites of biological significance are critical to their survival. For at least two species – the Kilsyth South Spider-orchid and the Porphyry Wallaby-grass – a site of biological significance is critical to their survival anywhere on Earth.

8.4 Changes Since 1997

This section of the report compares the extent and condition of sites of biological significance in this study with the findings in the 1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The comparisons are somewhat constrained by the limitation that the present study could not inspect some sites well due to lack of permission to enter private land. In addition, factors such as the time of year when a site is visited often differed between this study and the 1997 study, leading to differences in the detectability of seasonal species.

8.4.1 Recognition of Sites

The 1997 report recommended 82 sites to be covered by the current Vegetation Protection Overlay. Of these 82 sites, five (sites 10, 30, 39, 52 and 54) have lost nearly all their habitat and

biological significance and have ceased to qualify as sites of biological significance. The remaining 77 sites are retained here but some of them have changed boundaries. In addition, for practical reasons, one site has been split into four, two sites have been split in two and three abutting sites have been amalgamated into one. These changes have resulted in the original 77 sites becoming 80.

The 1997 report also recognised 50 sites (sites 83–132) as containing habitat that was less significant than the others but still warranting planning protection at a level lower than the Vegetation Protection Overlay. Of those 50 sites, the following 26 are not retained here as sites of biological significance:

- 7 sites (mostly very small) that have lost almost all of their habitat and significance;
- 5 small sites that have lost enough of their habitat that they no longer warrant recognition for their biological significance; and
- 14 sites that do not meet current criteria for sites of biological significance even though they would still qualify under the criteria of 1997.

On the positive side, this report recognises five new sites of biological significance. Four of them have shown no substantial improvement in their habitat but they now warrant recognition because the significance of the habitat has become better recognised. Finally, Croydon Library pond and its surrounds are added as a new site because the habitat has been substantially improved and has been observed to act as a drought refuge for threatened waterbirds.

8.4.2 Extent of Habitat

The amount of change in cover of native vegetation was estimated by comparing information from 2018 (aerial photography and this study's field observations) with information in the 1997 report and aerial photography from 2001. Small changes are hard to detect in this way.

Of the 82 sites recommended in 1997 for the Vegetation Protection Overlay, it is estimated that:

- 24 sites have experienced clear net decreases in the extent of habitat;
- 22 sites have experienced clear net increases; and
- 36 sites have shown no clear change.

However, note that these statistics say nothing about the sizes of the increases and decreases.

Of the additional 50 sites recognised in 1997 plus the five added in this report, it is estimated that:

- 19 sites have experienced clear net decreases in the extent of habitat;
- 18 sites have experienced clear net increases;
- 17 sites have shown no clear change; and
- 1 site's situation is unclear.

Table 6 summarises cases in which over 0.1 hectare of habitat has been lost. The total is 68.1 hectares. Forty-four percent of the total resulted from residential subdivision of the Croydon District Golf Club course to create 'The Range' housing estate.

Notably, the extensive Warranwood Environmental Living Precinct (Site 16) has not lost a detectable amount of native vegetation. This observation reflects well on the effectiveness of the area's planning provisions and the willingness of the residents to keep their native vegetation.

Table 6. Summary of hectares of habitat destroyed since 1997, categorised by cause.

Site number and location	Ha destroyed
Residential development – totally cleared	
3. 'Barnsdale Forest', 'Oban Woods' and Loughies Tk estates	3.5
39. Sacred Heart Monastery (now Aveo Mingarra), Croydon	1.2
10. Delatite Court drainage line, Warranwood	1.1
101. 'Tandarra' subdivision, Ringwood	0.5
118. The former Eastern Secondary College, Heathmont	0.2
Residential development and uses – partially cleared	
59. Croydon District Golf Club	30
37. Ruthven Avenue – Vasey Concourse Precinct, Croydon	1.5
46. Richardson Road Residential Precinct, Croydon	1.0
57. Village School, Croydon North (subdivided to 13 Holloway Rd)	0.8
67. Tereddan Drive, Kilsyth South	0.8
50a. Fairview Avenue residential area, Croydon North	0.7
64. Healesville Freeway Corridor, Bayswater North (mainly 51 Bayfield Rd)	0.6
5. Smedley Rd – Berringa Rd Residential Precinct, Ringwood North	0.5
8. Melbourne Rudolf Steiner School, Warranwood (Dromsally Rise)	0.5
76. Alexanders Bush, Heathmont	0.5
107. Jenkins Close, Ringwood North	0.5
123. Vista Avenue, Ringwood East	0.5
52. 141-149 Holloway Rd, Croydon North	0.4
62. Bennison St and Lyndhurst Close, Croydon	0.4
73. 2A Danielle Crescent, Heathmont	0.4
65. Skye Court estate, Bayswater North	0.2
110. Loughnans Hill Residential Precinct, Ringwood North	0.2
131. Bungalook Creek Corridor, Bayswater Rd to Canterbury Rd	0.2
Industrial development	
72. De Felice Development Site, Bayswater North	8.0
School developments (e.g. for buildings, car parks and sports areas)	
22. Yarra Valley Grammar School, Ringwood	0.6
113. Former Southwood School, Ringwood	0.3
8. Melbourne Rudolf Steiner School, Warranwood	0.2
34. Tintern Grammar, Ringwood East	0.2
55. Croydon Primary School	0.2
1. Ringwood Heights Primary School, Ringwood North	0.1
54. Yarra Road Primary School, Croydon North	0.1
120. Heathmont East Primary School	0.1
Road and rail projects	
30. Eastlink Corridor west of Cadburys, Ringwood	4.8
25. Mullum Mullum Valley west of New St, Ringwood	4.3
93. Canterbury Rd (south side), Bayswater North	1.5
82. Eastlink Corridor Billabongs west of Ringwood Public Golf Course	0.6
91. Mt Dandenong Road roadside (southern side), Kilsyth	0.5
88. Dorset Rd beside 'The Range' estate	0.2
109. Railway corridor, Heatherdale Rd to Eastlink	0.2
TOTAL	68.1

Increases in the extent of habitat have occurred through natural regeneration, planting, and broadening of the crowns of pre-existing trees. It is much easier to quantify the extent of clearing than the slow, incremental development of vegetation. This is particularly true of the countless trees whose crowns have expanded slightly into areas that formerly had no habitat – individually representing a tiny amount but contributing to a substantial total. Therefore, gains cannot be quantified in a similar way to the losses of Table 6. In any case, increases in extent are not very meaningful without consideration of the habitat's condition; e.g. 1 ha of a newly planted revegetation bed is not at all comparable with 1 ha of high-quality habitat cleared.

One example of habitat being added to a site is along Dandenong Creek. Figure 9 shows aerial photographs of the area between the creek and an aged care facility in 2000 and 2017.



Figure 9. Aerial view of revegetation beside Dandenong Ck, Ringwood, in 2000 (top) and 2017 (bottom).

The earlier photograph shows bare clay fill that had recently been dumped on the site during earthworks for the aged care facility. Over subsequent years, some of the eucalypts whose root systems were covered with the clay died. However, revegetation now provides habitat that contains canopy trees, understorey trees, shrubs and groundcover. This habitat expands the site of biological significance that abuts to the east (Scott Street Reserve – Site 80) and reduces fragmentation of habitat along the Dandenong Creek corridor (Site 69).

Another example of expanded habitat is the area of revegetation and artificial wetlands on the southern side of the Ringwood Bypass Road between Warrandyte Rd and New St. The habitat value has improved enough to make this strip meet the criteria for a site of biological significance, so it is added here to site 25. This area has achieved the intention of compensating in part for the habitat destroyed by the bypass road.

8.4.3 Ecological Condition of Vegetation

While comparing aerial photographs like those in Figure 9, it became apparent that the number of large eucalypt crowns has increased in many sites of biological significance. The abundant dead and dying eucalypts that were seen during fieldwork and in recent years are also visible in aerial photographs.

The possible causes of eucalypt decline and deaths are discussed in Section 5.1.5 (p. 43).

Eucalypt deaths and disease represent a decline in the ecological condition of habitat. The same might be said of the decline in the population of some indigenous plant species (Section 5.1.3 on p. 36). However, in many cases, the loss or decline of a plant species in one of Maroondah's sites of biological significance can be attributed to 'extinction debt', i.e. the delayed impacts of past actions. Some examples are given in Section 5.1.3. In other cases, the loss or decline of a species appears to be due to general deterioration of the ecological condition of the habitat, particularly due to drying of the landscape or displacement by highly competitive, non-indigenous plants ('environmental weeds') such as Sweet Pittosporum and Wonga Vine (Section 5.3, beginning on p. 50).

This study did not determine quantitative measures of each site's ecological condition. However, this study's fieldwork observations can be qualitatively compared with the categorisation of each site's vegetation on a scale from 'A' to 'D' by Lorimer *et al.* (1997).

On this qualitative basis, the author's assessment of changes in the ecological condition of the 82 sites recommended in 1997 to be covered by the Vegetation Protection Overlay is as follows:

- 4 sites have been largely or wholly cleared;
- 20 other sites have deteriorated noticeably in ecological condition;
- 12 sites have improved noticeably;
- 8 sites are quite variable between improvements and deterioration;
- 22 sites show no clear change; and
- 16 sites could not be adequately inspected to tell.

However, note that these statistics say nothing about the magnitudes of the improvements or deteriorations.

Of the additional 50 sites recognised in 1997 plus the five added in this report, it is estimated that:

- 7 sites have been largely or wholly cleared;
- 6 other sites have deteriorated noticeably in ecological condition;

- 14 sites have improved noticeably;
- 2 sites are quite variable between improvements and deterioration;
- 15 sites show no clear change; and
- 11 sites could not be adequately inspected to tell.

Council Land

Turning now to sites where Maroondah City Council has actively sought to improve or maintain the ecological condition (or arrest decline), 17 sites have improved, 7 have deteriorated, 13 have not changed noticeably and 5 have had mixed results.

The seven deteriorating sites have each experienced substantial eucalypt deaths and/or drying of floodplains.

A few sites have only been managed by Council as nature reserves in the past five years (approximately) and have shown remarkable improvements in ecological condition. The best examples are Proclamation Park (Site 111) and the 'tree reserve' on the corner of Dublin Rd and Maroondah Hwy (Site 122). In both cases, their ecological condition has improved so much that their significance rating has risen from Local to State.

The introduction of ecological burning has regenerated plant species in some of Council's nature reserves. It has also been found that fire can promote excessive regrowth of the indigenous Thatch Saw-sedge (*Gahnia radula*) and Forest Wire-grass (*Tetrarrhena juncea*), which can be a problem for fire hazard and ecological condition. A very effective response has been found to be following up a burn with cutting of ground flora during the largely dormant period of summer and early autumn. This has been very successful at favouring many small plant species such as orchids. As a result, carefully timed brushcutting has been extended to a number of nature reserves that are not burnt. The outcomes are good for biodiversity and fire protection.

Two main types of problem are associated with habitat having deteriorated despite council's efforts to stop it. The first is the drying of floodplains and the resultant displacement of the original vegetation by introduced plants adapted to less consistently wet conditions – see Section 5.1.3 (p. 36). The following sites have experienced deterioration of ecological condition of riparian (streamside) or floodplain vegetation despite adjacent vegetation improving in condition: B.J. Hubbard Reserve (Site 2), Warranwood Reserve (Site 15), Cherry Tree Grove Reserve (Site 23), Warrien Reserve (Site 47), Hochkins Ridge Drainage Reserve (part of Site 51), Eastfield Park (Site 61) and Connolly Crescent Reserve, Bayswater North (Site 72a).

Eucalypt deaths represent the other prevalent problem associated with habitat having deteriorated despite council's efforts.

Schools

Sites of biological significance within schoolgrounds have mostly deteriorated slightly in ecological condition since 1997. The declines have mostly been associated with increases in non-indigenous plants such as Wonga Vine (*Pandorea pandorana*) and Sweet Pittosporum (*Pittosporum undulatum*).

8.5 Threats to Biodiversity

This study assessed the threats to biodiversity in each site of biological significance. Most of the identified threats are widespread across the sites. The principal ones are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents. This is by far the greatest threat;
- Drying of floodplains due to drainage works and increasing impermeable surfaces in catchments;
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and possibly further urbanisation of the catchment.
- Water pollution, affecting vegetation, aquatic invertebrates, fish, frogs, waterbirds, Platypus and perhaps Rakali (or Water Rats);
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Displacement of indigenous plants by introduced plants ('environmental weeds');
- Eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Land development.

9 Findings about Biodiversity Outside the 'Significant Sites'

The level of biological significance varies across Maroondah in a continuous spectrum, from the most important areas to the least. While the 'sites of biological significance' in Volume 2 contain the most important habitat for indigenous flora and fauna, the remaining 88% of Maroondah still supports aspects of nature that are collectively important.

9.1 Values of Flora & Fauna Outside the Sites

The following is an assessment of the values of flora and fauna outside the sites of biological significance, categorised as in Sections 1.3 (p. 11) and 8.3 (p. 69).

1. Practical 'ecosystem services'

All of the ecosystem services discussed in Section 1.3 can be provided by vegetation outside the sites of biological significance, regardless of where the plant species may originate from. In fact, the small proportion of Maroondah occupied by sites of biological significance means that more people benefit from ecosystem services provided by vegetation outside the sites; e.g. shade from street trees and reduction of noise by shrubs in areas of heavy traffic. Even 'green roofs' can provide temperature regulation and noise reduction for large buildings.

These benefits are becoming increasingly important due to climate change, the increasing density of urban development and the associated reduction in vegetation cover noted by Kaspar (2018).

The provision of ecosystem services varies across Maroondah according to the amount and type of vegetation. There is too little vegetated ground in industrial areas and some commercial and residential areas for it to make a substantial contribution toward reduced stormwater runoff, flooding and water erosion. Those same areas tend to have too few trees to receive much shade, wind protection, temperature moderation and air purification compared with more treed areas. The benefits of shrubby vegetation for noise reduction are only realised where noise is a problem – particularly beside busy roads.

2. Financial and economic benefits

The ecosystem services just mentioned provide economic benefits such as reduced costs of air conditioning and management of water pollution.

The 'Maroondah 2040 Community Vision' speaks of the future community 'living in green, leafy neighbourhoods'. This attests to the desire of many in the community to live in areas with treed and shrubby neighbourhoods, not just sites of biological significance. That desire inevitably translates to higher real estate values in Maroondah's more vegetated neighbourhoods. For many people, birdlife and sometimes other fauna contribute to the attractiveness of 'green, leafy neighbourhoods'.

By promoting contact with nature, the vegetation reduces costs to the health system and improves productivity.

Maintenance of gardens and trees also generates economic activity and jobs.

3. Human attachment to nature

For most of the Maroondah community, day-to-day contact with nature comes not from sites of biological significance but from gardens, street trees and local parks. The popularity of gardening is one indication of people's desire to interact with nature. Birdwatching and feeding of birds are

others. Most people enjoy walking along tree-lined streets beside shrubby gardens, or through a vegetated park, rather than through an unvegetated landscape.

Obviously, plants do not have to be indigenous for people to enjoy them but for some people, it helps. As explained in Section 7.1.2 (p. 54), indigenous plants provide the greatest diversity of birds, butterflies, lizards and other wildlife for people to enjoy. Plant species from elsewhere in Australia are next-best. Most introduced plant species tend to displace most native wildlife.

Although wildlife is concentrated in the sites of biological significance, many birds, mammals, frogs, butterflies and other insects move out into surrounding neighbourhoods from time to time. These movements bring wildlife into the daily lives of those neighbourhoods.

For these reasons, the primary determinants of how well a particular neighbourhood serves people's attachment to nature are:

- Proximity to sites of biological significance;
- Whether the neighbourhood's vegetation is predominantly indigenous (best), Australian native (second-best) or of foreign species (clear last); and
- The amount and structure of vegetation, as discussed in Section 7.1.2 (p. 54).

4. Natural heritage

Unlike many parts of the world, most of Maroondah has at least a scattering of indigenous trees to retain something of the landscape from centuries ago. This is true even in central Ringwood, with native vegetation along Mullum Mullum Creek next to Eastland and wild eucalypts beside Seymour St south of Costco. These links with our natural heritage are mostly wild but some have been planted.

Few indigenous shrubs or wildflowers grow outside the sites of biological significance. Wild, indigenous trees have perhaps persisted longer than shrubs because more people are willing to retain them and they live longer than shrubs. Even the trees are dwindling due to lack of replacement as they die or are removed.

By contrast, there are several indigenous grass species and a few tiny indigenous wildflowers and creepers that are persisting well on some nature strips or in scattered lawns and gardens. Among the grasses are Clustered Wallaby-grass (*Rytidosperma racemosum*), Common Love-grass (*Eragrostis brownii*) and Mat Grass (*Hemarthria uncinata*). Among the wildflowers are Common Cotula (*Cotula australis*), Spreading Crassula (*Crassula decumbens*), Slender Onion-orchid (*Microtis parviflora*) and the solenogynes *Solenogyne dominii* and *Solenogyne gunnii*. Most of these species are more abundant outside the sites of biological significance than inside; we could call them 'urban-adapted'. While these small plants represent part of our natural heritage, they are rarely noticed.

More noticeable are the birds and possums. Species such as the Laughing Kookaburra, Eastern Rosella and Welcome Swallow are distinctively Australian, if not distinctive of Maroondah. Some bird species, such as the Little Corella, Noisy Miner and Crested Pigeon, are also Australian but absent or scarce from Maroondah prior to European colonisation. Species such as the Australian Magpie, Common Brushtail Possum and Common Ringtail Possum were probably present in Maroondah prior to colonisation but in much smaller numbers than today.

Overall, Maroondah's pre-colonisation flora and fauna are much better represented inside, rather than outside, the sites of biological significance. Nevertheless, the representation outside the sites provides a sketchy connection with Maroondah's past that pervades most of the municipality.

5. Caring for species other than our own

Conserving Maroondah's indigenous flora does not rely significantly on habitat outside the sites of biological significance, notwithstanding the aforementioned urban-adapted species. On the contrary, many properties outside the sites pose threats to indigenous flora, e.g. from nutrient pollution or spread of environmental weeds such as Ivy, Sweet Pittosporum and Cotoneasters.

By contrast, many bird species make extensive use of habitat outside Maroondah's sites of biological significance. For example, various parrot species, honeyeater species, Tawny Frogmouths and Laughing Kookaburras can be readily found in parts of Maroondah with at least a scattering of indigenous or Australian native trees. Some of these birds move in and out of the sites of biological significance and some other individuals live wholly outside the sites. Even those bird species that rely heavily on the sites of biological significance for their habitat often have to move elsewhere at times; e.g. during drought or while waiting until a home range can be claimed within a site.

Garden Skinks and Marbled Geckoes are fairly common outside sites of biological significance; less so Common Blue-tongue Lizards, Blotched Blue-tongue Lizards and Weasel Skinks. Each of these has been seen in parts of Maroondah so far from any site of biological significance that they can apparently live entirely outside the sites.

The Southern Brown Tree Frog is moderately common in the more treed parts of Maroondah, often far from any site of biological significance.

Some indigenous butterfly species are found only or principally within sites of biological significance. By contrast, the Common Brown Butterfly, Australian Admiral Butterfly and Australian Painted Lady Butterfly can readily be seen moving around Maroondah generally, often feeding in gardens or on street trees. The Common Grass-blue Butterfly, Meadow Argus and Greenish Grass-dart are perhaps seen more commonly outside sites of biological significance than inside, and probably much more commonly than prior to European settlement.

Many other indigenous flying insects can be seen both inside and outside sites of biological significance; e.g. hoverflies, native bees, paper wasps and cicadas.

Non-flying invertebrates are less mobile and are therefore less likely to move in and out of sites of biological significance. Some indigenous species are rarely seen outside the sites of biological significance (e.g. many species of ant) and some are common outside the sites (e.g. click beetles and badge huntsman spiders).

9.2 Relationship between the Values and Landscape Features

Some of the values discussed in Section 9.1 are related solely to vegetation (e.g. shade) and others are related to fauna. Section 7.1 (p. 53) provides information about how different types of fauna depend on particular types of vegetation.

Obviously, parts of Maroondah with minimal vegetation provide poor support for any of the values associated with flora or fauna. Pockets of vegetation within those areas can provide limited benefits to the neighbourhood, e.g. by harbouring beneficial insects or providing local residents with limited contact with nature. Areas with minimal vegetation mostly do not have any overlays in the Maroondah Planning Scheme to protect vegetation. The main exceptions are some neighbourhoods west of Wantirna Rd, Ringwood. Areas with minimal vegetation are increasing as housing density increases.

The amount of tree canopy is important for many of the values associated with flora and fauna, such as shade, wind protection, temperature moderation, economic benefits, enjoyment of birds,

natural heritage and retaining wildlife in the landscape. Shrubs contribute to noise reduction, visual screening, economic benefits, retaining wildlife in the landscape and encouraging birds and insects for people to enjoy. Grasses and other low-growing plants can reduce noise, generate economic activity and support lizards and a wide range of invertebrates. Any vegetated ground can aid infiltration of stormwater and hence reduce flooding and water erosion.

The Significant Landscape Overlay in the Maroondah Planning Scheme provides a level of protection to trees and large shrubs in most of Maroondah, subject to exemptions. There is also some planning control over removal of Victorian native plants (whatever their size) on properties larger than 0.4 hectares.

In the case of ecosystem services (e.g. shade) and the economic activity associated with vegetation maintenance, it makes little if any difference whether plant species originate from Maroondah, elsewhere in Australia or overseas. Natural heritage and conservation of fauna are mostly associated with Maroondah's indigenous species, followed by species from elsewhere in Australia (excluding 'environmental weeds'). Some foreign plant species may provide substantial benefits in some respects, e.g. shade, but they have mostly negative or neutral effects on values such as natural heritage and enjoyment of birds and butterflies.

10 Philosophical Issues with Practical Implications

Maroondah's environment is changing. Section 5.4 (p. 50) discussed how climate change is causing the rise of some plant species and the fall of others. Page 39 discussed how drainage works and increased impervious surfaces are causing soils to dry out and plant species to die out. Section 7.3 (p. 59) discussed the profound changes that have been occurring in Maroondah's birdlife.

These sorts of changes raise some important philosophical questions around what we regard to be 'indigenous' and how much it matters.

Through prehistory, species shifted their ranges as the environment changed. They also adapted, moved or died out when genetic mutations produced new organisms to compete with the old. Aborigines once hunted across the grassland that has since filled with seawater to become Port Phillip Bay. The plants they saw in Maroondah during the last ice age would have been quite different to when the first Europeans arrived.

Some of the species that died out in Maroondah prior to European colonisation would have moved to nearby areas and may now be moving back into Maroondah. Do we regard such species as 'indigenous' and embrace their return, aided by human-induced changes such as climate change or changed drainage?

For example, last year, Orchard (2017) published sound circumstantial evidence that Sifton Bush (*Cassinia sifton*, formerly regarded as part of *Cassinia arcuata*) was confined to New South Wales at the time of colonisation. Until 2017, Sifton Bush was presumed to be indigenous and widespread in Victoria, often sold in local indigenous nurseries. If it was only in New South Wales at settlement, it may still have been present in Maroondah at various times over the millennia, e.g. as a coloniser of bare ground following major bushfires or floods.

On learning of Orchard's work, some indigenous nurseries immediately removed Sifton Bush from sale, on the basis that it is not indigenous. Another view is that Sifton Bush might be regarded as indigenous if we do not anchor that adjective in a particular moment in history. One could also take into account that Sifton Bush might well be serving useful ecological purposes in Maroondah.

In this report, Sifton Bush is treated as an indigenous species but commentary about its questionable status is included where appropriate.

The related Shiny Cassinia (*Cassinia longifolia*) was more convincingly part of Maroondah's flora at the time of colonisation. It was probably confined to drier parts of the landscape, mainly in the north. During and since the Millennium Drought, it has been spreading into other parts of Maroondah. Do we embrace this expansion as part of nature's adaptation to environmental change or do we resist it because Shiny Cassinia is displacing some of the pre-existing indigenous flora in the newly occupied areas?

One might come to a different conclusion about the expansion of Wonga Vine into Maroondah. Wonga Vine occurred naturally in the Dandenong Ranges, a few kilometres east of Maroondah, at the time of colonisation. The first record from Maroondah was in 1990. In 1995–1996, this study's precursor (Lorimer *et al.* 1997) detected Wonga Vine in seventeen sites. In this study, it was found in at least fifty-three sites, as well as widespread in gardens. It is now often smothering large numbers of plants in native vegetation and substantially transforming habitat for flora and fauna (p. 49). It represents a significant threat of local extinction of other species, notwithstanding that it may well have been present in Maroondah at some stage prior to colonisation. Wonga Vine is therefore treated in this report as non-indigenous.

One strategy being used by the Victorian Government and others to adapt to climate change is to facilitate the movement of plants and animals around the landscape. Corridors are being created

to help species shift their ranges. Species like Wonga Vine may benefit from this strategy, and pre-existing flora and fauna will sometimes die out (at least locally) as a result.

Do we regard such species to be 'indigenous' in their new ranges? Do we embrace the way they are adapting to environmental change, notwithstanding their adverse impacts on pre-existing flora and fauna? If so, can we reconcile that with the concerted efforts that have been made over decades to resist the range expansions of species such as Sweet Pittosporum?

One might argue pragmatically that conditions are now changing so rapidly and profoundly that it is unrealistic to try to hold on to our natural heritage, and it is more appropriate to facilitate changes to existing ecosystems. However, that argument may lead us to lose more than just our natural heritage and many of the current-day indigenous species in Maroondah. Current indications are that if range shifts are all accommodated, the most aggressive species – such as Wonga Vine, Sweet Pittosporum and Noisy Miner – will establish so strongly in Maroondah that the total number of species will plummet. That would represent a serious reduction in biodiversity.

This outcome will be hard to accept for the many people who have resisted such changes for decades.

The discussion of these philosophical issues has scarcely begun. It has substantial implications for Maroondah City Council and the community. With community support, the council has put substantial resources into trying to retain nature as we have previously understood it, particularly in managing its nature reserves. It is time to review what we should try to keep and what changes we should accommodate, facilitate or resist. Some of the things that such a review could affect include:

- Park management, including the species selected for planting;
- Private land management, including gardening;
- Strategies to reserve or manage public land to conserve nature or facilitate immigration of new species;
- The level of strategic planning protection placed on private land that may serve as habitat corridors;
- The plant species chosen to receive planning protection in the Maroondah Planning Scheme;
- The selection of species in landscape plans associated with planning permit conditions.

11 Actions for Council Consideration

The information in the preceding chapters and in Volume 2 raise issues to which Maroondah City Council may wish to respond, or at least to take into account in related decisions that it has to consider. This chapter is intended to crystallise those issues and suggest responses for Council's consideration as part of its current 'Maroondah Vegetation Review'. Issues that affect other organisations are covered in Chapter 12.

11.1 Strategic Planning

In essence, strategic planning means the development or revision of a planning scheme. It involves setting and reviewing policies, objectives and rules for land use, land development and 'works'. It produces 'planning provisions' such as land zoning, overlays and planning permit requirements. Strategic planning for the Maroondah Planning Scheme is done partly by the state government through the Victoria Planning Provisions and partly by Maroondah City Council within constraints set by the state government. Community consultation is always involved in strategic planning before it results in the adoption of a planning scheme amendment.

By contrast, statutory planning involves administration of the planning scheme after the strategic planning has been done. For example, strategic planning may create a requirement that a permit is required under a particular circumstance and statutory planning will assess whether a permit will be issued for a particular application, and under what conditions. Strategic planners must take into account how the planning scheme can be best implemented and enforced by statutory planners.

The Victorian *Planning and Environment Act 1987* states that one of the objectives of planning in Victoria is 'to provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity' (clause 4(1)(b)). As normal in planning, this objective sometimes conflicts with other objectives such as bushfire safety.

The Victoria Planning Provisions (VPPs) aim to provide a state-wide, baseline level of protection of biodiversity across Victoria. They focus on species that are listed as rare or threatened throughout the state. It is left to councils to undertake strategic planning to protect natural assets that are important at regional to local scale, e.g. species or ecological communities that are locally threatened. It is also left to councils to protect the values of nature that are neglected in the VPPs, such as natural heritage or benefits to human health, wellbeing, childhood development and quality of life.

The local-scale biodiversity protection currently provided by the Maroondah Planning Scheme is strongly based on the *'Sites of Biological Significance in Maroondah'* report of Lorimer *et al*. (1997). Those protective measures have lost some of their effectiveness and relevance over the subsequent twenty-two years due to changes in planning law and state government guidelines. One of the purposes of the present study was to guide a path to more effective, up-to-date planning protection for biodiversity.

To guide councils about how to protect biodiversity through strategic planning, the Victorian Government prepared a document in 2017 titled *'Planning for Biodiversity – Guidance'*. That document updates parts of the more substantial 2002 document, *'VPP Practice Note – Biodiversity'*. Any strategic planning undertaken by Maroondah City Council for protecting biodiversity should have regard to those documents and the references therein, as has been done in the following subsections of this report.

At the time of writing, the optimum path for strategic planning to protect biodiversity has been muddied by state-wide planning amendment VC148. The amendment requires substantial parts

of planning schemes to be altered to conform with a new format and standards but it is not yet clear what changes will result in the Maroondah Planning Scheme. Those changes may invalidate some of the suggestions below regarding the use of particular planning provisions to protect biodiversity. An effort has been made here to provide information to assist adapting to the changes.

11.1.1 Establishing Objectives

For strategic planning purposes, Maroondah City Council's objectives and policies regarding biodiversity are stated in the planning scheme within sections on:

- Natural resources in general (section 21.10);
- Sites of biological significance (section 22.04);
- Waterway protection (section 22.01);
- Parts of Warranwood, Croydon Hills and Kilsyth South that lie outside the Urban Growth Boundary (section 22.03 – 'Non Urban Areas'); and
- The Ringwood Activity Centre (section 22.06).

Amendment VC148 requires all of these sections to be revised and integrated into the new Planning Policy Framework (PPF) of the planning scheme. The existing content encompasses most of the broad issues in this report but not those in the following two subsections, nor some of the matters concerning sites of biological significance covered in Section 11.1.2.

11.1.1.1 Connecting People with Nature

The importance of people experiencing nature in their daily lives is discussed in Section 1.3 (p. 11) and recognised in the state government's biodiversity strategy, *'Protecting Victoria's Environment: Biodiversity 2037'*. Bringing nature into people's daily lives yields benefits to health, wellbeing, childhood development and quality of life. Birds and birdsong are important components of our connection with nature, and they are promoted by the presence of locally indigenous and Australian native trees in the suburban landscape, as discussed in Sections 7.1.2 (p. 54) and 9.1 (p. 77).

The planning scheme currently does not recognise these matters. The imminent revision of the Maroondah Planning Scheme to conform with amendment VC148 offers an opportunity to correct this omission.

In particular, it is recommended to recognise the importance of locally indigenous and Australian native trees throughout Maroondah as habitat for birds and other wildlife. Such a recognition would provide a sounder policy basis for protecting habitat in suburbia through the use of schedules to zones and overlays.

Subject to how the imminent revision of the planning scheme proceeds, it may be appropriate to revise the four schedules of the Significant Landscape Overlay (SLO) to include an objective along the lines, 'To recognise the importance of indigenous and Australian native plants in bringing birds into suburbia'. The objective could alternatively be expressed in the PPF with reference to parts of Maroondah where the community is expected to benefit from birdlife.

In addition to protecting existing habitat trees, the recognition of the importance of indigenous and Australian native plants for birds would influence the selection of plant species in landscape plans under the planning scheme. (See also Section 11.8 re species selection for planting.)

The increasing amount of high density living in Maroondah is creating a substantial cohort of the community with limited daily interaction with nature. Rooftop gardens and community gardens

are two ways to compensate. They could be fostered by recognising them when the planning scheme is revised to conform with amendment VC148, e.g. through a strategy or action in the new Municipal Planning Strategy. The intention would be to influence larger developments to take the lead of the recent Eastland redevelopment in regard to its community garden and the use of plants around the development. Such measures are intended to benefit people and they may increase biodiversity within a highly urbanised precinct, e.g. by attracting butterflies and native bees. In sufficient numbers, these measures might also support the ecological functions of neighbouring natural habitats such as the Mullum Mullum Creek corridor, e.g. by increasing pollination and providing food for insectivorous birds.

11.1.1.2 Stormwater Management

Page 39 explains that urbanisation, drainage works and consequent gully erosion pose serious threats to rare plants on floodplains. Those problems also affect the ecology of streams and wetlands, e.g. the habitat for Platypus and fish. The Maroondah Planning Scheme does not currently recognise the problems.

This could be changed when the planning scheme is revised to conform with amendment VC148 by adding an objective along the lines, 'Restore more natural patterns of water runoff and seepage by encouraging on-site stormwater retention and influencing how urban development responds to the capacity of small catchments to cope with peak flows from urban runoff'. Such an objective would fit within clause 22.10-2 of the current planning scheme but it is unclear where the best place or places will be when the scheme is revised.

The primary intention is to protect significant floodplain vegetation and aquatic habitat threatened by changes to climate and hydrology, e.g. the regionally endangered Swampy Woodland EVC (p. 28) and its many vanishing plant species (Section 5.1.3 on p. 37). Planning controls need to be applied not only within the affected habitats but also higher in their catchments – ideally, the whole of Maroondah. The outcomes would not only benefit biodiversity but also support council's efforts to influence subdivisions and land development toward 'Water Sensitive Urban Design'.

11.1.1.3 Wildlife of Streams, Stream Corridors and Wetlands

Streams provide vital habitat for fish, Platypus, Rakali (or Australian Water Rat), waterbirds, aquatic plants and a wealth of invertebrates (p. 53). Native vegetation along streams provides an important base for food chains and corridors for wildlife movement, even if the vegetation is not in a very natural condition (Section 7.9, starting on p. 63). Wetlands provide habitat for wetland birds, frogs and even more aquatic plants and invertebrates than streams (p. 53).

Despite these facts, the only mention of flora or fauna in the Local Planning Policy on Waterway Protection (clause 22.01) relates to canopy vegetation, without regard to whether it is indigenous or not. A specific recognition of wildlife habitat would support the policies already in clause 22.01-3 as well as the application of the Environmental Significance Overlay suggested below.

11.1.2 Sites of Biological Significance

11.1.2.1 Selection of Planning Controls

Most of the sites in the 1997 *'Sites of Biological Significance in Maroondah'* report were given the protection of the Vegetation Protection Overlay (VPO) soon after the report was completed. The state government had only just introduced overlays to the 'new format planning schemes'. Soon after, the government changed its guidance for protecting sites of biological significance

from using VPOs to using Environmental Significance Overlays (ESOs). That became formalised in the 2002 *'VPP Practice Note – Biodiversity'*. However, the VPO remains in place in Maroondah, albeit with some amendments over the years to its provisions.

As a planning tool, a VPO is limited to controlling the removal, destruction or lopping of specified types of vegetation. It cannot require a permit for subdivision, building construction or 'works', even when those activities have substantial adverse consequences for biodiversity. For example, a vegetation protection overlay cannot affect a development that causes runoff or seepage of water, nutrients and pollutants into an adjacent environmentally sensitive site, even if it will kill native vegetation and destroy wildlife habitat. As another example, a VPO cannot influence subdivision design to provide a bushfire buffer within the subdivision rather than forcing an abutting part of a conservation reserve to be cleared for a firebreak to protect the new houses.

An Environmental Significance Overlay (ESO) is not subject to these restrictions.

The state government's document, *'Planning for Biodiversity – Guidance'*, states, 'The ESO has broader applicability than the VPO and is the preferred overlay when seeking to achieve biodiversity outcomes'.

Consistent with this guidance, it is recommended that the existing VPO used for Maroondah's sites of biological significance be largely replaced by the ESO. The most important aspect of this change will be the ability to influence subdivision, building and works, even when those activities do not involve direct vegetation removal.

While the ESO is appropriate for all the sites of biological significance in Volume 2, two separate categories of sites or parts of sites can be distinguished:

- Land whose biological significance relates to aquatic habitat and/or vegetation with indigenous trees and understorey (including buffers to such areas); and
- Land whose biological significance is toward the low end of the scale and relates to a good cover of indigenous and/or Australian native trees, with little indigenous understorey other than common native grasses. An example is the median strip of Mount Dandenong Rd near Dublin Rd.

These two categories differ in the type of habitat, the environmental objectives that can be met and the types of vegetation whose removal should be controlled. The former category does not require control over removal of non-indigenous plant species. The latter category warrants protection of indigenous tree and shrub species as well as the main types of Australian native trees that provide wildlife habitat, such as eucalypts and wattles. (Small trees are included, as they help avoid unnaturally high densities of Noisy Miners.)

Because of these differences, it is recommended that these two categories be given different schedules under the ESO: 'ESO1' and 'ESO2' respectively.

11.1.2.2 Content of Overlay Schedules

Details of the content of the proposed ESO1 and ESO2 schedules are outside the scope of this study. Instead, the following guidance is provided:

- Building, works and subdivision would be dealt with similarly between ESO1 and ESO2;
- A suitable model for both ESO1 and ESO2 would be the Knox Planning Scheme's ESO2;
- Consistent with Section 11.1.1.1 above, ESO1 and ESO2 should include an environmental objective along the lines, 'To maintain and improve the opportunities for the Maroondah

community to experience the benefits that natural environments provide for health, wellbeing, childhood development and amenity';

- ESO1 and ESO2 should give priority to protecting locally threatened plant species, as discussed further in Section 11.1.2.4;
- It is recommended that ESO1 and ESO2 include a requirement to:

  Apply the following three-step approach:

  1. Avoid direct and indirect adverse ecological impacts to sites of biological significance, such as alteration of soil hydrology;
  2. Minimise such impacts where they cannot be avoided; and
  3. Provide compensation for unavoidable impacts.

  Note that this approach parallels the state-wide provisions for protecting native vegetation at clauses 12.01-2S and 52.17 but it has a quite different scope.
- If possible, ESO1 and ESO2 (or a separate policy document) should explain the process for determining the magnitude and nature of acceptable compensation for vegetation losses and (ideally) other impacts such as altered soil hydrology. Note that 'offsets' under clause 52.17 of the VPPs will often not apply, e.g. in the cases of non-Victorian species or properties smaller than 4,000 m². Even when 'offsets' do apply, they will often not compensate for the broader range of impacts covered by ESO1 or ESO2;
- ESO1 would protect locally indigenous plant species, regardless of their stature. It is not proposed to include non-indigenous species because they rarely add to the affected sites' significance and sometimes they detract from it;
- ESO2 would only affect trees and shrubs over 2 m tall (not lower plants) of species that are either:
  - Native to Victoria, excluding Sallow Wattle (*Acacia longifolia* subspecies *longifolia*) and Sweet Pittosporum (*Pittosporum undulatum*). Those two exceptions are significant 'drivers' of habitat deterioration, in the sense discussed in Section 5.3 (p. 50); or
  - Species of *Allocasuarina*, *Angophora*, *Banksia*, *Callistemon*, *Corymbia*, *Eucalyptus*, *Leptospermum*, *Lophostemon*, *Melaleuca* and *Acacia* (other than *Acacia elata*).

  These groups cover almost all the important habitat trees within the proposed ESO2 areas, taking into account the finding of White *et al*. (2005) that indigenous trees are most important, followed by other Australian natives (Section 7.1.2 above). The height threshold of 2 m is low enough to provide protection for understorey that reduces overpopulation of Noisy Miners (p. 55).

The exemption of Sweet Pittosporum from the protection of ESO2 is not only justified by the adverse impacts of the species but also because failing to do so would perpetuate a perverse interaction with the existing SLO schedules, as follows: With the exception of properties larger than 2,000 m² inside the Urban Growth Boundary, Sweet Pittosporum is currently exempt from Maroondah's SLO schedules. As a result, no permit is needed to remove Sweet Pittosporum from the vast majority of private land covered by the SLO except where another planning control requires one. If ESO2 does not provide the same exemption, this environmentally damaging but attractive species will be protected in areas that are recognised as important habitat but not in areas where there is only protection for aesthetic reasons.

Sweet Pittosporum and Sallow Wattle are also proposed to be exempted from the protection of clause 52.17 – see Section 11.1.2.5.

11.1.2.3 Determination of Overlay Boundaries

There are at least five reasons why the boundary of an overlay area to protect a site of biological significance may extend beyond the area known to contain the significant features:

- The features of significance may be vulnerable to actions on adjacent land. For example, a conservation reserve may be at risk from a potential subdivision next door that could alter seepage or runoff into the site and create the need for a firebreak to be cleared within the reserve; or
- It is often preferable to align overlay boundaries with property boundaries to provide surety about what land is affected. However, it would be unreasonable to encumber the whole of a property with an overlay if only a small part of the property possesses, or could affect, biological significance; or
- Residential areas such as Site 37b in Volume 2 can contain a complex matrix of land with a variety of levels of biological significance, even within a single property. It is not always possible to excise lots or parts of lots that have no biological significance, particularly as they may be in backyards that could not be inspected in this study. Including the whole area can be described as a 'precinct approach' and was accepted by the Planning Panel for Knox's 'Sites of Biological Significance' amendment (Knox Amendment C49); or
- An area may be intended to accommodate an expected expansion of significant habitat; or
- In some cases, there are grounds to believe that the significant features may occupy more land than is currently known. For example, at least one Powerful Owl is known to roost on the edge of Warranwood Reserve and its hunting ground is expected to extend into nearby land.

It is also appropriate for an overlay not to cover the whole of a site of biological significance if:

- The excised part of the site is believed to be adequately protected without an overlay; or
- There are specific reasons why the overlay should not be applied to the excised land, e.g. where a decision has been made that it is more important to facilitate the excised land's development than to protect the land's biological significance.

The Victorian Government's *'Planning for Biodiversity – Guidance'* and Planning Practice Notes provide no guidance on how to set overlay boundaries. The government's *'Standard Criteria for Sites of Biological Significance in Victoria'* (Amos 2004) is more helpful despite not specifically addressing overlays. It concludes that a site of biological significance may be delineated to include not just the biologically significant features but also a separately identified 'buffer' area, as appropriate. That is the approach taken here: The description of each site in Volume 2 states which parts are of significance in their own right and which parts (if any) are proposed to be included or excluded because of any of the reasons in the dot points above. That information is intended to avoid anyone doubting the basis for land being included within a site, and to provide guidance to Council or a Planning Panel if they wish to vary the boundaries proposed in Volume 2.

11.1.2.4 Locally Threatened Plants

The Victorian government gives legal protection to species that are rare in Victoria even if those species are not rare or protected interstate or overseas; e.g. *Austrostipa rudis* subsp. *australis* (Section 5.1.4 p. 40). For the same reasons, a municipality can provide protection for species and communities that are rare or threatened in its jurisdiction even if they are not rare in some other jurisdiction. Section 5.1.3 (p. 36) explains the motivation for doing so.

The Maroondah Planning Scheme currently provides only weak recognition of locally threatened plants. That recognition is in the form of an objective in the 'Sites of Biological Significance'

Local Planning Policy, 'To ensure that all species of indigenous flora and fauna remain present in Maroondah' (clause 22.04-2). There are no associated policies to specifically protect locally threatened plants and achieve the objective. In any case, that whole policy may have to be abolished to bring the planning scheme into conformity with amendment VC148.

It is therefore recommended to include in ESO1 and ESO2 an environmental objective such as 'To reduce the threat of local extinction to flora or fauna species in Maroondah'.

As a complementary measure, the associated 'Application requirements' could be augmented with a requirement to provide estimates of population sizes of species listed as 'critically endangered' with dying out in Maroondah. A suggested wording of the new application requirement is to provide: 'The population sizes of any indigenous plant species affected by the application that are critically endangered with dying out in Maroondah, and the potential impacts on those species'.

Ideally, the term 'critically endangered' would be replaced by the broader term 'threatened', with a reference to a schedule of locally threatened species that can be updated without requiring a planning amendment. Planning law may not allow that to happen. In that case, a list of 'critically endangered' species identified in Appendix A of this report will have to suffice.

Some plant species in that list, such as Red Stringybark and White Stringybark, are not at all confined to sites of biological significance. That provides an argument for recognising such species not only in ESO1 and ESO2 but also in the Planning Policy Framework when it is reviewed for amendment VC149.

11.1.2.5 'Sites of Biological Significance' Local Planning Policy

Maroondah's current Local Planning Policy on sites of biological significance (clause 22.04) applies to applications for vegetation removal under the Vegetation Protection Overlay, with a reference to the 1997 report, *'Sites of Biological Significance in Maroondah'*. Not all the sites in the 1997 report are covered by the overlay.

Amendment VC148 may require the existing policy to be abolished. However, its intent could be maintained by integrating it in the proposed ESO1 and ESO2.

11.1.2.6 Exemption of Species from Clause 52.17

Section 11.1.2.2 discussed the perverse interaction that results from having SLO schedules that exempt Sweet Pittosporum and an ESO that does not. A similarly perverse interaction currently exists between the SLO schedules and clause 52.17 (the state-wide controls to protect native vegetation for its environmental values). It is recommended to amend the clause 52.17 schedule to exempt Sweet Pittosporum, because of the perverse interaction and because of the species' adverse environmental impacts in Maroondah (Section 5.3 above).

The Knox Planning Scheme also exempts twenty-three additional species from clause 52.17 because there is no rational reason to require a permit for their removal and in some cases, they have adverse ecological impacts. For most of those species, the arguments that led Knox to exempt them apply equally in Maroondah. It is therefore proposed here to exempt the following species from clause 52.17:

Acacia falciformis – Large-leaf Hickory-wattle
Acacia howittii – Sticky Wattle
Acacia longifolia subspecies *longifolia* – Sallow Wattle
Acacia longifolia subspecies *sophorae* – Coast Wattle
Acacia pravissima – Ovens Wattle

Acacia provincialis (formerly regarded as part of *Acacia retinodes*) – Wirilda
Acacia uncifolia (formerly regarded as part of *Acacia retinodes*) – Coast Wirilda
Callitris rhomboidea – Port Jackson Pine
Corymbia maculata – Spotted Gum
Dichanthium sericeum – Silky Blue-grass
Dysphania pumilio (formerly *Chenopodium pumilio*) – Clammy Goosefoot
Eucalyptus botryoides – Bangalay or Southern Mahogany
Grevillea rosmarinifolia – Rosemary Grevillea
Kennedia rubicunda – Dusky Coral-pea
Melaleuca armillaris – Bracelet Honey-myrtle
Melaleuca decussata – Totem-poles
Myoporum species – Boobiallas
Paspalum distichum – Water Couch
Passiflora cinnabarina – Red Passionflower
Pittosporum undulatum – Sweet Pittosporum
Portulaca oleracea – Pigweed
Syzygium smithii (formerly *Acmena smithii*) – Lilly Pilly

Note that exempting these species from clause 52.17 does not withdraw the protection that the tree species gain from the SLO. Note also that the plants in the list should not all be regarded as 'weeds'; In fact, many of them are quite desirable in a garden. The reason for the proposed exemptions is that they do not materially contribute to biodiversity in Maroondah and hence do not relate to the objectives of clause 52.17.

A counter argument has been put that the proposed exemption increases complexity because it relies on a person removing vegetation to be able to identify the species. However, even without the exemption, clause 52.17 requires the same person to identify the species *and* know whether it is native to Victoria.

11.1.3 Zones

The ESO and VPO can control vegetation removal and the ESO can additionally control subdivision, works and development to some degree but neither overlay can control land use or set minimum lot sizes. Zoning is the primary planning tool to regulate land use and set minimum lot sizes.

The main aspects of zones that relate to biodiversity are:

- Minimum lot sizes, as small lots result in less vegetation in the landscape;
- Allowed land uses;
- Required amounts of garden and private open space;
- Setbacks (i.e. required space between buildings and property boundaries);
- Required amounts of permeable surfaces, which affects the amount of vegetation, seepage and runoff.

Opportunities to rezone land for increased biodiversity protection are rare compared with the occasions when rezoning allows more intensive development to accommodate Melbourne's rapid growth. An example in the latter category is the introduction by successive state governments of new sets of residential zones. The ratcheting down of biodiversity protection that arises from these rezonings makes it important that when they occur, the impact on biodiversity is considered carefully.

Biological significance is only one of many considerations in zoning, so sometimes, zoning works against the interests of biodiversity. For example, properties abutting Warranwood Reserve on the western side of Merrill Crescent (in Site of Biological Significance no. 16) are zoned NRZ3, with no minimum lot size, whereas properties of equal or lower biological significance on the opposite side of the road are zoned NRZ1, with a minimum lot size of 2,000 m².

It is beyond the scope of this report to weigh up biodiversity matters against competing planning objectives. It is hoped that the information in this report will allow that to happen when future rezoning amendments are considered.

11.1.1 Greyfield Redevelopment

Melbourne's population is rapidly expanding and land values have increased greatly. Many of Maroondah's residential areas have a predominance of houses nearing the end of their useful lives, on land that is very sought-after for redevelopment. These areas are called 'greyfields', as distinct from 'greenfield' redevelopments on rural land and 'brownfield' redevelopments on formerly industrial land. Smaller lot sizes distinguish greyfields from the other types of redevelopment land.

Currently, most redevelopment of these greyfields is occurring piecemeal, one house block after another. A substantial part of the land becomes occupied by driveways. The space available for gardens is fragmented into a tiny area for each house. This pattern is normally repeated until a neighbourhood has an unnecessary amount of driveway pavement, no diversity in housing and no garden big enough to provide space for a substantial tree. The area loses its green and leafy aspect, including the benefits of biodiversity.

These problems are greatly ameliorated when multiple, neighbouring house blocks are amalgamated and redeveloped as a whole. A larger development site allows:

- More flexibility in subdivision design and housing types;
- More efficient alignment of driveways, reducing the space they occupy;
- Incorporation of a common space with trees, birds and sunshine;
- Sometimes paths between streets, for safer and shorter walking and cycling routes;
- Less environmental problems such as urban runoff from excessive paving.

These advantages not only provide the new residents with more nature in their lives but they also reduce off-site impacts on the ecological health of streams and wetlands.

Changing the way greyfields are developed requires incentives for landowners to favour amalgamation of lots over piecemeal, lot-by-lot redevelopment. Most of the incentives that strategic planners are exploring are outside the scope of planning schemes and outside the scope of this report. Nevertheless, it is important to note here that Maroondah City Council and Swinburne University have a pilot program called 'Greening the Greyfields' directed toward fostering the advantages of multi-lot redevelopment.

11.2 Statutory Planning

11.2.1 Planting Guidance

When someone seeks a planning permit, statutory planners often have the capacity to influence what plant species are planted under the conditions of the permit. In some areas, there may be a planning priority to promote the presence of birds or other wildlife, e.g. to enhance the natural

aspects of the neighbourhood character. In such cases, the dot-points on p. 56 provide guidance about suitable plant species and vegetation structure.

Landscape plans prepared as part of the permit process can help conserve local flora by including plant species that are in the 'critically endangered' category of dying out in Maroondah, i.e. species whose names are bold in Appendix A. It must be acknowledged that many of those species are unsuitable for most properties and some are hard to obtain or grow.

11.2.2 Harmonisation of Offsets and other Permit Conditions

When a planning permit is issued for removal of vegetation under a VPO, ESO, SLO or clause 52.17, it is normal for a permit condition to require compensation by way of replanting or an undertaking to improve and maintain existing vegetation. The compensation under clause 52.17 is called 'offsets' and its magnitude and nature are determined by rather tight specifications set by the state government. Compensation under the other planning controls is open to wider discretion.

Some vegetation-related permit applications can simultaneously involve more than one control out of the VPO, SLO, clause 52.17 and (if the recommendations above are adopted) the ESO. Applications for sites of biological significance must also address the 'Sites of Biological Significance' Local Planning Policy. There is no hierarchy of one planning control overriding another; all must be met for a permit to be issued.

In a case involving multiple requirements for 'offsets' or other compensation, those requirements are not necessarily cumulative. For example, if the replanting of twenty trees fulfils the offset requirements under clause 52.17 and it is also adequate to satisfy another control, there is no need to plant two lots of twenty trees just because two controls are involved. On the other hand, the SLO (for example) may require replanting of ten plants with certain visual characteristics but those plants might not simultaneously provide the right kind or amount of compensation, or in the right locations, to compensate for the ecological impacts addressed by the VPO or ESO. A wide variety of situations can arise where offsets and other compensation partially overlap between planning controls. In general, the maximum degree of overlap should be sought to minimise the overall regulatory burden on the permit applicant.

One important way to achieve overlap on sites of biological significance is to favour species that are 'critically endangered' with dying out in Maroondah.

The present study has found no guidance from the Department of Environment, Land, Water and Planning about how to harmonise the various compensation requirements that can arise when multiple planning controls are triggered. Nor was any example found in the Maroondah Planning Scheme or while reviewing the small number of other planning schemes of similar municipalities. Nevertheless, the method or principles for calculating compensation should be written down in a guideline document to provide transparency and consistency, and to safeguard against administrative fiat and corruption.

11.2.3 Mapping Inaccuracies

There is another complication that can arise when dealing with a permit application that involves clause 52.17 as well as a local provision such as an overlay. Sections 2.2 and 4.1 of this volume and the site descriptions in Volume 2 make it clear that the mapping and other information that the Department of Environment, Land, Water and Planning relies upon for biodiversity information is often inadequate or inaccurate in Maroondah. The inaccuracies particularly affect the bioregional boundary and where particular EVCs and plant species occur. These inaccuracies propagate through the Department's derived mapping of 'strategic biodiversity value', 'nature print' and 'strategic management prospects'.

A planning permit application under clause 52.17 via the 'Basic Assessment Pathway' or 'Intermediate Assessment Pathway' can, at the applicant's choice, rely wholly on the Department's mapping of the land in question. Council cannot override that mapping for a clause 52.17 application, even if the mapping is clearly wrong. However, if the vegetation removal also triggers an overlay or the 'Sites of Biological Significance' Local Planning Policy (Section 11.1.2.5), Council is able (indeed, obligated) to use correct information even though it is forced to accept inaccurate information regarding clause 52.17.

In such cases, it is important for Council to explain as early as possible in the application process how these inconsistencies arise and how they must be handled.

There is a recommendation in Section 12.4 below for the Department of Environment, Land, Water and Planning to consider correcting its mapped information where it is known to be inaccurate.

11.2.4 Staff Training

Neither the present report not the state government's mapping of native vegetation can provide all the information about flora and fauna that may be required to assess a planning permit application. An example would be when a proposed subdivision design would result in depriving an adjacent conservation reserve of the seepage it requires, or places a demand on the reserve to clear a firebreak to protect new houses.

It is a lot to ask of a statutory planner to be able to handle all such eventualities. Maroondah City Council has a reasonable breadth of expertise and to some degree, responsibilities can be allocated among staff according to their strengths. Nevertheless, consultation with staff indicated that the statutory planning team could operate more effectively with more training, or ready access to expertise, regarding:

- Plant identification, particularly regarding species whose risk of dying out in Maroondah falls into the 'critically endangered' category;
- Understanding hydrology and the role of maintaining soil moisture availability in native vegetation, particularly in swampy areas; and
- Basics of what land management activities are required to look after vegetation that must be maintained, improved or created under a planning permit condition.

11.3 Locally Threatened Species Strategy

One of the objectives that Maroondah City Council has set in the 'Sites of Biological Significance' Local Planning Policy is 'To ensure that all species of indigenous flora and fauna remain present in Maroondah' (clause 22.04-2 of the Maroondah Planning Scheme). That objective will require concerted effort, given the findings of Section 5.1.3 (p. 36). In addition to the measures discussed in Section 11.1.2.4, there are equally important measures to be taken outside the planning scheme.

It is beyond the scope of this report to devise measures to address any significant number of the threats faced by species of flora and fauna at all the sites where they occur. That could be done by having a separate strategy prepared, as Knox City Council did in the same situation. However, the following two subsections deal with the two highest-priority issues.

11.3.1 Rescuing Plants of Winter-sodden Soil

Section 5.1.3 (p. 36) discusses the dire plight of numerous plant species – listed in Table 5 – that are specifically adapted to floodplain soils that are normally sodden through most of winter and

quite dry in summer. The reason for those species' decline is the drying of the soil due to land development and perhaps climate change.

It is not inevitable that these species will soon die out completely within Maroondah.

In some of the affected habitat, the land might be rehydrated by bringing stormwater in pipes to the surface, as has been done at Wicks Reserve in The Basin and Coomoora Reserve in Keysborough. The paperbark thicket west of the Benson Oval at Eastfield Reserve, Croydon South, is an ideal candidate for such a treatment. So is the former horse pond beside Dandenong Creek downstream of Dorset Rd – part of Site 72 of Volume 2.

Another problem that afflicts locally threatened plants on winter-sodden soils of floodplains is mowing during the flowering and seeding season and when the ground is boggy. Section 11.5 describes an example at Dorset Recreation Reserve in Croydon. In most cases, all that needs to be done to overcome the problem is to adjust mowing schedules and practices, and ensure that the changed practices are adhered to. This has happened at Dorset Recreation Reserve as an outcome of the present study.

Similar changes are being made by Melbourne Water in response to the same problems at Bungalook Conservation Reserves in Kilsyth South.

11.3.2 Planting Locally Threatened Plants

Council's bushland management team have been planting locally threatened plants into reserves to increase population sizes and hence reduce inbreeding. Some of the planted plants were detected in this study's fieldwork and there is evidence that the strategy has worked in some cases. The best example is the planting of three species of Hakea in the council reserve at Bungalook Conservation Reserves in Kilsyth South. The populations of two of those species (*Hakea decurrens* and *Hakea ulicina*) were down to less than ten each, a decade or so ago. Planted individuals then bred with the wild individuals, producing many seed capsules. Ecological burns killed the plants and stimulated the germination and establishment of dozens of new plants, making the species much more secure.

Unfortunately, most other attempts to establish self-sustaining populations of locally threatened species by planting have failed. A plausible explanation for planted species dying without reproducing is that the same factors that caused the species to be scarce or absent from the planting sites prior to planting were still operating after the planting. That would be consistent with the success of plantings in Bungalook Conservation Reserves (where the habitat is quite natural and a complex pattern of ecological processes can be observed) and the failures in less natural environments.

Another cause of failed plantings has been prolonged dry spells during the establishment phase. This has been an increasing problem due to increasing climatic variability. Council's bushland management team is responding to this challenge by changing its practices to a grid planting pattern so that monitoring and watering are easier and more reliable.

While these efforts to save plant species from local extinction are laudable, it is clear that they should not be thought of as a satisfactory alternative to conserving wild populations. When a species dies out in the wild, it is currently unlikely that planting will be able to establish a new, self-sustaining population.

11.4 Management of Nature Reserves

Maroondah City Council has a dedicated 'bushland' team who manage reserves that are wholly or predominantly set aside for nature conservation. Habitat in other reserves is discussed in Section 11.5.

The principle objective of the bushland team is nature conservation, which has improved as a result. The prevalence of environmental weeds has significantly reduced since the 1997 *'Sites of Biological Significance in Maroondah'* report. Some areas that appeared to be just trees over mown lawn twenty years ago now support diverse understorey with many wildflowers – e.g. Dublin Road Reserve in Ringwood (Site 122 in Volume 2). The situation would be much worse without the bushland team, considering the trajectory up to the time the team was created around two decades ago. Some of the credit for the improvements goes to habitat management contractors who assist the bushland team, and 'Friends' groups who operate in some of the reserves.

An important consideration for the bushland team is that Maroondah City Council formally adopted the following targets at its Council Meeting on 24th April 2017:

- 'No net loss of the area and quality of existing native vegetation on 171 hectares of land managed by the City of Maroondah to 2040;
- 'Improved native vegetation quality on an additional 6.7 hectares of land managed by the City of Maroondah by 2025 and a further 13.1 hectares by 2040'.

Funding should be allocated to ensure the targets are met. Monitoring needs to be conducted to check progress. The methods that can be used for monitoring are discussed in Section 11.12.

This report cannot conduct a review of Council's management structures. Nevertheless, it would be remiss not to observe that the bushland team is based at the council depot in Croydon and have limited interaction with Council's environmental planners at the civic centre in Ringwood. Separation between those who plan biodiversity management and those who conduct it on the ground is unfortunate but not uncommon. There has been a parallel situation at Manningham City Council for decades but a decision was recently taken that the environmental planners will be relocated to the depot where the practitioners are located. Conversely, Knox City Council relocated its bushland management staff from the depot to beside the biodiversity planners at the civic centre, which is not far from the depot. The interplay and sharing of skills between the practitioners and planners in Knox is conspicuously greater than in Maroondah or Manningham.

Maroondah's bushland team has vehicles, chemicals and equipment that need to be stored at the depot or somewhere similar. They also have similar needs for safety programs and training to others in the depot, and sharing of skills and experience with other depot staff is important. Environmental planners have parallel reasons to be located at the civic centre and interact with staff there. Perhaps the optimum way of facilitating interaction between the bushland team and the planners is through a scheduled program of occasions to meet and discuss issues in common.

11.5 Management of Other Reserves

Maroondah City Council's 'bushland' team manage council's dedicated nature reserves but there are plenty of areas of significant habitat in other reserves, e.g. Ringwood Lake Park (Site 26 in Volume 2) and Proclamation Park in Ringwood (Site 111 in Volume 2). These other reserves are managed principally for recreational activities. In some cases, such as Proclamation Park, the most significant areas of native vegetation are so well recognised as important that they are managed by specialist contractors. However, in most cases, significant vegetation is either unmanaged or managed for tidiness, causing conservation values to either decline or hang on through benign neglect.

A good example is the floodway at Dorset Recreation Reserve in Croydon, part of Site 62 in Volume 2, as discussed in Section 11.3.1 (p. 93). Of the indigenous plant species growing there:

- Brown-back Wallaby-grass (*Rytidosperma duttoniana*) is not known to grow any closer than Yarra Glen (which was last century);
- The minute trigger-plant called Hundreds and Thousands (*Stylidium despectum*) was also at Bungalook Conservation Reserves until 2016 but there is only one other report of that species occurring closer than 20 km in the past two decades; and
- The Veined Swamp Wallaby-grass (*Amphibromus nervosus*) could only be found at one other site in Maroondah during this study, despite targeted searching.

These plants are part of the most threatened vegetation community in Maroondah – Swampy Woodland – as discussed in Section 5.1.3.

The floodway is therefore very important for biodiversity. The rare plants are very vulnerable to being mown when the ground is boggy or during their reproductive period, October to early December. However, until this study, the rare plants were mowed regularly during the reproductive period in the belief that mowing for the benefit of walkers was more important than conserving the rare plants. An outcome of this study has been a change in the mowing program to accommodate both tidiness and nature conservation.

Another practice associated with the pursuit of tidiness over nature has been the increasing use of herbicide to kill plants around the bases of trees. For example, the last remaining Common Flat-pea (*Platylobium obtusangulum*) at Jubilee Park was one of many indigenous plants killed by herbicide in spring 2018 as part of an effort to change the appearance of the area north of the No. 2 Oval.

The tension between nature conservation and perceived community preferences for tidiness also arises in a number of other reserves, such as Ringwood Lake Park. The balance has tilted substantially toward tidiness in the past year. Even if Council meets the targets it set for maintaining habitat quality in bushland reserves at the Council Meeting of 24th April 2017, there could be an overall deterioration due to the recent increase in mowing and herbicide use on native vegetation outside nature reserves.

11.6 Eucalypt Deaths

As noted in Section 5.1.5, Maroondah City Council is funding a current investigation by the University of Melbourne to identify the causes of widespread eucalypt deaths in Maroondah. Hopefully, the investigation will identify measures that Council and others can take to reduce or reverse the decline of eucalypts. Those measures may require substantial funding.

Without wishing to pre-empt the investigation, the present author notes that many ailing eucalypts show signs of heavy browsing by possums, such as bite-marks on their leaves and dense possum faeces beneath. Even without waiting for the investigation to finish, banding of tree trunks to prevent possums from climbing them would serve the useful purpose of determining whether the trees recover. Recovery can normally be seen within a few weeks if possums are the only cause of foliage loss, as demonstrated in 2017 when bands were used in a trial in the 100 Acres Reserve in Park Orchards, 1½ km outside Maroondah (p. 45). Of course, banding only works if possums cannot access the trees from adjacent trees or shrubs. Even if only one tree in a reserve is banded and seen to recover, that would indicate an excessive possum population which could explain foliage loss over a much larger area. Corrective measures could then be considered, such as reducing connectivity between trees.

11.7 Water Management

As discussed on p. 37, drying out of soils and wetlands due to prolonged drought and urbanisation represents the greatest threat of plant species dying out in Maroondah. Stream ecology and stability are also affected by the unnaturally large fluctuations in flow resulting from too much impervious surface. The most acute concern is in relation to Swampy Woodland and the disappearance of species specially adapted to winter-sodden floodplains, as listed in Table 5 (p. 38).

Section 11.1.1.2 (p. 85) proposes a response that can be taken in the Maroondah Planning Scheme.

Council's civil engineers and others responsible for implementing Council's 'Water Sensitive City Strategy' can also play an important part in responding to these problems by:

- Avoiding unnecessary draining of native vegetation when designing drainage works;
- Stabilising and correcting gully erosion in Maroondah's north, particularly Warranwood Reserve and Hochkins Ridge Nature Conservation Reserve;
- Working with environmental planners to extract stormwater from pipes, purify it and use it to return water to floodplains and wetlands, as discussed in Section 11.3.1 (p. 93); and
- Installing new wetlands to provide habitat and help maintain water table levels between rain events. Shallow gradients at the edges of wetlands are very important for creating diverse aquatic ecosystems and hence for functions such as oxygenation of the water (p. 54).

As discussed in Section 11.8.3, River Club-rush (*Schoenoplectus tabernaemontani*) should not be planted in wetlands.

Council has collaborated with Melbourne Water in a 2018 project involving Dandenong Creek between the Belgrave Railway Line and H.E. Parker Reserve. The pipe that carried the waters of the creek was dug out and the water now flows along a sinuous, artificial channel at the same depth as the former pipe. This process is being called 'daylighting the creek' and it is proposed to be also applied to part of Tarralla Creek in Croydon.

'Daylighting' is likely to be beneficial to some fish and stream invertebrates. The effects on vegetation are uncertain, except that some trees were removed for the Dandenong Creek project and the root systems of some retained trees (including rare Yarra Gums) were damaged to a possibly fatal extent. There is now water passing over a stream bed rather than through a pipe, so one might expect a positive impact on infiltration of water into the floodplain. However, the new water surface is roughly 2 m deeper than the creek's natural level, so the channel may actually lower the water table compared with when the pipe was well beneath the ground. Vegetation on the floodplain may suffer, particularly deeper-rooted species such as the majestic Manna Gums (*Eucalypts viminalis*). Melbourne Water staff advise that no investigation has been done into impacts on the water table or its dependent vegetation.

It is therefore recommended to monitor the health of the trees and other vegetation on the banks of Dandenong Creek beside the 'daylighting' project and for some distance downstream. If adverse impacts from a lowered water table are detected, that finding may influence whether, or how, future 'daylighting' projects are conducted.

It is probably already too late to install groundwater monitoring bores on the Dandenong Creek floodplain to monitor changes in the water table level. It is recommended to do so urgently along Tarralla Creek to obtain baseline data before commencement of the proposed 'daylighting' project there.

11.8 Planting

Council does a lot of planting in a range of situations such as street trees, around community facilities, along streams, in wetlands and in amenity parks. The plants include indigenous species, other Australian species and foreign species, from grass to large trees. The ecological impacts range from positive to negative.

11.8.1 The Trend Toward Smaller Tree Species

As residential density increases and space for trees reduces as a result, the tree cover maintained by Council becomes increasingly important. However, at the same time that residential land is losing its larger trees, Council is replacing the larger street trees that provide habitat with smaller, mainly non-Australian trees such as Crepe Myrtles and ornamental fruit trees. Council's motivation is to reduce the high cost of tree maintenance and root damage to roads and footpaths. As discussed in Section 7.1.2 (p. 54), indigenous trees generally provide better bird habitat than trees from elsewhere in Australia, and foreign species mainly favour introduced bird species.

It seems an appropriate time for Council to review the balance between maintenance costs and environmental costs of street trees. There may also be ways to reduce maintenance costs while retaining more large trees and species that benefit native birds.

11.8.2 Diversity of Tree Species

The arrival of Myrtle Rust fungal disease in Melbourne in 2011 prompted an immediate reaction from some people that tree plantings by organisations such as municipal councils should aim to reverse the long-standing dominance of the myrtle family. The myrtle family includes eucalypts, bottlebrushes, tea-trees, paperbarks, lilly pillies and many smaller genera such as *Angophora*, *Lophostemon, Kunzea, Thryptomene* and *Baeckea*. Fortunately, Myrtle Rust has not proved to be anywhere near as bad as had been feared.

Maroondah City Council may consider this issue, as other councils have done.

The standard reference for diversification of families in tree plantings is Santamour (1990). It relates to the United States of America, where the flora has not evolved a heavy concentration of tree species in one family, as the Australian flora has done with the myrtle family. The Australian and local flora have been dominated by the myrtle family over millions of years without succumbing to pests and diseases. This may be partly due to the huge diversity within the family. No-one would consider the grass family to be too dominant in lawns, so there is no inherent cause for concern about dominance of an individual family of plants.

With these observations in mind, considerations of landscape values and environmental concerns justify a continuing bias toward the myrtle family for tree planting. In particular, eucalypts are so dominant in the local environment that any significant reduction in their representation in Maroondah could cause substantial ecological disruption and decline of species of birds and insects.

11.8.3 *Correas*

As discussed in Section 5.1.6 (p. 47), the indigenous form of Common Correa (*Correa reflexa* variety *reflexa*) is being displaced by hybrids that are its own progeny, and some of those hybrids have become serious environmental weeds. It would be prudent for Maroondah City Council to not exacerbate these problems by planting Correas within (say) 200 m of nature reserves where wild Correas grow.

11.8.4 Stormwater Treatment Wetlands

Artificial wetlands are increasingly used by councils, Melbourne Water and property developers to remove stormwater pollution, provide wildlife habitat and return water to floodplains. Melbourne Water has published guidelines for how to plant the wetlands and which species to use.

Even without any planting, a newly created wetland rapidly becomes colonised by plants that arrive on the wind or waterbirds. For example, it took less than a year for a wetland constructed in 2017 at Colchester Reserve, Boronia, to become naturally colonised by the locally rare plant species, Swamp Lily (*Ottelia ovalifolia*) and Waterwort (*Elatine gratioloides*), along with various rushes and knotweeds. Wetlands are planted not because they would otherwise be bare but to favour certain species with perceived desirable characteristics for water purification over those that nature would otherwise provide.

Among the species being planted is River Club-rush (*Schoenoplectus tabernaemontani*). It occurs naturally in the Melbourne region, on the edge of the water of major streams (principally, the Yarra River). Before it began being used in planting about fifteen years ago, it was not recorded any closer to Maroondah than the Yarra River, and not in any wetland within at least 20 km of Maroondah. However, since it has been planted in artificial wetlands, it has spread (presumably by waterbirds) into at least four natural wetlands in Maroondah, and many others in the region. In some cases, as in Site 72 of Volume 2, it is aggressively displacing the natural plant and animal species, significantly reducing biodiversity in the affected wetlands.

There are alternative species that can be used for water purification without the harm of spreading into natural environments and disrupting them. River Club-rush should not be planted.

11.8.5 Planting into Forests, Wetlands and Roadsides

The fieldwork in this study detected substantial numbers of plants that had been planted into forests and wetlands in nature reserves during the past few years. They were planted variously by Council, Friends groups and CRISP nursery volunteers. While most species were ecologically appropriate, a significant minority were not. Some, like the River Club-rush discussed above, are not indigenous to Maroondah but were probably presumed to be so: *Baumea articulata*, *Correa* hybrids, *Dichelachne crinita*, *Juncus usitatus* and *Lycopus australis*.

As discussed above, the River Club-rush and the *Correa* hybrids are environmental weeds and should not be planted.

Even if a species is not ecologically hazardous, planting it outside its natural habitats upsets the naturalness of the planting sites and confuses people about where the species grows naturally. If a species does not occur naturally in a particular type of habitat, there is usually a good reason why that habitat type is unsuitable for the species. Planting of indigenous species into nature reserves should therefore stick to species that occur naturally at that site or in vegetation similar to that which is likely to develop. The 1750 EVC mapping in Figure 1 (p. 25) does not provide a reliable indication of the natural vegetation at individual sites because it contains errors and it was never claimed to be spatially precise.

Regardless of species, one needs to pay attention to the density of planting of trees. In local forests, the crowns of mature trees do not overlap because there is only enough sunlight, soil moisture and nutrients beneath a eucalypt's crown to serve one tree. This is the 'crown shyness' discussed on p. 43. The typical diameter of a mature eucalypt in Maroondah is 12 m and the pre-European spacing between eucalypts was probably similar. Yet it is common to see eucalypts being planted at 1–2 m spacing, as in Figure 10. In such cases, the vast majority of the eucalypts must ultimately die, and in the meantime, the trees grow spindly and develop poor structure. The excessive

competition for moisture in summer kills most other perennial plants among them, such as those planted with the eucalypts. The plants that do survive well with the eucalypts are ones that don't have to compete for moisture in summer, i.e. annual species – mainly *Oxalis* species and annual grasses such as *Ehrharta longiflora*.

The problem is worse when eucalypts are planted beneath mature wild eucalypts, which are under enough stress already without humans adding more competition within their root zones.

More generally, planting into natural or semi-natural vegetation should consider the competition that the planted plants will create. Nature does not leave ecological resources unused for very long, so any resources required by your planted plants will be taken away from pre-existing plants.



Figure 10. A revegetation area overplanted with eucalypts.
There is a white sheet of A4 paper to convey scale.

Planting into native vegetation should also take into account that it carries the following risks:

- Digging holes to insert a new plant often digs up existing plants. For example, Warrien Reserve's last remaining Long Purple-flag (*Patersonia occidentalis* – a locally rare species) was dug up to plant a very common species. This problem can be reduced by careful inspection and planning of planting sites by someone with a good knowledge of the flora; and
- Planting carries a risk of introducing soil-borne plant disease to the naturally occurring plants.

11.9 Support for Private Biodiversity Stewardship

Most of Maroondah was cleared before there were any planning controls over vegetation removal and biodiversity conservation. As the decades go by, the owners of properties that have not yet been cleared are incurring steadily greater regulatory obstacles to clearing and costs such as 'offsets' when vegetation is removed. Today, those of us who live on land that has already been

cleared rely on a relatively small number of others to keep their native vegetation for its environmental and community benefits, to compensate for clearing that has occurred elsewhere.

There is an argument based on fairness that if some landowners are expected to provide those benefits for the greater good, they deserve the support of the broader community.

There is also an argument that well-targeted support for private landowners to be good stewards of nature on their land can be a cheap and efficient way of achieving environmental and community benefits.

There are many programs in Victoria for this purpose, such as 'Land for Wildlife', 'Backyard Biodiversity', 'Gardens for Wildlife', grant programs and municipal rate rebate schemes. Some councils, such as Knox City Council, provide owners of significant habitat with assistance from expert council staff about how to care for nature on their land.

The 'Gardens for Wildlife' program was created by Knox City Council and the Knox Environment Society in c. 2005. It has recently become state-wide – see gardensforwildlifevictoria.com. Three councils neighbouring Maroondah already have local 'Gardens for Wildlife' programs running: Knox, Yarra Ranges and Whitehorse. These programs are free for the local community to join and they give participants expert advice, recognition, training, events and networking opportunities.

In addition to the benefits to the local environment and the wellbeing of the participants, 'Gardens for Wildlife' programs engender community spirit and a sense of working with others toward a worthy cause. These kinds of community benefits are increasing in importance because of a general decline in participation in traditional community service groups.

Such a program would fit well in Maroondah. Local community groups would probably be prepared to join with Council to get a local program running.

Knox City Council makes membership of its 'Gardens for Wildlife' program a precondition for residents to apply for 'Biodiversity Buddies' grants. Each year, grants of up to $1,000 (matched by grantees) provide an incentive to undertake the most cost-effective and beneficial management actions in, and adjacent to, sites of biological significance.

Manningham City Council offers similar grants of up to $1,000/year under its Biodiversity Incentive Grants Program. There is no linkage to a program like 'Gardens for Wildlife' but the council provides similar expert advice about how to manage land for the benefit of indigenous flora and fauna.

Along similar lines, Maroondah City Council ran a 'Biodiversity Rate Concession Program' from 2002 to 2012 to provide an incentive for owners of land with significant habitat to care for it.

The various programs outlined above not only provide environmental and social benefits but they can also improve compliance with planning permit conditions that compensate for vegetation removal. That is because the holders of such permits may be required to create or maintain vegetation but they often don't have the understanding or interest in how to really achieve the environmental improvement being sought. A program like 'Gardens for Wildlife' can provide permit holders with encouragement and understanding to fulfil their permit conditions and look after their habitat in the long term. Having done so, a program like a dollar-for-dollar grant program may encourage activities beyond what is required by the permit conditions.

If Council is prepared to consider programs such as 'Gardens for Wildlife', grants and rate concessions, this report can help by providing an up-to-date indication of the importance of biodiversity in Maroondah and which areas of Maroondah to focus on.

11.10 Support for Community Involvement with Nature

Maroondah's many bushland reserves and stream reserves offer wonderful opportunities for people to enjoy nature and its benefit to health, wellbeing, childhood development and quality of life. However, there appears to be a low awareness of most of the reserves and what they contain. In addition, most people who visit a reserve don't have much understanding of what is going on around them. For example, people who approached the author during his fieldwork at Ringwood Lake Park were surprised and fascinated to learn that there were kangaroos and Sugar Gliders living in the park, eels in the water that migrate to and from the Coral Sea, and orchid flowers that imitate the sex-scent of a female insect to lure males for pollination.

A poor level of appreciation of nature can lead to treating it with contempt; e.g. encouraging pet dogs to chase breeding waterbirds or using bushland as a dumping ground for garden rubbish or dog faeces. Better appreciation would not only help nature directly but also garner support for Council's efforts to look after nature and nature reserves. It may even recruit more volunteers to 'Friends' groups, which help Council look after its reserves. That sort of community involvement helps build community spirit, which is under threat from the rise of 'dormitory suburbs' and the general decline in participation in community service groups.

There are therefore many reasons to encourage greater appreciation of nature. The following paragraphs highlight some ideas for doing so.

11.10.1 'Get to Know Your Park' Tours

Some years ago, Maroondah City Council invited people living near certain bushland parks to take a guided tour with one of Council's bushland management staff. It may be worth exploring whether a modification of that concept could provide benefits worthy of the cost.

One variation that could be considered is to run tours at the popular recreational destination of Ringwood Lake Park. The aim would be to attract people not just through advertising in advance but also from among park visitors on the day, many of whom would not be attracted by advertising. The tours would need to be led by someone who is good at communicating about nature. The effectiveness of the tours could be gauged in the same way as Council does for other events but the benefits would be hard to quantify in dollar terms.

If tours at Ringwood Lake Park are deemed a success, tours could be conducted at other reserves. Among the reserves best suited for tours are B.J. Hubbard Reserve, Warranwood Reserve, Warrien Reserve, Eastfield Park, Bungalook Conservation Reserves, H.E. Parker Reserve, Proclamation Park and Mullum Mullum Reserve. The volunteer groups who help Council look after some of those reserves should be invited to contribute, if a tour is conducted in their reserve.

A possible extension of this concept would be to offer guided tours to nearby school communities.

11.10.2 Events for Volunteer Groups

A substantial amount of voluntary work is done in Council's nature reserves by 'Friends' groups and the CRISP indigenous nursery. The groups have an umbrella organisation called Maroondah Bushlinks.

Council supports these groups by providing insurance and advice, running an annual civic reception for volunteers, and offering small grants for administrative expenses. Some years ago, Council also funded two training sessions on plant identification.

A small expenditure by Council on further training of volunteers, particularly about weed control and revegetation, could provide a substantial increase in the effectiveness of the work by volunteers and the fulfillment they get from their work.

There is very little interaction between the volunteer groups other than among some of the group leaders. This means the groups do not learn from each other and their members have little appreciation of how their efforts and their reserve fit into the bigger picture. Bringing the groups together more could improve their effectiveness, build community spirit and increase the volunteers' enjoyment and keenness.

To that end, Council could organise a program in which each group, in turn, runs a tour to showcase their reserve (or nursery) and their activities for the other groups to see. This could be done about three times each year. It would be desirable for a Council officer to attend to discuss any ideas, concerns or matters of interest.

11.10.3 Citizen Biological Surveys

The budget for this study did not extend to surveying the flora and fauna of all reserves and roadsides with native vegetation. It would be desirable to conduct more surveys, not just to fill in the current gaps but to update the data and monitor changes over the years. More information could guide allocation of management resources and avoid actions that inadvertently harm important natural assets.

A program to encourage and enable members of the community to collect data would not only increase the amount of information available but also increase community skills and strengthen the connections between Council, the community and the natural environment. The sum of all these benefits and the benefits that come from connecting people with nature would hopefully outweigh the cost of running the program.

The program would need to include:

- Training of volunteers to collect reliable information according to a consistent protocol in a manner that is safe for themselves and the environment;
- A facility for following up species that the volunteers cannot confidently identify themselves;
- A geo-database to keep the collected data;
- Periodic analysis and reporting of the data to determine what actions may be appropriate for Council or others;
- Periodic get-togethers of the volunteers; and
- Coordination by Council staff for all the above purposes and to communicate important discoveries or issues to relevant other members of staff.

Volunteers should ideally work in pairs or larger groups, for safety and to increase the reliability of data.

11.10.4 Art

Art is outside the scope of this report but it would be remiss not to note the role of art in drawing community attention and conscience to environmental issues. A good example is the chainsaw-carving of two giant Yellow-tailed Black-Cockatoos out of a dead tree outside 82 Long View Rd, Croydon South. The statue was commissioned by Maroondah City Council in 2018. Apart from its attractiveness, it serves the purpose of a totem, drawing the attention of passers-by to nature.

Wetlands and waterways seem to offer good opportunities for similar artworks to draw attention to fish, Platypus, Rakali, Sacred Kingfishers, frogs, rubbish and pollution. Ringwood Lake Park would give such works good exposure.

11.11 Social Licence

This report aims to provide technical information to support sound decisions by Maroondah City Council and others. However, all the technical justification in the world cannot, on its own, ensure community support for decisions made by an organisation such as a municipal council. Community support relies greatly on how much trust the organisation enjoys and how well the organisation's actions are explained.

Therefore, it is recommended that Maroondah City Council concentrate on explaining to the community how it will use the information in this report and give opportunities for the community to be involved. In practice, few people actually take up invitations to be involved in such things except when they feel threatened by changes that haven't been adequately explained and justified. As Maroondah City Council will be aware from the experiences of some other councils, good governance and community harmony benefit when a council is open and engenders trust in its decision-making.

The suggestions in Sections 11.9 and 11.10 would also engender trust in Council and an appreciation that Council's biodiversity activities are worthwhile.

11.12 Monitoring

Monitoring of changes in flora and fauna can help Maroondah City Council adjust its activities as required to optimise outcomes and avoid allowing problems to develop unnecessarily. An example of the use of monitoring is the tracking of vegetation removal under planning permits to see whether strategic planning objectives are being met. Another would be monitoring of biodiversity in nature reserves to see whether Council's resources allocated to management of the reserves needs adjustment.

The following subsections explain Council's options for monitoring and, in Section 11.12.7 (p. 110), how to decide which options to take.

11.12.1 State-wide Monitoring of Planning Controls

The state government's 2017 document, *'Planning for Biodiversity – Guidelines'* recommends a step-by-step approach to strategic planning for biodiversity that includes the following:

> *Step 8: Establish a monitoring system, performance targets and indicators*
>
> Establish a monitoring system and indicators for measuring the effectiveness of the planning scheme tools in achieving biodiversity objectives.

This is more difficult than it may appear. The state government's main planning scheme tool to regulate vegetation removal for biodiversity outcomes is clause 52.17. In 2002, the government set the following 'net gain' target for clause 52.17: 'A reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain'. The only associated monitoring report that could be found during the present study was one titled *'Native Vegetation Net Gain Accounting First Approximation Report'* (DSE 2008). It documented many difficulties that were encountered in the monitoring as well as measures that were expected to improve future monitoring. Its conclusion was that there was a substantial ongoing rate of loss of

native vegetation. The rate of net loss was greatest on private land, estimated to be 9,900 'habitat hectares' per year (+/- 20%). (A 'habitat hectare' is always larger than a normal hectare, to a degree that increases inversely with the average condition of the vegetation.)

The state government in 2013 abandoned the 'net gain' target. The present target for clause 52.17 is 'To ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation'. Note that the current target excludes vegetation losses from causes such as drought, weed invasion and urban pressures, unlike the former 'net gain' target.

Despite 'Step 8' above, the state government has produced no reporting of the rate of loss of native vegetation under clause 52.17 in the past ten years. This situation is salutary for a municipal council considering its own monitoring.

With this background, the state government's 2016 report titled *'Outcomes Report – Review of the Native Vegetation Clearing Regulations'* included the following:

> Proposed improvement 4: Improve monitoring to determine if the regulations are achieving their objective and make this information publicly available.
>
> Implement by developing a monitoring and reporting plan in partnership with local government, and in consultation with other relevant stakeholders. This plan will include roles and responsibilities and efficient approaches to gather and report on native vegetation clearing and offsetting. Initially the plan will improve monitoring and reporting on:
>
> - permitted native vegetation clearing and offsets that are occurring (including linking clearing and offsets);
> - levels of known non-compliance with the regulations, including with management of offset agreements;
> - gains in native vegetation that is *[sic.]* occurring at offset sites.

If this proposal comes to fruition, the monitoring in Maroondah can include not just clause 52.17 but also local controls such as overlays. That would put Maroondah City Council's monitoring on an equal footing with the state government.

The second dot point above may be of very limited use because changes in known non-compliance could be dominated by changes in the thoroughness of detection.

The stated purpose of the monitoring proposed above is 'to determine if the regulations are achieving their objective', the objective being 'no net loss'. The proposed monitoring cannot support that purpose because it does not include vegetation removal under exemptions or through undocumented illegal clearing. Lack of information about the extent of clearing under exemptions is discussed in the same document as the monitoring proposal.

There is a lesson here: When considering a proposal for monitoring of any kind, it is important to ask, What is the intended ultimate use for the monitoring outputs and can the proposal support that use? It is also important to consider whether the statistical reliability of the monitoring outputs will be adequate for the intended use.

Another deficiency in the state government's monitoring proposal is that it only deals with identified native vegetation, not the matrix of habitat distributed through suburbia (Chapter 9) or the problem of fragmentation of habitat.

11.12.2 Random Plot Monitoring

A possible solution to at least some of the problems identified above comes from an innovative but presently untried and unpublished technique devised by the present author. It is based on the

'iTree Eco' method of the United States Forest Service (www.itreetools.org). It involves recording basic habitat-related information at 200 or more randomly distributed plots across Maroondah. Within the information gathered at each plot is a metric for habitat connectivity, which is missing from the state government's monitoring plans. The plot centres would be located at a subset of the sample points used by Kaspar (2018) to monitor tree canopy cover with iTree, thereby allowing synergies to be achieved between the two types of monitoring.

The data obtained would facilitate not only monitoring but also analysis of the distribution of habitat and changes in habitat values among different parts of Maroondah or different land categories, e.g. according to land zoning or EVC.

As with all iTree monitoring, the tactic of gathering basic data at many random locations is a way of harnessing the power of statistical analysis. Firstly, it overcomes the statistical bias that results from relying on planning permit applications and compliance records. Secondly, it provides statistical measures of uncertainty in the observed changes. Thirdly, it allows exploration of the causes of change by analysing how well the changes correlate with land categories, climate and other parameters. Correlations cannot prove causality but careful analysis – controlled for confounding influences – can be quite powerful; e.g. epidemiology is founded on correlations between observed illness and plausible causes such as smoking.

11.12.3 EAGA Monitoring

A quite different and potentially complementary approach to monitoring has been devised for the Eastern Alliance for Greenhouse Action (EAGA), of which Maroondah City Council is a member. The approach is described by Threlfall *et al.* (2015). It involves measuring any or all of the following 'indicators':

1) The extent of native vegetation in actively managed areas on Council land;
2) Detailed data about every plant species within each of a set of sample plots called 'quadrats';
3) Data about bird species and abundances observed by an expert during a 20-minute period within each of a set of two-hectare areas; and
4) Phenology - the timing each year when seasonal events occur, such as swooping by magpies.

Indicators 1 and 2 relate solely to native vegetation in Council bushland reserves. Threlfall *et al.* (2015) recommend monitoring them very five years. Indicators 3 and 4 could be done anywhere in Maroondah, at recommended intervals of 2–3 years.

Indicator 1 – Extent of Native Vegetation

Measuring the extent of native vegetation in well-defined patches can be done easily from aerial photography in a Geographic Information System. However, there are examples of vegetation which some observers would regard as native vegetation and others would not; e.g. patchy areas of native grass beneath scattered trees. Differences arise even between native vegetation assessors accredited by the Department of Environment, Land, Water and Planning.

Such differences present a particular problem around the edges of many bushland reserves, where the transition between introduced vegetation and native vegetation is very gradual and patchy. Different but equally defensible decisions can be made about where to put the boundary even when a single observer inspects a site on different days within the same season. Much larger variability can result when different people do the observing, or in different seasons (e.g. whether or not wildflowers are flowering among the grass) or in a dry year compared with a wet year.

Uncertainties in boundary locations can cause false indications of change in vegetation extent between monitoring cycles.

An equivalent problem occurs in monitoring the expansion of a patch of native vegetation, which normally occurs gradually in a patchy transitional zone around the edge: At what point in the transition process does vegetation change from being non-native to native, and how do you measure its extent when it is very patchy? The same problem arises when a patch of native vegetation deteriorates in condition and contracts around the edges.

The criteria recommended here for treating a point as being part of the extent of native vegetation are that the point must either:

- Have at least 25% of the total perennial understorey plant cover being indigenous species, as determined by inspecting a 4 m radius around the point; or
- Be within an area beneath three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy.

These criteria are adapted from the definition of a 'patch of native vegetation' under clause 52.17 of the planning scheme. They do not solve all the problems above; e.g. the indigenous percentage of understorey cover can change substantially during slashing or brushcutting for fire hazard reduction. Doing all assessments in (say) October will reduce some of the problems.

An important reason to monitor the extent of native vegetation is because Maroondah City Council resolved at the Council meeting on 24th April 2017 to adopt the target, 'No net loss of the area and quality of existing native vegetation on 171 hectares of land managed by the City of Maroondah to 2040'.

Indicator 2 – Quadrats

The quadrats (plots of vegetation) in the EAGA monitoring require a very proficient field botanist and an assistant to spend typically two hours in each quadrat, followed by data entry, quality control and database curation. Excellent botanical skills and avoidance of rushing are required to ensure all species are detected, identified and properly documented. Otherwise the data will vary spuriously between one observer and the next. For the same reason, each survey of a quadrat must be done at the same part of each year's seasonal cycle. When a quadrat is re-surveyed, its location must match the previous survey(s) within a few metres or else the changes observed may reflect the changed location rather than genuine changes in vegetation.

Threlfall *et al.* (2015) recommend two quadrats within each reserve but more may be required in larger reserves. The cost of botanical consultants to do the fieldwork, alone, is therefore substantial. Analysis and reporting of changes between the first and second survey years will take 2–3 times as long as one year's fieldwork and subsequent cycles will take progressively longer, in the present author's experience.

Unfortunately, Threlfall *et al.* (2015) do not provide a method for analysing or reporting changes, so devising such a method will involve additional cost and effort. In addition, there is no suggestion about how, or whether, any observed changes can be attributed to particular causes such as management efforts, drought, climate change or natural fluctuations. The addition of 'control' quadrats could help isolate changes associated with certain factors; e.g. one set of quadrats may be given a particular level of management effort and another set of quadrats could be given a different level of effort. However, the high cost of quadrat work is likely to impede this approach. For these reasons, the balance between the cost and benefit of quadrats is unclear.

Indicator 3 – Monitoring of bird data

The EAGA monitoring of bird data uses the standard 'twenty-minute bird census' method of Loyn (1986), which has many similarities with the quadrat method for plants. It is equally affected by the need for an expert observer at a consistent time of year. Important differences from plant quadrats are that: (a) each twenty-minute bird census is much quicker than a quadrat; (b) birds (being mobile) can vary greatly from one twenty-minute period to another; and (c) bird censuses can be conducted anywhere, not just bushland. Point (b) means that more bird surveys are required than quadrats to gain a statistically robust data set, somewhat counterbalancing the shorter duration of the bird censuses.

As in the case of quadrats, Threlfall *et al.* (2015) do not provide a method for analysing or reporting changes in bird data, or suggestions about how, or whether, any observed changes can be attributed to particular causes. This is particularly important for bird data as there have been numerous large, unexplained shifts in bird fauna over the past two decades; e.g. the spread into capital cities of Crested Pigeon and many parrot species (Australian King-Parrot, Rainbow Lorikeet, Little Corella, …) and the decline of species such as Bell Miner and House Sparrow. As there is no indication that the causes of such changes could be inferred from the bird monitoring data, it is unclear what practical purpose will be served.

Indicator 4 – Phenology

EAGA plans to use the 'ClimateWatch' program (www.climatewatch.org.au) to monitor phenology. This involves people (including the general community) recording the date of specific events such as the first flowers of Golden Wattle or the swooping season of magpies. It is expected that once enough years of data have been gathered from enough people and sites, it will be possible to separate climate-related trends from natural fluctuations that occur between one year and another. The program has been operating Australia-wide since 2009 but no analysis of the data has been conducted to assess whether any trends can be detected yet. Neither ClimateWatch nor Threlfall *et al.* (2015) explain how trends can be separated from natural fluctuations or at what statistical confidence level. That omission may not matter if obvious trends occur over periods significantly greater than natural cycles (e.g. the drought cycle and the natural solar cycle of approximately eleven years).

Summary

The four EAGA monitoring indicators were selected on sound scientific grounds as methods to detect change. However, the selection did not consider:

- Cost;
- Certain practical problems;
- How to disentangle trends in quadrat and bird data from natural or random fluctuations; or
- How to attribute any observed trends to particular causes (although that is fairly straightforward in the case of phenology).

11.12.4 Modified Habitat-Hectare Monitoring

As explained by Threlfall *et al*. (2015) and Lorimer (2008), the standard 'Habitat Hectares' method of assessing the habitat value of native vegetation is inappropriate for monitoring change. However, Knox City Council and Manningham City Council are using a modification of the Habitat Hectares method that overcomes the shortcomings of the original method for monitoring.

The modifications were devised by the present author and are described in an unpublished document available from Manningham City Council. The method involves much less time, effort and expertise than quadrats but it provides less detailed data. In other respects, the two methods are similar.

11.12.5 Monitoring of Eucalypt Decline

The death or decline of many eucalypts in Maroondah is discussed in Sections 5.1.5 (p. 43) and 11.6 (p. 96). Photographs vertically upward into the tree canopy of bushland reserves would be a simple and effective way of monitoring changes in eucalypt condition. To apportion the causes of any decline that is observed, it will be important to monitor a range of sites where the prevalence of different candidate causes is known to differ. For example, the impact of possums could be determined by monitoring some trees protected from possums by trunk bands and some trees that are unprotected.

In addition to photographs, notes should be recorded about ancillary indications of causes, such as the density of possum faeces beneath the trees, detection of insect infestations, and the condition of any nearby grass-trees or Common Heath.

The current investigation of eucalypt decline in Maroondah by the University of Melbourne will hopefully recommend a monitoring program.

11.12.6 Pest Animal Monitoring

Section 7.2 (p. 57) explains the important ecological harm that can be done by certain mammal species – both native and introduced. Rabbits are well established in Warranwood, Croydon Hills and Croydon North and are spreading westward into Kilsyth South. Deer are rapidly expanding into northern Maroondah and beginning to cause environmental problems and a traffic hazard. Foxes are abundant throughout Maroondah and their population appears to be stable. The problem of the unnaturally high populations of Common Brushtail Possums and Common Ringtail Possums are threatening eucalypts and perhaps birds, with broader ecological implications. Kangaroos are spreading into Maroondah from large, increasing populations in Warrandyte and Wonga Park but they are still in small numbers in Maroondah.

The value of monitoring these ‘pest animals’ depends on how predictable their future populations will be. For example, there is little point in monitoring foxes beyond the state government’s program because there is no current reason to expect change. The value of monitoring pest animals also depends on how harmful they are and how easily their impacts can be reduced.

Warranwood Reserve is already involved in a program led by Manningham City Council to monitor the abundance and vegetation impacts of deer. The monitoring uses exclosure fences, control plots and wildlife cameras. Volunteers from the Warranwood Reserve Committee of Management are assisting a researcher in the monitoring program. The findings over the next year or two will guide decisions about whether further monitoring is warranted. If damage by deer is found to be serious, the options for reducing it are limited within Maroondah. However, such a finding would increase the impetus for deer control at a larger scale, particularly in areas to the north where the deer are presumably breeding.

Monitoring of kangaroo numbers does not appear to be worthwhile from an ecological perspective at the moment because none of the vegetation inspected in this study shows signs of overgrazing. If such signs appear in vegetation monitoring, kangaroo monitoring could commence on a similar basis to the current monitoring of deer numbers and impacts.

Monitoring of eucalypt decline due to possums and other causes is discussed in Section 11.12.5. Monitoring possum numbers in suburbia is difficult and not justified unless there are plans to reduce the population.

11.12.7 Choosing the Right Monitoring

As noted in Section 11.12.1 (p. 104), Maroondah City Council can maintain an equal footing with the state government's monitoring of native vegetation planning controls by simply extending the planned monitoring of clause 52.17 to include local controls such as overlays. However, that will not deal with vegetation removal that is exempt from planning controls or is illegal and goes undetected. There must also be some uncertainty about how soon the state-wide monitoring system will be fully in place, given that it hasn't happened in the ten years since the need was identified in the 'First Approximation' report discussed in Section 11.12.1.

The iTree monitoring system established by Kaspar (2018), using randomly distributed sample points to measure change in tree cover, will be a useful additional measure. The related (but untested) random plot method described in Section 11.12.2 (p. 105) offers the potential to provide complementary information about habitat values across the municipality. Both these methods allow extraction of statistics for any chosen category of land. For example, vegetation changes inside an overlay area can be compared with changes outside.

An important feature of these methods is that they enable us to statistically separate different contributors to observed changes; e.g. how much of an observed change can be explained by the presence of an overlay as opposed to factors such as tree density or age of housing stock. Another advantage of these methods is that measures of statistical uncertainty can be calculated, alerting us to the level of confidence that we can place in observed changes. To gain these advantages, at least 150 monitoring locations are required, thereby limiting the amount of time and effort that can be spent on gathering data at each one.

Automated detection of trees and structures from remote sensing (lidar and aerial images) is becoming more reliable and holds promise for automating some of the tasks in the random point and random plot monitoring.

The utility of the EAGA monitoring methods (Section 11.12.3) and the modified Habitat Hectares method (Section 11.12.4) for strategic planning is unclear and dependent upon an assessment of exactly what Maroondah City Council hopes to get from the monitoring. It is important to assess any candidate monitoring method against its ability to support a clearly defined ultimate use. Monitoring without a plan for how it will lead to action would risk being of only academic interest, or even useless. It is also important to consider whether the statistical reliability of the monitoring outputs will be adequate for the intended use.

The uses of monitoring by Maroondah City Council will normally relate to things that Council can influence or control, or might need to do so in future. Once such a use is defined, a common obstacle for most indicators and monitoring methods is that they measure changes that are influenced not just by Council but also by extraneous agents, without an ability to apportion contributions.

As an example, Maroondah City Council might choose 'Number of Platypus sightings' as an indicator to be monitored, but that indicator is influenced to an unknown degree by factors outside the council's control, such as drought, Melbourne Water's stream management actions and the effectiveness of the EPA and industry in avoiding water pollution. It would be hard to relate observed changes to something that Council does or should do.

The methods based on randomly distributed plots or points use correlations of their many data points to isolate the influence of a particular change agent from confounding influences. That is

not feasible for quadrats, bird censuses or the modified Habitat Hectares method because they are too labour-intensive for monitoring at a statistically adequate number of locations. For those methods, there is the alternative of designing 'controlled experiments'.

Controlled experiments are perhaps best explained by example. To test the relationship between bushland management funding and changes in habitat condition, a set of quadrats might be set up, all treated the same except for variation in the funding allocated to their management. It might be found that the quadrats with higher funding do consistently better than those with less funding, even though drought or other factors may also affect outcomes. Applicability of this method is limited by the requirement to identify a single 'independent variable' (funding amount, in the example) at the outset and manipulate it differently between monitoring sites that are otherwise the same. There is also a problem that people who manage the vegetation at the monitoring sites may consciously or subconsciously bias their activities toward what they hope the experiment will demonstrate.

Another way to deal with extraneous influences in monitoring data is to monitor actions rather than outcomes. To give an example, the number of person-hours spent on bushland management is a measure of council action whereas the associated outcome may be the amount of improvement in habitat condition. Monitoring council actions is straightforward, very familiar to councils, subject to very little uncertainty and leaves no doubt about how much of it is influenced by the council. However, council actions can be poor indicators of the effectiveness in achieving outcomes.

As an example, Maroondah City Council could easily and accurately monitor 'The area of vegetation that Council manages for nature conservation'. That indicator is a measure of action. However, what matters is whether the action provides acceptable environmental outcomes, which are much more difficult to monitor and confidently attribute to Council.

If monitoring demonstrates a strong correlation between actions of a particular kind (e.g. person-hours spent on bushland management) and corresponding outcomes (e.g. improvement in habitat condition), it may become adequate to monitor just the actions, confident in the expectation that the outcomes will follow.

For some monitoring purposes, it is not as important to isolate how much of observed change is due to Council's actions. For example, Council may wish to detect when habitat condition in bushland reserves is declining, so that funding can be boosted to reverse the decline. Even if the decline may be due to an extraneous factor such as drought, Council may still wish to respond and not be too concerned about apportionment of cause.

'State of the Environment' reporting is another situation where Council may not be particularly concerned about isolating its own relationship to observed changes. That is because the purpose of 'State of the Environment' monitoring is to inform the community about what changes have occurred and which ones deserve attention.

In summary:

- It would be sensible for Maroondah City Council to extend the proposed state-wide monitoring of native vegetation removal to include removal under local planning controls (Section 11.12.1);
- Council has already commenced iTree monitoring of tree cover, which is expected to provide useful information for strategic planning;
- The extension of that monitoring as suggested in Section 11.12.2 offers promise to provide similar information that relates more directly to biodiversity. A trial of the method is recommended;

- It is necessary to monitor the extent of native vegetation in regard to the target set at the Council meeting on 24th April 2017 – 'No net loss of the area and quality of existing native vegetation on 171 hectares of land managed by the City of Maroondah to 2040'. The method discussed in Section 11.12.3 would be appropriate;
- It is also necessary to conduct monitoring of vegetation condition in regard to the same target as well as a second target adopted in the same Council meeting – 'Improved native vegetation quality on an additional 6.7 hectares of land managed by the City of Maroondah by 2025 and a further 13.1 hectares by 2040'. Monitoring of small plots (e.g. the quadrats in the EAGA monitoring) may not be representative of the whole area. The modified 'Habitat Hectares' method described in Section 11.12.4 would be an appropriate method;
- Monitoring of eucalypt decline and its causes will hopefully be guided by the outcome of the current investigation of those things by the University of Melbourne;
- It is recommended to monitor the condition of vegetation beside the Dandenong Creek 'daylighting' project to see if it suffers from a possible lowering of the water table;
- It is also recommended to install groundwater bores to monitor water table levels beside the 'daylighting' project of Dandenong Creek and (urgently) at the proposed project on Tarralla Creek;
- The current monitoring of deer in Warranwood Reserve and nearby parts of Manningham will provide a basis for determining what subsequent monitoring will be worthwhile in Maroondah generally; and
- The advisability of other monitoring will rely on clarity about how it will translate to action, as well as care to ensure the chosen method is statistically robust and provides the required level of attribution of observed changes to things within Council's control.

12 Issues for Bodies other than Council

12.1 Schools

Eleven schools in Maroondah have sites of biological significance within their grounds. In alphabetical order, those schools are as follows (preceded by the relevant site numbers):

114. Aquinas College (a tiny sliver)
55. Croydon Primary School
63. Croydon Special Development School
44. The former Croydon High School
81. Heathmont College
8. Melbourne Rudolf Steiner School
1. Ringwood Heights Primary School
34. Tintern Grammar
57. The Village School
54. Yarra Road Primary School
22. Yarra Valley Grammar

Some other schools have sites of biological significance adjacent or in close proximity.

Some of the sites are in school sanctuaries, which specifically recognise the presence of indigenous flora and fauna. However, even in those cases, the school management and community probably have little appreciation of the significance of the habitat or how to exploit it in the curriculum. That lack of appreciation is likely to be greater in those schools whose sites of biological significance are outside the schoolgrounds or not physically demarcated within the schoolgrounds. It is hoped that the information in Volume 2 will help raise the school communities' appreciation of the sites and their value for childhood development.

To make the best use of the educational resource provided by the habitat within the sites requires: (a) teachers or 'incursion' experts who have a good understanding of indigenous flora, fauna and ecology; and (b) space in the curriculum to include educational experiences in the habitat. Both of these appear to be significant constraints, although the Melbourne Rudolf Steiner School may be an exception. In practice, the opportunities for environmental education appear to be rarely taken.

A related constraint is that the educational experience offered by the sites depends on their ecological condition. The ecological condition of most of the sites within schoolgrounds has deteriorated since the 1997 *Sites of Biological Significance in Maroondah* study. This is not only a constraint on educational opportunities but also an ecological and ethical problem.

'Environmental weeds' are the main cause of ecological deterioration in these sites.

The capacity of school communities to maintain habitat within schoolgrounds has steadily diminished over recent decades. Attendance at school working bees has diminished as people's lives have become busier and the spirit of volunteering for community benefit has waned. Typically, school working bees have no volunteers with expertise in managing native vegetation and the wildlife habitat it forms. There are always other things to spend school funding on than maintenance of habitat.

The former Croydon High School is a special case, now that Melba College no longer uses the site. Maroondah City Council has recently taken over management of the former school's bushland area. There are also uncommon indigenous plants elsewhere on the property.

12.2 Melbourne Water

Melbourne Water owns most of the public land along streams and on floodplains. This land is the habitat of the most threatened cohort of plant species in Maroondah, i.e. specialists of soils that are sodden in winter and dry in summer – see p. 37. Therefore, Melbourne Water's actions play a

critical role in conserving or threatening many of the plant species at the highest risk of dying out in Maroondah. The Swamp Skink, which is listed as vulnerable in Victoria, is confined in Maroondah to Melbourne Water land at Bungalook Conservation Reserves. A number of rare waterbirds also frequent Melbourne Water land and its wetlands.

Some (but not all) of the sites of biological significance on Melbourne Water's land are documented within that organisation.

Despite the high importance of some of Melbourne Water's properties in Maroondah for biodiversity, the significant features are often given little weight compared with engineering objectives or the objective of providing neatly mown expanses.

An example is provided by an area of the retarding basin at Bungalook Conservation Reserves. The site contains several very rare plants, including the world's only known population of a species within the Porphyry Wallaby-grass group (p. 42). The various rare species are all critically reliant on soil that is sodden in winter. The area was mapped in Melbourne Water's 2016 management plan for the site. However, the following year, Melbourne Water excavated a drainage trench through the area to drain it. The year after (2018), at least half the surviving Porphyry Wallaby-grass plants were sprayed with herbicide (along with other rare species) and the survivors were mown just before their annual seed production was ripe. Great ecological harm has been done to a recognised site of National significance.

Another problem at the same retarding basin and one other retarding basin is mowing when the ground is boggy. Doing so results in mud being churned up and rare plants being replaced by wheel ruts and bare ground. Weeds tend to colonise the disturbed ground.

The incompatibility between threatened species conservation and the use of herbicide and mowing to create neat lawns mirrors the situation in Maroondah City Council discussed in Section 11.5 (p. 95).

Sedimentation of retarding basin lakes is a thorny problem for Melbourne Water. As discussed in Section 7.1.1 (p. 53), sediment has accumulated to such a degree at Bungalook Conservation Reserves that little open water remains and biodiversity is suffering. Sediment can contain toxic contaminants such as heavy metals, so it must be dumped at landfill sites licensed to take toxic waste. The cost is almost prohibitive. A solution will hopefully be found before this widespread problem becomes much worse.

Melbourne Water's recent 'daylighting' of Dandenong Creek, and the prospective daylighting of Tarralla Creek, offer promise of improvement of two of Maroondah's streams. Information about the potential for groundwater drawdown, and hence harm to groundwater dependent ecosystems and trees, was sought from Melbourne Water for this study but none could be found. In the absence of such information, it is desirable to monitor the water table depth and the health of vegetation beside the affected streams. Baseline monitoring of Tarralla Creek is recommended immediately, if it has not already begun. See also Sections 11.7 and 11.12.7.

12.3 Railway Corridors

Railway reserves are managed with little regard for protection of rare plants, except for two fenced areas in Heathmont: one north of Heathmont Station and the other opposite The Greenway. Those areas are managed by Maroondah City Council and the Heathmont Bushcare voluntary group, respectively.

It was beyond the scope of this study to survey railway reserves other than where public access is provided. Nevertheless, it was still possible to find two quite rare plant species.

The first is a small patch (perhaps one plant) of the nationally-listed Matted Flax-lily (*Dianella amoena*) near Churchill Rd in Croydon. It is regularly slashed and vulnerable to herbicide use and a proposal for 'skyrail' to replace the existing railway tracks. It would be desirable to propagate from the patch of Matted Flax-lily and to breed with Maroondah's other four known plants of the species, to avoid inbreeding.

The other rare species found on a railway reserve in Maroondah is a patch of the spear-grass, *Austrostipa rudis* subspecies *australis*, which is listed as rare in Victoria. Hundreds of plants grew immediately east of the Eastfield Rd bridge, on the southern side of the tracks. They had probably existed there for millennia until several years ago, when regular spraying with herbicide began. There are few if any plants of the species left there.

It would be desirable for a targeted survey of rare plants to be conducted in the vicinity of the Matted Flax-lily and the rare spear-grass, to see whether current management practices should be modified in favour of presently undetected rare plants.

12.4 Department of Environment, Land, Water and Planning

12.4.1 Fauna Surveys

As discussed in Section 7.2.1 (p. 57) and Section 7.4 (p. 60), Maroondah's microbats and reptiles are poorly known and there appears to have been very little effort to detect them for decades, at least. A targeted survey for each group of fauna would significantly improve the situation and hopefully lead to measures to ameliorate the apparent decline in species.

12.4.2 Biodiversity Information

Section 2.2 (p. 16) describes the substantial errors that this study found in the flora and fauna data provided by the Department. The Victoria Planning Provisions require local government to have regard to that data when amending and implementing planning schemes. The errors in the data mislead councils and others and lead to bad planning. Unless funding is allocated to correct the errors in the data, the requirement for local government to make use of the data should be tempered with a frank disclosure of the errors and limitations.

The same applies to the mapping of Ecological Vegetation Classes (EVCs), whose substantial errors in Maroondah are described in Chapter 4 (p. 24). Similar errors have been found in other municipalities; e.g. Manningham (Foreman 2004).

The flora data, fauna data and EVC mapping play pivotal roles in assessment of planning permit applications for removing native vegetation. They do this through the 'Native Vegetation Information Management' (NVIM) system. Errors in the data and mapping can substantially affect whether an application is granted, how much cost is involved for the applicant and council, and the cost of 'offsets'. The present regulations are so prescriptive that the capacity of an applicant or council to override faulty information in NVIM is very limited.

Appendix A - Indigenous Plant Species Inventory

This Appendix provides summary lists of the apparently reliable records of indigenous species of mosses, liverworts, ferns and flowering plants in Maroondah. A list of species for which only weak evidence has been found is at the end of this appendix. Some species are annotated to indicate that, rather than being indigenous, they may actually have arrived in Maroondah since colonisation as a result of human agency, as discussed in Section 3.1 (p. 23).

The columns of the lists contain the following information:

Column heading	Description
Code no.	Identifier given to each species by the Department of Environment, Land, Water and Planning.
Names	The scientific names are those adopted by the National Herbarium of Victoria, ordered alphabetically within each major group of plants. Hybrids are only included where they have been formally named. Names in red are here presumed to have died out in Maroondah. **Names in bold** indicate species that can confidently be regarded as 'critically endangered' within Maroondah – see Section 5.1 (p. 34).
Legal status	Legal protective measures, indicated by combinations of these letters: C, E or V: Listed under the federal *Environmental Protection and Biodiversity Conservation Act 1999* as Critically endangered, Endangered or Vulnerable, respectively; L: Listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*; e, v, r or k: Listed in the *'Advisory List of Rare or Threatened Plants in Victoria – 2014'* as endangered, vulnerable, rare or poorly known, respectively.
Source	For species not seen in the wild by the present author, the source of the record is indicated with abbreviations as follows: AVH: Australasia's Virtual Herbarium; DGC: David Cameron's list for Melbourne Rudolf Steiner School in c. 1981; GWC: Several lists by Geoff Carr.
Missing since	The year of the most recent record of species that the author could not find growing wild during the current study.
No. SoBS	The number of 'sites of biological significance' (SoBS) in Volume 2 where each species has been recorded in the past 40 years, excluding plantings.
No. reserves	As above, except restricting the SoBS to those managed for conservation.
No. plantings	The number of SoBS where this study observed the species to have been planted.

Wild, Indigenous Flowering Plants

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
504778	***Acacia acinacea***	**Gold-dust Wattle**				2	1	2
500008	*Acacia aculeatissima*	Thin-leaf Wattle				14	7	2
500018	***Acacia brownii***	**Heath Wattle**				5	2	8

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
500025	*Acacia dealbata*	Silver Wattle				48	18	20
500038	*Acacia genistifolia*	Spreading Wattle				8	5	8
500045	*Acacia implexa*	Lightwood				28	8	17
500056	*Acacia mearnsii*	Black Wattle				91	34	11
500057	*Acacia melanoxylon*	Blackwood				111	36	15
500062	***Acacia mucronata* subsp. *longifolia***	**Variable Sallow Wattle or Narrow-leaf Wattle**				5	3	0
500063	*Acacia myrtifolia*	Myrtle Wattle				52	25	13
500072	*Acacia paradoxa*	Hedge Wattle				58	26	11
500078	*Acacia pycnantha*	Golden Wattle				54	23	15
505140	*Acacia stictophylla*	Dandenong Range Cinnamon Wattle	r			25	11	14
500091	*Acacia stricta*	Hop Wattle				44	20	14
500098	*Acacia ulicifolia*	Juniper Wattle				17	8	18
500100	*Acacia verticillata*	Prickly Moses				48	19	17
500106	*Acaena echinata*	Sheep's Burr				15	6	0
500105	*Acaena novae-zelandiae*	Bidgee-widgee				85	34	5
500107	*Acaena ovina*[1]	Australian Sheep's Burr		AVH	1989	0	0	0
500110	***Acianthus caudatus***	**Mayfly Orchid**				4	3	0
504439	***Acianthus pusillus***	**Small Mosquito Orchid**				7	6	0
500123	*Acrotriche serrulata*	Honey-pots				69	34	1
500174	*Alisma plantago-aquatica*	Water Plantain				42	19	1
500451	***Allittia cardiocarpa***	**Swamp Daisy**			2016	5	4	2
500677	*Allocasuarina littoralis*	Black Sheoak				16	7	30
502875	***Almaleea subumbellata***	**Wiry Bush-pea**				2	1	0
505097	*Alternanthera denticulata*	Lesser Joyweed				24	12	0
500208	***Amphibromus archeri***	**Pointed Swamp Wallaby-grass**				2	1	0
503628	***Amphibromus nervosus***	**Veined Swamp Wallaby-grass**				3	1	0
500220	***Amyema pendula***	**Drooping Mistletoe**				31	11	0
500222	*Amyema quandang*	Grey Mistletoe				4	2	0
500146	*Anthosachne scabra*	Common Wheat-grass				24	9	0
508061	*Aphanes ?australiana*[2]	Piert				1	0	0
500242	***Aphelia gracilis***	**Slender Aphelia**				4	1	0
500243	***Aphelia pumilio***	**Dwarf Aphelia**			1996	1	1	0
500269	*Arthropodium milleflorum*	Pale Vanilla-lily			1983	1	1	0
505126	*Arthropodium strictum*	Chocolate Lily				78	37	1
500278	***Asperula conferta***	**Common Woodruff**				2	2	0
500304	***Astroloma humifusum***	**Cranberry Heath**				11	6	0
503285	*Austrostipa nodosa*	Knotty Spear-grass		AVH	1929			
503288	*Austrostipa pubinodis*	Tall Spear-grass				32	14	0
503289	*Austrostipa rudis*[3]	Veined Spear-grass				47	14	0
504940	*Austrostipa rudis* subsp. *australis*	Veined Spear-grass	r			24	13	0
504941	***Austrostipa rudis* subsp. *nervosa***	**Veined Spear-grass**				1	1	0
504942	*Austrostipa rudis* subsp. *rudis*	Veined Spear-grass				104	40	1
503291	***Austrostipa semibarbata***	**Fibrous Spear-grass**				1	1	0
500363	***Banksia marginata***	**Silver Banksia**				14	10	5
500373	***Baumea acuta***	**Pale Twig-rush**				4	3	0
500374	***Baumea arthrophylla***	**Fine Twig-rush**				3	1	0
504229	***Baumea rubiginosa***	**Soft Twig-rush**			2012	2	1	0
500381	***Baumea tetragona***	**Square Twig-rush**				3	2	0

[1] The record of *Acaena ovina* may actually be of *A. echinata*, given how obscure the differences are in Maroondah.
[2] The common *Aphanes* of gardens and disturbed ground in Maroondah appears to match *Aphanes australiana* but a definitive identification is required. Regardless, it may be present only due to human activity.
[3] The present study identified all plants of *Austrostipa rudis* to subspecies level but many prior records have not.

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
504291	*Billardiera mutabilis*	Common Apple-berry				79	37	0
500440	*Bossiaea prostrata*	Creeping Bossiaea				46	26	0
500455	***Brachyscome decipiens***	**Field Daisy**			1996	1	0	0
500456	***Brachyscome diversifolia***	**Tall Daisy**			2008	1	0	0
500508	*Brunonia australis*	Blue Pincushion				26	17	0
500510	*Bulbine bulbosa*	Yellow Bulbine-lily				10	8	0
500512	*Burchardia umbellata*	Milkmaids				46	27	0
500513	*Burnettia cuneata*	Lizard Orchid	r	AVH	1921			
505690	*Bursaria spinosa*	Sweet Bursaria				103	39	11
500518	*Caesia parviflora*	Pale Grass-lily				45	29	0
503680	***Caladenia carnea***	**Pink Fingers**				8	6	0
504900	***Caladenia catenata***	**White Caladenia**				5	5	0
500528	*Caladenia clavigera*	Plain-lip Spider-orchid		AVH	1915			
500529	***Caladenia congesta***	**Black-tongue Caladenia**				1	1	0
501019	*Caladenia dilatata*	Green-comb Spider-orchid	k	AVH	1949			
500541	*Caladenia flavovirens*	Summer Spider-orchid	r	AVH	1927			
504351	*Caladenia fragrantissima*	Scented Spider-orchid	Le	AVH	1949			
	Caladenia gracilis – see *Caladenia moschata*							
500536	*Caladenia iridescens*	Bronze Caladenia		AVH	1946			
500535	***Caladenia moschata***	**Musky Caladenia**			2015	4	3	0
503694	*Caladenia oenochila*	Wine-lipped Spider-orchid	v	VBA	1996	1	1	0
504476	*Caladenia parva*	Small Spider-orchid			1996	1	1	0
504350	*Caladenia patersonii*	Common Spider-orchid	e	AVH	1921			
500543	*Caladenia praecox*	Early Caladenia				2	2	0
500545	***Caladenia pusilla***	**Tiny Caladenia**			2009	2	2	0
505431	***Caladenia* sp. aff. *venusta* (Kilsyth South)**	**Kilsyth South Spider-orchid**	CLe			1	1	0
503677	*Caladenia tentaculata*	Large Green-comb Spider-orchid		AVH	1941			
500547	*Caladenia tessellata*	Thick-lip Spider-orchid	Vv	AVH	1908			
505422	***Caladenia transitoria***	**Eastern Bronze Caladenia**			2016	5	4	0
500585	***Calochilus campestris***	**Copper Beard-orchid**			2016	2	2	0
500587	***Calochilus paludosus***	**Red Beard-orchid**			2005	4	3	0
500589	***Calochilus robertsonii***	**Purplish Beard-orchid**				9	4	0
503805	*Calotis scabiosifolia* var. *integrifolia*	Rough Burr-daisy		AVH	1922			
500603	***Calystegia marginata***	**Forest Bindweed**				1	0	0
500623	*Carex appressa*	Tall Sedge				26	11	20
500627	*Carex breviculmis*	Short-stem Sedge				65	32	0
500638	*Carex fascicularis*	Tassel Sedge				6	4	10
500639	***Carex gaudichaudiana***	**Fen Sedge**				6	3	2
500642	*Carex inversa*	Knob Sedge				17	10	0
500666	*Cassinia aculeata*	Common Cassinia				78	36	6
500668	*Cassinia longifolia*	Shiny Cassinia				46	30	6
500667	*Cassinia sifton*	Drooping Cassinia				100	40	0
500669	***Cassinia trinerva***	**Three-nerved Cassinia**			2015	1	1	0
500671	***Cassytha glabella***	**Slender Dodder-laurel**				2	0	0
500672	*Cassytha melantha*	Coarse Dodder-laurel				34	16	0
500674	*Cassytha pubescens*	Downy Dodder-laurel				44	23	0
500706	*Centella cordifolia*	Centella				42	21	1
500707	*Centipeda cunninghamii*	Common Sneezeweed		AVH	1935			
505614	***Centipeda elatinoides***	**Elatine Sneezeweed**				3	2	0
	Centipeda minima – see *Centipeda elatinoides*							
500711	***Centrolepis aristata***	**Pointed Centrolepis**				4	3	0
500713	*Centrolepis fascicularis*	Tufted Centrolepis			2001	1	1	0
500716	***Centrolepis strigosa***	**Hairy Centrolepis**				5	1	0

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
500726	*Chamaescilla corymbosa*	Blue Stars				17	12	0
500750	*Chiloglottis cornuta*	Green Bird-orchid		AVH	1923			
500753	***Chiloglottis reflexa***	**Autumn Bird-orchid**				3	2	0
500754	***Chiloglottis trapeziformis***	**Dainty Bird-orchid**				2	2	0
504888	*Chiloglottis valida*	Common Bird-orchid				10	8	0
504632	*Chorizandra cymbaria*	Heron Bristle-rush			1992	1	1	0
501606	***Chrysocephalum apiculatum***[4]	**Common Everlasting**				1	1	1
501628	***Chrysocephalum semipapposum***	**Clustered Everlasting**				11	7	9
500788	*Clematis aristata*	Mountain Clematis				48	23	1
507387	*Clematis decipiens*[5]	a small-leafed clematis				48	27	2
	Clematis microphylla – see *Clematis decipiens*							
500797	***Comesperma ericinum***	**Heath Milkwort**				7	4	0
500801	*Comesperma volubile*	Love Creeper				32	21	0
500822	*Coprosma quadrifida*	Prickly Currant-bush				54	24	6
501626	*Coronidium scorpioides*	Button Everlasting				38	22	1
504370	***Correa reflexa* var. *reflexa***	**Common Correa**				46	26	8
502698	*Corunastylis archeri*	Variable Midge-orchid		AVH	1980	1	0	0
502705	***Corunastylis despectans***	**Sharp Midge-orchid**				5	3	0
502715	***Corunastylis morrisii***	**Bearded Midge-orchid**				3	2	0
500838	***Corybas diemenicus***	**Veined Helmet-orchid**				3	3	0
500842	*Corybas unguiculatus*	Small Helmet-orchid		AVH	1899			
500846	*Cotula australis*	Common Cotula				28	16	0
504649	*Craspedia paludicola*	Swamp Billy-buttons		AVH	1897			
504650	***Craspedia variabilis***	**Variable Billy-buttons**			1996	3	2	0
500860	*Crassula decumbens* var. *decumbens*	Spreading Crassula				32	16	0
500862	*Crassula helmsii*	Swamp Crassula				10	5	5
500866	***Crassula sieberiana/tetramera***	**Sieber Crassula**				3	1	0
500883	***Cryptostylis leptochila***	**Small Tongue-orchid**				2	2	0
500884	*Cryptostylis subulata*	Large Tongue-orchid				13	10	0
500524	*Cyanicula caerulea*	Blue Caladenia		AVH	1927			
504074	*Cycnogeton alcockiae*	Water-ribbons			1996	2	1	0
504073	*Cycnogeton procerum*	Water-ribbons		AVH	1903			5
500908	*Cynoglossum australe*	Austral Hound's-tongue		AVH	1948			
500910	***Cynoglossum suaveolens***	**Sweet Hound's-tongue**				4	3	0
500112	*Cyrtostylis reniformis*	Small Gnat Orchid			1988	2	2	0
500989	***Daucus glochidiatus***	**Austral Carrot**			1996	2	2	0
500996	*Daviesia latifolia*	Hop Bitter-pea				15	6	6
501000	*Daviesia leptophylla*	Narrow-leaf Bitter-pea				51	24	4
501016	***Deyeuxia densa***	**Heath Bent-grass**				2	1	0
501023	*Deyeuxia quadriseta*	Reed Bent-grass				69	31	1
505084	***Dianella amoena***	**Matted Flax-lily**	ELe			3	1	1
504420	*Dianella longifolia* var. *longifolia*	Pale Flax-lily				67	28	17
504413	*Dianella revoluta* var. *revoluta*	Black-anther Flax-lily				100	37	5
501030	*Dianella tasmanica*	Tasman Flax-lily				37	17	18
501033	*Dichelachne crinita*[6]	Long-hair Plume-grass			2001	2	0	1
503792	*Dichelachne rara*	Common Plume-grass				39	19	0

[4] There is a 1911 specimen of *Chrysocephalum apiculatum* from Ringwood. The solitary plant discovered in Ringwood in 2018 may have escaped from a garden.

[5] While *Clematis decipiens* can confidently be regarded as indigenous in northern Maroondah, it has spread greatly since 2000 and is now threatening the survival of many indigenous plants in its expanded range.

[6] *Dichelachne crinita* is dubiously indigenous in Maroondah. A solitary plant sometimes appears before dying without replacement, except where the species has been planted.

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
503791	*Dichelachne sieberiana*[7]	Plume-grass				13	6	0
501036	*Dichondra repens*	Kidney-weed				56	28	0
505931	*Dillwynia cinerascens*	Grey Parrot-pea				70	34	2
504889	*Dipodium roseum*	Hyacinth Orchid				40	24	0
501061	***Diuris behrii***	**Golden Cowslips**	v		2008	1	0	0
505423	*Diuris chryseopsis*	Golden Moths		JA Jeanes	1981	1	1	0
501079	*Diuris orientis*	Wallflower Orchid				11	7	0
501081	*Diuris* × *palachila*	a hybrid Diuris	r	AVH	1915			
501080	*Diuris pardina*	Leopard Orchid				10	4	0
501084	*Diuris punctata* var. *punctata*	Purple Diuris	Lv	AVH	1924			
501085	***Diuris sulphurea***	**Tiger Orchid**				6	4	0
501110	*Drosera aberrans*	Scented Sundew				40	21	0
501102	*Drosera auriculata*	Tall Sundew				50	26	0
501103	*Drosera binata*	Forked Sundew		AVH	1945			
528663	***Drosera hookeri***[8]	**Branched Sundew**				11	5	0
	Drosera peltata subsp. *peltata* – see *Drosera hookeri*							
501108	***Drosera pygmaea***	**Tiny Sundew**				4	2	0
501122	***Echinopogon ovatus***	**Common Hedgehog-grass**				5	3	1
501138	*Elatine gratioloides*	Waterwort				6	4	0
501139	*Eleocharis acuta*	Common Spike-rush				8	4	1
501146	*Eleocharis sphacelata*	Tall Spike-rush				14	4	2
501155	***Empodisma minus***	**Spreading Rope-rush**				7	4	0
501681	***Epacris gunnii***	**Ace of Spades**			1995	1	1	3
504478	*Epacris impressa* var. *impressa*	Common Heath				72	35	2
504444	*Epilobium billardiereanum* subsp. *billardiereanum*	Robust Willow-herb			2012	1	0	0
504445	*Epilobium billardiereanum* subsp. *cinereum*	Variable Willow-herb				16	11	0
504447	*Epilobium billardiereanum* subsp. *intermedium*	Robust Willow-herb				10	7	0
501179	*Epilobium hirtigerum*	Hairy Willow-herb				55	22	0
501185	*Eragrostis brownii*	Common Love-grass				43	12	0
501219	***Eriochilus cucullatus***	**Parson's Bands**			2010	3	3	0
501240	***Eryngium vesiculosum***	**Prickfoot**				3	1	0
515932	*Eucalyptus* × *brevirostris*	a hybrid eucalypt	r[9]			2	1	0
503733	*Eucalyptus cephalocarpa*	Mealy Stringybark				77	23	7
501267	***Eucalyptus cypellocarpa***	**Mountain Grey Gum**				1	1	0
501281	***Eucalyptus globoidea***	**White Stringybark**				20	8	2
503732	*Eucalyptus goniocalyx*	Bundy, Long-leaf Box				98	36	3
501294	***Eucalyptus macrorhyncha***	**Red Stringybark**				93	35	0
501297	*Eucalyptus melliodora*	Yellow Box				53	20	7
501304	*Eucalyptus obliqua*	Messmate Stringybark				95	35	1
501307	*Eucalyptus ovata*	Swamp Gum				85	28	9
504335	*Eucalyptus polyanthemos* subsp. *vestita*	Red Box				28	8	13
503828	*Eucalyptus radiata* subsp. *radiata*	Narrow-leaved Peppermint				105	37	8
501315	***Eucalyptus rubida***	**Candlebark**				20	7	3

[7] It is quite possible that all records of *Dichelachne sieberiana* in Maroondah actually belong to *D. rara*.

[8] It is presumed here that all past written records of *Drosera peltata* subsp. *peltata* are referable now to *Drosera hookeri*. Further investigation is warranted.

[9] The *'Advisory List…'* wrongly indicates that *E.* × *brevirostris* is a hybrid between *E. macrorhyncha* and *E. muelleriana*. Examination of the National Herbarium of Victoria specimens from Lilydale and Warrandyte shows that they are *E. macrorhyncha* × *E. obliqua*. *E. muelleriana* does not occur at these localities or the type locality.

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
504463	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum				13	7	11
501326	***Eucalyptus yarraensis***	**Yarra Gum**	r			3	1	0
501465	*Euchiton involucratus*	Common Cudweed				31	15	0
501466	*Euchiton japonicus*	Creeping Cudweed				33	16	0
501471	*Euchiton sphaericus*	Star Cudweed				7	1	0
504472	*Euphrasia collina* subsp. *trichocalycina*	Purple Eyebright	r	AVH	1935			
501350	*Exocarpos cupressiformis*	Cherry Ballart				113	42	0
501353	*Exocarpos strictus*	Pale-fruit Ballart				6	2	0
501357	*Festuca asperula*	Graceful Fescue				113	38	0
501394	*Gahnia radula*	Thatch Saw-sedge				17	8	13
501395	*Gahnia sieberiana*	Red-fruit Saw-sedge				7	3	0
501409	*Galium gaudichaudii*	Rough Bedstraw			1996	6	4	0
504459	*Gastrodia sesamoides*[10]	Cinnamon Bells				4	3	0
503826	*Gentianella polysperes*	Early Forest-gentian	r	AVH	1922			
501427	*Geranium homeanum*	Rainforest Crane's-bill				7	4	0
501431	*Geranium potentilloides*	Cinquefoil Crane's-bill				18	11	0
501434	*Geranium solanderi* group[11]	Austral Crane's-bill				12	5	0
505346	*Geranium* sp. 5	Naked Crane's-bill				1	1	0
501445	*Glossodia major*	Wax-lip Orchid				17	10	0
501451	*Glyceria australis*	Australian Sweet-grass				11	7	0
501455	*Glycine clandestina*	Twining Glycine				20	11	0
503741	***Glycine microphylla***	**Small-leaf Glycine**				2	1	0
501481	***Gompholobium huegelii***	**Common Wedge-pea**				17	9	2
501484	***Gonocarpus humilis***	**Shade Raspwort**			2001	2	2	0
501486	***Gonocarpus micranthus* subsp. *micranthus***	**Creeping Raspwort**			2012	8	2	1
501489	*Gonocarpus tetragynus*	Common Raspwort				103	42	0
501496	***Goodenia elongata***	**Lanky Goodenia**				8	8	1
501503	***Goodenia humilis***	**Swamp Goodenia**				6	2	0
501504	*Goodenia lanata*	Trailing Goodenia				34	22	0
501507	*Goodenia ovata*	Hop Goodenia				67	27	27
505076	*Goodia lotifolia*	Common Golden-tip			1995	1	1	8
501524	***Gratiola peruviana***	**Austral Brooklime**			1996	3	1	0
503747	***Gratiola pubescens***	**Glandular Brooklime**				11	3	0
503853	***Gynatrix pulchella***	**Hemp Bush**				6	2	11
505070	***Hakea decurrens***	**Bushy Needlewood**				4	3	8
501568	***Hakea nodosa***	**Yellow Hakea**				12	7	9
501573	*Hakea teretifolia* subsp. *hirsuta*	Dagger Hakea		AVH	1891			
501574	***Hakea ulicina***	**Furze Hakea**				10	7	16
501596	*Hardenbergia violacea*	Purple Coral-pea				54	28	3
501654	*Hemarthria uncinata* var. *uncinata*	Mat Grass				27	13	0
505437	***Hibbertia empetrifolia* subsp. *empetrifolia***	**Tangled Guinea-flower**				4	3	3
501671	***Hibbertia obtusifolia***	**Grey Guinea-flower**				3	2	0
501675	*Hibbertia riparia*	Erect Guinea-flower				24	12	2
501360	***Hookerochloa hookeriana***	**Hooker Fescue**				7	5	2
501705	*Hovea heterophylla*	Common Hovea				49	27	2
501718	***Hydrocotyle callicarpa***	**Small Pennywort**				2	1	0
501720	*Hydrocotyle foveolata*	Yellow Pennywort				11	9	0

[10] There are confirmed records of *Gastrodia sesamoides* from Maroondah and many records that do not distinguish between *G. sesamoides* and *G. procerum*. The latter species may occur in Maroondah, as it does nearby.

[11] *Geranium* sp. 2 is sometimes segregated from *G. solanderi* but not here.

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
501722	*Hydrocotyle hirta*	Hairy Pennywort				10	8	0
501723	*Hydrocotyle laxiflora*	Stinking Pennywort				8	3	0
501728	*Hydrocotyle sibthorpioides*	Shining Pennywort			1996	2	1	0
501741	*Hypericum gramineum*	Small St John's Wort				67	29	0
501743	***Hypericum japonicum***	**Matted St John's Wort**				5	1	0
501756	***Hypoxis hygrometrica***[12]	**Golden Weather-glass**				12	7	0
	Hypoxis species – see also *Pauridia*							
501760	*Imperata cylindrica*	Blady Grass				14	9	0
501761	*Indigofera australis*	Austral Indigo				16	10	10
501772	*Isolepis cernua*	Nodding Club-rush				7	4	0
501775	***Isolepis fluitans***	**Floating Club-rush**				3	1	0
501777	*Isolepis hookeriana*	Grassy Club-rush				12	7	0
501779	*Isolepis inundata*	Swamp Club-rush				46	19	0
501780	*Isolepis marginata*	Little Club-rush				6	4	0
501783	*Isolepis platycarpa*	a club-rush				22	10	0
501793	***Isotoma fluviatilis* subsp. *australis***	**Swamp Isotome**				4	2	0
501803	*Juncus amabilis*	Hollow Rush				61	22	1
501808	*Juncus australis*	Austral Rush				16	6	1
501810	*Juncus bufonius*	Toad Rush				46	20	0
501817	***Juncus filicaulis***[13]	**Thread Rush**				1	0	0
501818	***Juncus flavidus***	**Gold Rush**				3	3	0
504053	*Juncus fockei*[14]	Slender Joint-leaf Rush				25	8	0
501820	*Juncus gregiflorus*	Green Rush				61	25	2
501821	***Juncus holoschoenus***[15]	**Joint-leaf Rush**				4	1	0
501830	*Juncus pallidus*	Pale Rush				81	34	2
501831	*Juncus pauciflorus*	Loose-flower Rush				24	14	0
501833	*Juncus planifolius*	Broad-leaf Rush				29	12	0
501834	*Juncus prismatocarpus*	Branching Rush		AVH	1932			
501835	*Juncus procerus*	Tall Rush				35	13	4
501838	*Juncus remotiflorus*[16]	Diffuse Rush		AVH	1951			
501841	*Juncus sarophorus*	Broom Rush				65	26	1
501843	*Juncus subsecundus*	Finger Rush				53	28	0
501847	***Kennedia prostrata***	**Running Postman**				14	5	2
507040	*Kunzea ?leptospermoides*[17]	Yarra Burgan	k			92	36	8
500149	***Lachnagrostis aemula***	**Purplish Blown Grass**			2004	3	2	0
504219	*Lachnagrostis filiformis*	Common Blown Grass				49	24	0
	Lagenophora gracilis – see *L. sublyrata*							
501863	***Lagenophora stipitata***	**Common Lagenophora**				19	13	0
501861	*Lagenophora sublyrata*	Slender Lagenophora				31	20	0
502762	*Laphangium luteoalbum*	Jersey cudweed				13	6	0
501893	*Lemna disperma*	Common Duckweed				15	7	0

[12] Most records of *Hypoxis hygrometrica* in Maroondah do not indicate which variety but var. *hygrometrica* certainly occurs and var. *villosisepala* is represented by herbarium specimens up to 1944.

[13] The sole record of *Juncus filicaulis* in Maroondah is represented by a pressed specimen collected in this study. Until it can be compared with specimens at the National Herbarium of Victoria, there remains a chance that it is actually an aberrant form of *Juncus subsecundus* or a hybrid between the two species.

[14] The many plants in Maroondah that are regarded here as *J. fockei* have narrowly pointed seed capsules exceeding their tepals by less than is typical for *J. fockei*. They are distinct from the similar *J.holoschoenus* (see below).

[15] The author has found only a few plats that fit all the expected characters of *Juncus holoschoenus*, including blunt-topped seed capsules that are shorter than the tepals. All those plants have been in Site 72a of Volume 2.

[16] The solitary record of *Juncus remotiflorus* from Maroondah must be either a misidentified hybrid or a fluky transient occurrence.

[17] See p. 33.

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
501919	*Lepidosperma elatius*[18]	Tall Sword-sedge				19	14	0
501920	***Lepidosperma filiforme***	**Common Rapier-sedge**				4	4	0
504699	*Lepidosperma gunnii*	Slender Sword-sedge				48	27	0
501923	*Lepidosperma laterale*[18]	Variable Sword-sedge				54	28	1
501926	***Lepidosperma longitudinale***	**Pithy Sword-sedge**				1	1	0
500540	*Leptoceras menziesii*	Hare Orchid		AVH	1897			
505610	*Leptorhynchos squamatus* subsp. *squamatus*	Scaly Buttons		AVH	1935			
501947	*Leptorhynchos tenuifolius*	Wiry Buttons				27	12	5
501956	*Leptospermum continentale*	Prickly Tea-tree				77	28	2
501958	***Leptospermum lanigerum***	**Woolly Tea-tree**				4	3	2
501965	*Leptospermum scoparium*	Manuka				37	21	10
504391	*Leucopogon virgatus* var. *virgatus*	Common Beard-heath				34	19	3
501997	*Levenhookia dubia*	Hairy Stylewort		AVH	1901			
501998	*Levenhookia sonderi*	Slender Stylewort	r	AVH	1948			
502017	*Linum marginale*	Native Flax				17	5	0
502024	*Lobelia anceps*	Angled Lobelia				28	17	1
504703	***Lobelia gibbosa***	**Tall Lobelia**				5	4	0
504704	***Lobelia simplicicaulis***	**Narrow Lobelia**		[19]	2005	1	1	0
504709	*Lomandra filiformis* subsp. *coriacea*	Wattle Mat-rush				110	41	1
504710	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush				77	35	0
504713	*Lomandra longifolia* subsp. *exilis*	Cluster-headed Mat-rush				56	25	0
504714	*Lomandra longifolia* subsp. *longifolia*	Spiny-headed Mat-rush				76	31	23
502048	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush				6	4	0
502051	***Lomatia ilicifolia***	**Holly Lomatia**				1	1	1
502063	*Ludwigia peploides* subsp. *montevidensis*	Clove-strip				1	1	0
503841	*Luzula meridionalis*[20]	Common Woodrush				27	17	0
502087	*Lyperanthus suaveolens*	Brown-beaks				9	5	0
502092	*Lythrum hyssopifolia*	Small Loosestrife				46	21	0
502133	*Mazus pumilio*	Swamp Mazus			2000	1	1	0
502147	*Melaleuca ericifolia*	Swamp Paperbark				52	18	13
504933	*Melicytus dentatus*	Tree Violet				1	1	0
502167	*Mentha laxiflora*	Forest Mint		AVH	1935			
502179	*Microlaena stipoides* var. *stipoides*	Weeping Grass				122	43	1
503887	***Microseris walteri***	**Murnong**				3	3	0
502258	***Microtis arenaria***	**Sand Onion-orchid**			2003	2	1	0
502185	*Microtis atrata*	Yellow Onion-orchid		AVH	1926			
502187	*Microtis parviflora*	Slender Onion-orchid				47	22	0
502188	*Microtis rara*	Sweet Onion-orchid		AVH	1929	0	0	0
502189	*Microtis unifolia*	Common Onion-orchid				8	4	0
504309	*Montia fontana* subsp. *chondrosperma*	Water Blinks				5	1	0
502233	***Muellerina eucalyptoides***	**Creeping Mistletoe**				16	8	0
502251	*Myriophyllum amphibium*	Broad Water-milfoil		AVH	1892			
503867	***Myriophyllum crispatum***	**Upright Water-milfoil**				4	2	0
503873	***Myriophyllum simulans***	**Amphibious Water-milfoil**			2012	3	1	1
502299	*Olearia argophylla*	Musk Daisy-bush				2	0	2
502307	***Olearia glandulosa***	**Swamp Daisy-bush**				1	1	0

[18] It is not unusual in Maroondah to find plants intermediate between *Lepidosperma elatius* and *L. laterale*.
[19] *Lobelia simplicicaulis* is known in Maroondah only by a specimen of Ruth Jackson from Kilsyth South.
[20] All three varieties of *Luzula meridionalis* (*viz densiflora, flaccida* and *meridionalis*) occur in Maroondah but too few records distinguish them to be able to present statistics for each.

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
502312	*Olearia lirata*	Snowy Daisy-bush				25	15	19
502316	*Olearia myrsinoides*	Silky Daisy-bush				30	16	1
504781	*Olearia phlogopappa* subsp. *continentalis*	Dusty Daisy-bush				2	2	0
502341	*Opercularia ovata*	Broad-leaf Stinkweed				26	15	0
502344	*Opercularia varia*	Variable Stinkweed				64	34	0
503521	***Ornduffia reniformis***	**Running Marsh-flower**				3	2	0
502370	*Orthoceras strictum*	Horned Orchid		AVH	1944			
502375	***Ottelia ovalifolia* subsp. *ovalifolia***	**Swamp Lily**			1996	1	1	0
507311	*Oxalis exilis/perennans*	Wood-sorrel				83	31	0
501616	*Ozothamnus ferrugineus*	Tree Everlasting				76	30	9
501620	***Ozothamnus obcordatus***	**Grey Everlasting**				3	2	3
501624	***Ozothamnus rosmarinifolius***	**Rosemary Everlasting**				1	1	0
502426	*Parsonsia brownii*[21]	Twining Silkpod				2	2	0
502435	***Patersonia fragilis***	**Short Purple-flag**				2	2	0
502437	*Patersonia occidentalis*	Long Purple-flag				13	5	6
504081	*Pauridia glabella*	Tiny Star		AVH	1935			
504584	***Pauridia vaginata* var. *vaginata***	**Yellow Star**			1994	7	4	0
502446	***Pelargonium inodorum***	**Kopata**				5	4	0
502456	***Pentapogon quadrifidus* var. *quadrifidus***	**Five-awned Spear-grass**				11	4	0
503919	*Persicaria decipiens*	Slender Knotweed				49	23	2
502628	*Persicaria hydropiper*[22]	Water-pepper				14	6	0
502630	*Persicaria lapathifolia*[22]	Pale Knotweed				3	2	0
503938	***Persicaria praetermissa***	**Spotted Knotweed**				3	2	0
502637	***Persicaria subsessilis***	**Hairy Knotweed**				1	1	0
502463	***Persoonia juniperina***	**Prickly Geebung**				14	10	0
500531	*Pheladenia deformis*	Bluebeard Caladenia		AVH	1926			
502497	*Phragmites australis*	Common Reed				30	11	0
504829	*Pimelea axiflora* subsp. *axiflora*	Bootlace Bush		AVH	1923			
504145	***Pimelea curviflora* var. *sericea***	**Curved Rice-flower**				2	2	0
502523	*Pimelea humilis*	Common Rice-flower				69	34	0
504819	***Pimelea linifolia* subsp. *linifolia***	**Slender Rice-flower**				5	1	0
502566	*Plantago varia*	Variable Plantain				18	10	1
528676	*Platylobium infecundum*	a flat-pea	e			18	9	0
502569	*Platylobium obtusangulum*	Common Flat-pea				79	35	1
528675	*Platylobium reflexum*	a flat-pea	r	AVH	1945			
502590	*Poa ensiformis*	Sword (Purple-sheathed) Tussock-grass				41	22	13
504694	*Poa labillardierei* var. *labillardierei*	Common Tussock-grass				15	6	25
502602	*Poa morrisii*	Soft Tussock-grass				79	37	2
502609	*Poa rodwayi*[23]	Velvet Tussock-grass		AVH	1960			
504835	*Poa sieberiana* var. *sieberiana*	Grey Tussock-grass				37	17	1
502610	***Poa tenera***	**Slender Tussock-grass**				26	15	0
502643	*Polyscias sambucifolia*	Elderberry Panax				21	11	2
502650	*Pomaderris aspera*	Hazel Pomaderris				7	2	14
502660	*Pomaderris lanigera*	Woolly Pomaderris			1989	1	1	1

[21] *Parsonsia brownii* first appeared in Maroondah in 2001 at 'Uambi' and then in recent years at Appletree Hill Reserve, where it is now abundant and smothering many indigenous species. It has presumably spread from its natural range (e.g. Dandenong Ranges). See Chapter 10 (p. 32).

[22] Botanists are unsure whether *Persicaria hydropiper* and *P. lapathifolia* are native to Victoria.

[23] There is disagreement among botanists about whether Victorian plants that have been identified as *Poa rodwayi* are actually forms of *P. morrisii*.

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
502670	*Pomaderris prunifolia* var. *prunifolia*	Plum-leaf Pomaderris				2	1	3
502671	***Pomaderris racemosa***	**Cluster Pomaderris**				5	3	4
507704	*Poranthera microphylla*	Small Poranthera				74	33	0
505274	***Potamogeton cheesemanii***	**Small-fruit Pondweed**			1996	2	1	0
502688	***Potamogeton crispus***	**Curly Pondweed**				4	2	0
502690	*Potamogeton ochreatus*	Blunt Pondweed				13	7	0
502699	*Prasophyllum australe*	Austral Leek-orchid		AVH	1944			
502703	***Prasophyllum brevilabre***	**Short-lip Leek-orchid**			1999	1	1	0
504154	*Prasophyllum colemaniae*	Lilac Leek-orchid	extinct	AVH	1921			
502708	*Prasophyllum flavum*	Yellow Leek-orchid		AVH	1920			
	Prasophyllum frenchii – see *Prasophyllum pyriforme*							
502702	*Prasophyllum lindleyanum*	Green Leek-orchid	v	AVH	1921			
502717	*Prasophyllum odoratum*	Fragrant Leek-orchid		AVH	1944			
502710	*Prasophyllum pyriforme*	Silurian Leek-orchid	k	AVH	2001	1	1	0
504845	*Prostanthera lasianthos* var. *lasianthos*	Victorian Christmas-bush				20	12	14
504873	***Pterostylis alpina***	**Mountain Greenhood**			2016	4	3	0
502807	***Pterostylis atrans***	**Dark-tip Greenhood**			2003	1	1	0
504728	*Pterostylis chlorogramma*	Green-lined Greenhood	VLv	AVH	1921			
505293	***Pterostylis clivosa***	**Red-tip Greenhood**	r			3	2	0
502789	***Pterostylis concinna***	**Trim Greenhood**				2	2	1
502791	*Pterostylis curta*	Blunt Greenhood				5	4	1
504877	*Pterostylis falcata*	Large Sickle Greenhood		AVH	1970			
502796	*Pterostylis foliata*	Slender Greenhood		AVH	1922	0	0	0
502798	*Pterostylis grandiflora*	Cobra Greenhood	r	GWC	1982	1	1	0
502800	*Pterostylis* × *ingens*	Sharp Greenhood	r			1	1	0
504131	*Pterostylis melagramma*	Tall Greenhood				24	15	0
502805	***Pterostylis nana***	**Dwarf Greenhood**				6	5	0
502806	*Pterostylis nutans*	Nodding Greenhood				38	25	0
504033	*Pterostylis parviflora*	Tiny Greenhood				4	3	0
502810	*Pterostylis pedunculata*	Maroonhood				10	9	0
502811	*Pterostylis plumosa*	Bearded Greenhood		AVH	1933			
502816	***Pterostylis squamata***	**Rusty-hood**		AVH	1983	1	1	0
504857	***Pultenaea forsythiana***	**Eastern Prickly Bush-pea**				4	4	1
504138	*Pultenaea gunnii* subsp. *gunnii*	Golden Bush-pea				56	29	6
502864	***Pultenaea pedunculata***	**Matted Bush-pea**				1	0	0
502871	***Pultenaea scabra***	**Rough Bush-pea**			1997			
504862	*Pultenaea sericea*	Heathland Bush-pea		AVH	1902			
502086	*Pyrorchis nigricans*	Red-beaks		AVH	1932			
502890	***Ranunculus glabrifolius***	**Shining Buttercup**				2	1	2
502893	*Ranunculus inundatus*	River Buttercup			1992	1	1	0
502894	*Ranunculus lappaceus*	Australian Buttercup				6	5	0
502956	*Rubus parvifolius*	Small-leaf Bramble				16	10	0
502968	***Rumex brownii***	**Slender Dock**			2010	2	1	0
504938	***Rytidosperma* aff. *caespitosum* (South-west Swamps) – Kilsyth South form**	**Porphyry Wallaby-grass**	k			1	1	0
500961	*Rytidosperma caespitosum*	Common Wallaby-grass				9	5	0
500963	***Rytidosperma duttonianum***	**Brown-back Wallaby-grass**			2016	1	0	0
504409	*Rytidosperma fulvum*	Leafy Wallaby-grass				62	27	0
500965	*Rytidosperma geniculatum*	Kneed Wallaby-grass				19	10	0
500976	***Rytidosperma indutum* (*procerum*)**	**Tall Wallaby-grass**			2014	1	1	0
500967	*Rytidosperma laeve*	Smooth Wallaby-grass				43	20	0

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
	Rytidosperma monticola/erianthum[24]	**a wallaby-grass**	r			4	2	0
500973	*Rytidosperma pallidum*	Red-anther (or Silvertop) Wallaby-grass				86	38	0
500974	*Rytidosperma penicillatum*	Slender Wallaby-grass				86	35	0
504404	*Rytidosperma pilosum*	Velvet Wallaby-grass				51	24	0
500977	*Rytidosperma racemosum* var. *racemosum*	Clustered Wallaby-grass				105	38	1
500979	*Rytidosperma semiannulare*	Tasmanian Wallaby-grass				36	16	0
504379	*Rytidosperma setaceum*	Bristly Wallaby-grass				87	37	1
500981	*Rytidosperma tenuius*	Purplish Wallaby-grass				81	32	0
503039	*Schoenus apogon*	Common Bog-rush				84	35	0
503055	***Schoenus lepidosperma***	**Slender Bog-rush**				5	4	0
503048	***Schoenus maschalinus***	**Leafy Bog-rush**			2000	3	2	0
503056	***Schoenus tesquorum***	**Soft Bog-rush**				6	2	0
507136	*Senecio campylocarpus*	Floodplain Groundsel	r			5	2	0
503107	*Senecio glomeratus*	Annual Fireweed				37	23	0
504959	*Senecio hispidulus*	Rough Fireweed				63	36	0
503115	*Senecio linearifolius*	Fireweed Groundsel			1996	2	2	0
503119	***Senecio minimus***	**Shrubby Fireweed**				47	22	0
507176	*Senecio phelleus*	Stony Fireweed				5	3	0
505244	*Senecio pinnatifolius* var. *lanceolatus*	Lance-leaf Groundsel		AVH	c. 1900			
503126	*Senecio prenanthoides*	Beaked Fireweed				28	17	0
503124	*Senecio quadridentatus*	Cotton Fireweed				72	36	0
503125	*Senecio runcinifolius*	Tall Groundsel				0	0	0
507175	***Senecio squarrosus***	**Leafy Fireweed**		AVH	1984	0	0	0
503149	***Sigesbeckia orientalis* subsp. *orientalis***	**Indian Weed**				2	1	0
503169	***Solanum aviculare***	**Kangaroo Apple**				5	4	0
503179	*Solanum laciniatum*	Large Kangaroo Apple				37	20	6
503195	*Solenogyne dominii*	Solenogyne				17	9	1
503196	*Solenogyne gunnii*	Solenogyne				11	5	0
504725	***Sphaerolobium minus***	**Globe-pea**				7	3	0
503223	*Spiranthes australis*	Ladies' Tresses			1996	1	0	0
503224	*Spirodela punctata*	Thin Duckweed			2011	4	1	0
503235	*Spyridium parvifolium*	Australian Dusty Miller				22	11	15
503244	*Stackhousia monogyna*	Candles				22	13	0
503250	***Stellaria flaccida***	**Forest Starwort**			2010	1	0	0
504972	*Stylidium armeria*	Grass Trigger-plant			2003	1	0	0
503303	*Stylidium armeria/graminifolium*[25]	Grass Trigger-plant				54	31	1
503304	***Stylidium despectum***	**Hundreds and Thousands**				2	1	0
504971	*Stylidium graminifolium*	Grass Trigger-plant				6	3	0
	Stylidium inundatum – see *Stylidium despectum*							
503348	*Tetrarrhena juncea*	Forest Wire-grass				27	12	0
503351	*Tetratheca ciliata*	Pink-bells				19	14	4
503308	***Thelionema caespitosum***	**Tufted Blue-lily**				5	2	1
505355	*Thelymitra arenaria*	Forest Sun-orchid				3	2	0
503362	*Thelymitra aristata*	Great Sun-orchid		AVH	1929			
505916	*Thelymitra brevifolia*	Peppertop Sun-orchid				4	4	0
503364	***Thelymitra carnea***	**Salmon Sun-orchid**				2	2	0

[24] This entry is for plants that best fit *Rytidosperma monticola* but differ from typical forms in their broader leaf blades. The local form differs from the closest alternative (*R. erianthum*) in having slender glumes, short lemma lobe bristles and lemma hairs scattered between the two rows.

[25] *Stylidium armeria* was separated from *S. graminifolium* so recently that most records do not distinguish, but both occur in Maroondah – sometimes side by side.

Code no.	Scientific name	Common name	Legal Status	Source	Missing since	No. SoBS	No. reserves	No plantings
503368	*Thelymitra flexuosa*	Twisted Sun-orchid		AVH	c. 1980	1	0	0
503372	***Thelymitra ixioides/juncifolia***[26]	**Dotted Sun-orchid**				7	5	0
504999	***Thelymitra media***	**Tall Sun-orchid**			2003	3	3	0
505914	*Thelymitra peniculata*	Trim Sun-orchid				27	13	0
503384	***Thelymitra rubra***	**Salmon Sun-orchid**				6	4	0
503373	*Thelymitra* × *truncata* complex	Short Sun-orchid		GWC	1998	0	0	0
503387	*Themeda triandra*	Kangaroo Grass				97	40	10
503399	*Thysanotus patersonii*	Twining Fringe-lily				22	17	0
504998	*Thysanotus tuberosus* ssp. *tuberosus*	Common Fringe-lily				10	6	0
503421	*Tricoryne elatior*	Yellow Rush-lily				67	32	0
503449	*Triglochin striata*	Streaked Arrow-grass				15	9	0
503468	*Typha domingensis*	Cumbungi				20	8	0
503470	*Typha orientalis*	Cumbungi				29	13	0
503478	***Utricularia australis***	**Yellow Bladderwort**			1996	1	1	0
503479	***Utricularia dichotoma***	**Purple Bladderwort**			2004	2	1	0
502641	*Utricularia tenella*	Pink Bladderwort		AVH	1897			
503503	***Veronica calycina***	**Hairy Speedwell**			1996	6	3	0
502415	***Veronica derwentiana***	**Derwent Speedwell**				3	3	6
503506	*Veronica gracilis*	Slender Speedwell				12	5	2
503512	*Veronica plebeia*	Trailing Speedwell				5	4	0
503514	*Veronica subtilis*	Thread Speedwell		AVH	1947			
503523	***Viminaria juncea***	**Golden Spray**			2012	4	1	3
503526	*Viola betonicifolia*	Showy Violet			1996	1	1	0
505056	*Viola cleistogamoides*	Hidden Violet		AVH	1901	0	0	0
505058	*Viola hederacea*	Ivy-leaf Violet				54	29	0
503555	*Wahlenbergia gracilenta*	Annual Bluebell		GWC	1983	1	1	0
503558	*Wahlenbergia gracilis*	Sprawling Bluebell				19	9	0
503557	***Wahlenbergia gymnoclada***	**Naked Bluebell**				4	3	0
503560	***Wahlenbergia multicaulis***	**Tadgell's Bluebell**				7	2	0
503559	*Wahlenbergia stricta* subsp. *stricta*	Tall Bluebell				10	6	0
503578	*Wolffia australiana*	Tiny Duckweed			2011	3	1	0
504082	*Wurmbea dioica* subsp. *dioica*	Common Early Nancy				16	8	0
503588	*Xanthorrhoea minor* subsp. *lutea*	Small Grass-tree				73	32	0
504561	*Xanthosia dissecta*	Cut-leaf Xanthosia				35	20	0
503763	*Xerochrysum palustre*	Swamp Everlasting	VLv		1996	1	0	4

The following additional species of flowering plants have also been reported but without adequate confidence or verification to be relied upon:

Scientific name	Common Name	Locations
Acacia verniciflua	Varnish Wattle	in a garden on Smedley Rd, Ringwood North
Acrotriche prostrata	Trailing Ground-berry	at Cheong Wildflower Sanctuary
Ajuga australis	Austral Bugle	
Amphibromus ?neesii	Southern Swamp Wallaby-grass	near Bungalook Ck, just west of Dorset Rd
Calystegia sepium subsp. *roseata*[27]	Large Bindweed	could be anywhere along a perennial creek
Drosera macrantha	Climbing Sundew	could only occur near the northern border
Poa clelandii	Matted Tussock-grass	Bungalook Conservation Reserves
Poa sieberiana var. *hirtella*	Grey Tussock-grass	
Pimelea flava	Yellow Rice-flower	at Cheong Wildflower Sanctuary

[26] There does not seem to be a clear disjunction in Maroondah between *T. ixioides* and *T. juncifolia*.

[27] In the author's experience, all plants of the common, weedy bindweed of Maroondah's stream banks are found on close inspection to be hybrids between the indigenous *Calystegia sepium* and the introduced *C. silvatica*. The sole record of the indigenous species may not have been sufficiently carefully considered to check for hybridisation.

Wild, Indigenous Ferns and Fern Allies

None of the species listed below has any specific legal protection.

Code no.	Scientific name	Common name	Source	Missing since	No. SoBS	No. reserves	No plantings
500129	*Adiantum aethiopicum*	Common Maidenhair			33	20	0
500232	*Anogramma leptophylla*[28]	Annual Fern	AVH	1904			
500288	*Asplenium flabellifolium*	Necklace Fern	DGC	1981	1	0	0
500347	*Azolla rubra*	Pacific Azolla			5	1	0
500404	***Blechnum cartilagineum***	**Gristle Fern**			2	0	0
500407	***Blechnum minus***	**Soft Water-fern**			4	4	0
501098	***Blechnum parrisiae***	**Common Rasp-fern**			1	1	0
500887	***Calochlaena dubia***	**Common Ground-fern**			11	7	0
500730	***Cheilanthes austrotenuifolia***	**Green Rock Fern**		2012	4	4	0
500895	*Cyathea australis*	Rough Tree-fern			26	14	0
501691	*Histiopteris incisa*	Bat's Wing Fern			1	0	0
501752	***Hypolepis glandulifera***	**Downy Ground-fern**			1	0	0
501751	***Hypolepis muelleri***	**Harsh Ground-fern**			2	2	0
501753	***Hypolepis rugosula***	**Ruddy Ground-fern**			1	1	0
502014	*Lindsaea linearis*	Screw Fern			26	18	0
502345	*Ophioglossum lusitanicum*	Austral Adder's-tongue	AVH	1903			
502503	*Phylloglossum drummondii*	Pigmy Clubmoss	AVH	1912			
502645	***Polystichum proliferum***	**Mother Shield-fern**			11	6	1
502777	*Pteridium esculentum*	Austral Bracken			97	37	0
502779	*Pteris tremula*[29]	Tender Brake			7	6	0
503098	***Selaginella uliginosa***	**Swamp Selaginella**		2012	4	2	0

Indigenous Mosses and Liverworts

Because mosses and liverworts are so hard to survey thoroughly, and because there is so little prior data, the risk of each species dying out in Maroondah can rarely be inferred from this study's data. The exceptions are the two species with names in bold text below – they are more readily detected and clearly quite rare. Some of the species on the list may have already died out in Maroondah but they might also be able to re-colonise spontaneously.

None of the species listed below has any specific legal protection.

'GC' in the 'Source' column below refers to a 1982 list of mosses, liverworts and lichens at Hochkins Ridge Nature Conservation Reserves by Garry Cheers.

[28] A 1904 specimen of *Anogramma leptophylla* is labelled 'Croydon', but that name was applied to land extending well outside Maroondah at that time, including current-day Wonga Park, where the species has been collected.

[29] *Pteris tremula* has rapidly increased in abundance in Maroondah in the past two decades and was not recorded prior to 2000. It may have spread from its natural range (e.g. Dandenong Ranges) or escaped from gardens, or both. See Chapter 10 (p. 33) about whether to regard such species as indigenous.

Code no.	Scientific name	Common name	Source	Missing since	No. SoBS	No. reserves
Mosses						
506694	*Barbula calycina*	a moss			1	1
506049	*Barbula crinita*	a moss			1	1
506076	*Brachythecium rutabulum*	Rough-stalked Feather-moss			2	2
506077	*Brachythecium salebrosum*	Smooth-stalk Feather-moss	AVH	1998	0	0
506079	*Breutelia affinis*	Common Breutelia			9	6
506095	*Bryum argenteum*	Silver Moss			1	1
506121	*Calliergonella cuspidata*	a moss			6	4
506137	*Campylopus clavatus*	Broody Swan-neck Moss			47	29
506140	*Campylopus introflexus*	Heath Star Moss			39	25
506144	*Campylopus pyriformis*	Dwarf Swan-neck Moss			1	0
506154	*Ceratodon purpureus* subsp. *convolutus*	a moss			1	1
506191	*Dawsonia longiseta*	Small Dawsonia			4	3
506201	*Dicranoloma billarderi*	a moss			10	6
506214	*Didymodon torquatus*	Beard Moss			2	1
506225	*Ditrichum difficile*	a moss			3	2
506260	*Eurhynchium praelongum*	Common Feather-moss			7	5
506281	*Fissidens bifrons*	a pocket-moss			5	2
506285	*Fissidens megalotis*	a moss			1	1
506283	*Fissidens taylorii*	a moss			1	1
506329	*Funaria hygrometrica*	Common Fire-moss			3	3
506109	*Gemmabryum dichotomum*	Broody Bryum			1	1
506363	*Gymnostomum calcareum*	a moss	AVH	1951		
506387	*Hypnum cupressiforme*[30]	Common Hypnum			34	22
506413	*Lembophyllum divulsum*	String-of-Pearls	AVH	1995		
506431	*Leptostomum inclinans*	a moss	AVH	1995		
506487	*Orthodontium lineare*	Cape Thread-moss			1	1
506493	*Orthodontium tasmanicum*	a moss	GC	1982	1	1
506557	*Polytrichum juniperinum*	Common Juniper-moss			15	8
506588	*Ptychomnion aciculare*	Paper Moss, Pipe-cleaners			11	8
506609	*Racopilum cuspidigerum* var. *convolutaceum*	a moss			6	6
506659	*Rhaphidorrhynchium amoenum*	a moss			2	2
506621	*Rhynchostegium tenuifolium*	Feather Moss			6	4
506099	*Rosulabryum billarderi*	Common Thread-moss			24	15
506103	*Rosulabryum capillare*	Capillary Thread-moss			3	2
506661	*Sematophyllum homomallum*	a moss			7	7
506678	*Tayloria octoblepharum*	Dung Moss	GC	1982	1	1
506692	*Thuidiopsis furfurosa*	Golden Weft-moss			37	23
506703	*Tortula muralis*	Wall Screw-moss			0	0
506731	*Triquetrella papillata*	a moss			5	3
506745	*Wijkia extenuata*	Spear Moss			4	3
506751	*Zygodon menziesii*	a moss	AVH	1951		
Liverworts						
506040	***Asterella drummondii***	**Liquorice Strap**	GC	1982	1	1
506447	*Chiloscyphus semiteres*	Green Worms			35	21
509385	*Fossombronia* species	a liverwort			4	1
506315	***Frullania falciloba***	**a liverwort**			1	1
506450	*Lunularia cruciata*	Moonwort			10	9
506459	*Marchantia berteroana*	a liverwort			1	1
506634	*Riccia bifurca*	a liverwort			1	1
506679	*Telaranea centipes*	a liverwort	GC	1982	1	1

[30] Two varieties of *Hypnum cupressiforme* were collected during the current study: var. *cupressiforme* and var. *lacunosum*. Too few records have been identified to varietal level to provide separate statistics.

The National Herbarium of Victoria holds thirty-nine specimens of mosses and liverworts collected by a visiting Tasmanian bryologist, Richard Austin Bastow, on 8th November 1892. Although the specimens are of species normally found in rainforests and tall, wet forests, the herbarium staff have mapped them in Croydon on the basis that the collector stated the locality of most of them was 'Croydon – behind the landslip'. All but one of the remaining specimens were labelled 'Mount Corram', which the staff could not locate but they presumed the specimens were all collected in Croydon because they were all on the same day and matched the same sort of habitat requirements. The one label that differs gives the location as 'Dandenong Range, Croydon', revealing that this visiting Tasmanian in 1892 had a rather inflated concept of the extent of 'Croydon'. Croydon would have been the last village he reached before the Dandenong Ranges. The largest documented landslide in Australia's history had occurred the previous year on Mt Dandenong, from Kalorama to Montrose (Ritchie & Hunt 2000; Middelmann 2007; Lillydale Express, August 1891), and this is presumably the landslip to which Bastow referred. The reference to 'Mount Corram' seems likely to be a corruption of Mount Corhanwarrabul, which was the name of the settlement that was renamed Mount Dandenong the following year. Mount Dandenong still has rainforest habitat suitable for the species collected by Bastow. Therefore, none of Bastow's specimens are treated in this report as being from Maroondah.

Appendix B - Inventory of Naturalised Flora

The table below lists all non-indigenous species of plant species that have been recorded in Maroondah's natural and semi-natural vegetation, excluding species that the author believes were either planted or transient, with no material impact.

The table is to be interpreted the same as Appendix A except for the additional feature that underlining is used to highlight the names of species posing the most serious threats to indigenous flora – the main 'drivers', in the sense of Section 5.3 (p. 50).

Code no.	Scientific name	Common name	Source	Missing since	No. SoBS	No. reserves
Flowering Plants						
500014	*Acacia baileyana*	Cootamundra Wattle			30	17
500028	*Acacia decurrens*	Green Wattle			5	4
500031	*Acacia elata*	Cedar Wattle			21	12
500036	*Acacia floribunda*	White Sallow-wattle			15	10
500044	*Acacia howittii*	Sticky Wattle			8	8
505015	*Acacia iteaphylla*	Flinders Range Wattle			2	2
500053	*Acacia longifolia* subsp. *longifolia*	Sallow Wattle			47	28
500077	*Acacia pravissima*	Ovens Wattle		2005	2	2
503649	*Acacia prominens*	Gosford Wattle			3	3
504209	*Acacia provincialis*	Wirilda		2015	1	1
500084	*Acacia saligna*	Orange (or Golden Wreath) Wattle		2012	2	1
504210	*Acacia uncifolia*	Wirilda		2012	1	0
504389	*Acer negundo*	Box Elder			8	5
500108	*Acer pseudoplatanus*	Sycamore Maple			3	2
502975	*Acetosa sagittata*	Rambling Dock			1	1
502966	*Acetosella vulgaris*	Sheep Sorrel		2016	8	6
503638	*Agapanthus praecox* subsp. *orientalis*	Agapanthus			21	11
500153	*Agrostis capillaris*	Brown-top Bent			56	27
500162	*Agrostis viridis*	Water Bent			2	1
500164	*Aira caryophyllea*	Silvery Hair-grass			16	11
500165	*Aira cupaniana*	Small Hair-grass		2004	1	1
500166	*Aira elegantissima*	Delicate Hair-grass			13	9
500179	*Allium triquetrum*	Angled Onion			27	15
503632	*Anredera cordifolia*	Madeira Vine			1	1
500236	*Anthoxanthum odoratum*	Sweet Vernal-grass			62	32
500253	*Arbutus unedo*	Irish Strawberry Tree			15	9
500255	*Arctotheca calendula*	Cape Weed			13	6
503774	*Aristea ecklonii*	Blue Stars			1	1
500265	*Arrhenatherum elatius*	Onion Twitch, False Oat-grass			1	1
505377	*Asparagus aethiopicus*	Sprengeri Fern			4	4
500274	*Asparagus asparagoides*	Bridal Creeper			17	8
500276	*Asparagus scandens*	Asparagus Fern			18	11
500318	*Atriplex prostrata*	Hastate Orache			10	7
500340	*Avena barbata*	Bearded Oat			10	7
500346	*Axonopus fissifolius*	Narrow-leafed Carpet-grass			1	1
500384	*Bellis perennis*	English Daisy			11	5
503202	*Billardiera fusiformis*	Bluebell Creeper			17	11
500417	*Bolboschoenus caldwellii*	Salt Club-rush			1	0
500417	*Bolboschoenus medianus*	Marsh Club-rush			1	0
500488	*Brassica fruticulosa*	Twiggy Turnip			4	2
500495	*Briza maxima*	Large Quaking-grass			52	29

Code no.	Scientific name	Common name	Source	Missing since	No. SoBS	No. reserves
500496	*Briza minor*	Lesser Quaking-grass			22	12
500498	*Bromus catharticus*	Prairie Grass			33	20
500500	*Bromus diandrus*	Great Brome			19	12
500501	*Bromus hordeaceus*	Soft Brome			10	7
504662	*Cabomba caroliniana*	Fanwort	AVH	1989	0	0
508176	*Callistemon* ?*citrinus*	a bottlebrush			1	1
500570	*Callitriche brutia* var. *brutia*	a water-starwort			1	0
500574	*Callitriche stagnalis*	Pond (or Common) Water-starwort			18	11
500605	*Calystegia silvatica* and hybrids	Greater Bindweed			1	1
500612	*Cardamine flexuosa*	Wood Bitter-cress			5	5
505022	*Cardamine hirsuta*	Common Bitter-cress			5	4
500634	*Carex* ?*disticha*	Brown Sedge		1996	1	0
504619	*Carex punctata*	a sedge		2012	1	0
500687	*Catapodium rigidum*	Fern Grass			9	6
502451	*Cenchrus clandestinus*	Kikuyu			31	14
500702	*Centaurium erythraea*	Common Centaury			48	27
500705	*Centaurium tenuiflorum*	Branched Centaury			7	5
500719	*Cerastium glomeratum*	Common Mouse-ear Chickweed			23	12
500946	*Chamaecytisus palmensis*	Tree Lucerne		2012	7	3
500736	*Chenopodium album*	Fat Hen		1995	3	1
500756	*Chloris truncata*	Windmill Grass			0	0
505405	*Chlorophytum comosum*	Spider Plant			8	6
504359	*Chrysanthemoides monilifera* subsp. *monilifera*	Boneseed			28	14
500776	*Cicendia filiformis*	Slender Cicendia			4	1
500777	*Cicendia quadrangularis*	Square Cicendia			4	3
500779	*Ciclospermum leptophyllum*	Narrow-leaf Celery			2	2
500782	*Cirsium vulgare*	Spear Thistle			44	21
500803	*Conium maculatum*	Hemlock	VBA	2004	1	0
500823	*Coprosma repens*	Mirror-bush			17	11
500824	*Coprosma robusta*	Karamu		1992	1	1
504393	*Cordyline australis*	New Zealand Cabbage Tree			14	12
507640	*Correa baeuerlenii*	Chef's Cap Correa			2	2
508257	*Correa glabra*, cultivars & hybrids	non-indig. Correa			13	10
500825	*Cortaderia selloana*	Pampas Grass			17	12
504765	*Cotoneaster franchetii*	Grey Cotoneaster			3	1
500843	*Cotoneaster glaucophyllus* var. *serotinus*	Cotoneaster			35	21
500844	*Cotoneaster pannosus*	Cotoneaster			30	17
503690	*Cotoneaster simonsii*	Himalayan Cotoneaster			14	10
500848	*Cotula coronopifolia*	Water Buttons		1996	9	5
500858	*Crassula alata* var. *alata*	Three-part Crassula	VBA	2002	1	0
505186	*Crassula multicava* subsp. *multicava*	Shade Crassula		2004	7	7
500867	*Crataegus monogyna*	Hawthorn			20	13
500869	*Crepis capillaris*	Smooth Hawksbeard			22	12
500875	*Crocosmia* × *crocosmiiflora*	Montbretia			18	13
500876	*Crowea exalata*	Small Crowea			2	2
500901	*Cymbalaria muralis* subsp. *muralis*	Ivy-leaf Toad-flax			0	0
504554	*Cynodon dactylon* var. *dactylon*	Couch			36	22
500912	*Cynosurus echinatus*	Rough Dog's-tail			11	10
500916	*Cyperus congestus*	Dense Flat-sedge			1	1
500918	*Cyperus eragrostis*	Drain Flat-sedge			38	18
500947	*Cytisus scoparius*	English Broom			12	8
500948	*Dactylis glomerata*	Cocksfoot			52	24
503148	*Danthonia decumbens*	Heath Grass			4	2

Code no.	Scientific name	Common name	Source	Missing since	No. SoBS	No. reserves
500988	*Daucus carota*	Carrot			5	3
503118	*Delairea odorata*	Cape Ivy			8	7
505561	*Dianella caerulea* var. *producta*	Tall Flax-lily			4	3
501048	*Digitaria sanguinalis*	Summer-grass			1	1
505502	*Dimorphotheca fruticosa*	Dimorphotheca		1999	1	1
501077	*Dittrichia graveolens*	Stinkweed			3	0
501095	*Dodonaea viscosa*	Sticky Hop-bush			2	2
500748	*Dysphania pumilio*	Clammy Goosefoot			0	0
501118	*Echinochloa crus-galli*	Common Barnyard Grass			10	5
501123	*Echium plantagineum*	Paterson's Curse			2	1
501126	*Egeria densa*	Dense Waterweed			4	3
501128	*Ehrharta erecta* var. *erecta*	Panic Veldt-grass			59	28
501129	*Ehrharta longiflora*	Annual Veldt-grass			28	17
505732	*Einadia nutans* (matted form)	Nodding Saltbush			3	1
501134	*Einadia trigonos* subsp. *trigonos*	Lax Goosefoot			1	1
501176	*Epilobium ciliatum*	Glandular Willow-herb			7	4
501210	*Erica lusitanica*	Spanish Heath			28	17
501706	*Erica quadrangularis*	Angled Heath			1	1
500812	*Erigeron bonariense*	Flaxleaf Fleabane			7	4
501212	*Erigeron karvinskianus*	Seaside Daisy			12	9
500810	*Erigeron sumatrensis*	Fleabane			30	22
505295	*Eriobotrya japonica*	Loquat			7	7
509283	*Eucalyptus* species	naturalised eucalypts			0	0
501332	*Euphorbia peplus*	Petty Spurge			15	9
501356	*Festuca arundinacea*	Tall Fescue			23	15
501363	*Festuca rubra*	Red Fescue			2	2
501370	*Foeniculum vulgare*	Fennel		2012	6	1
504306	*Fraxinus angustifolia* subsp. *angustifolia*	Desert Ash			23	14
501378	*Freesia alba* × *leichtlinii*	Freesia			9	6
503684	*Freesia laxa* subsp. *laxa*	Anomatheca			1	1
501379	*Fumaria bastardii*	Bastards Fumitory			2	1
501380	*Fumaria capreolata*	Ramping Fumitory	VBA	2006	1	0
501382	*Fumaria muralis* subsp. *muralis*	Wall Fumitory			5	4
501402	*Galium aparine*	Cleavers			41	20
501412	*Galium murale*	Small Bedstraw			2	1
504336	*Gamochaeta purpurea*	Spiked Cudweed			10	7
501421	*Genista linifolia*	Flax-leafed Broom			5	4
501422	*Genista monspessulana*	Montpellier Broom			25	16
501426	*Geranium dissectum*	Cut-leaf Crane's-bill			5	2
501428	*Geranium molle* var. *molle*	Dovesfoot			1	0
505338	*Geranium robertianum*	Herb Robert			1	1
503751	*Geranium yeoi*	Geranium			1	1
–	*Geranium yeoi* × ?	a hybrid geranium			1	1
501438	*Gladiolus undulatus*	Wild Gladiolus			11	8
501452	*Glyceria declinata*	Manna Grass			5	2
505206	*Grevillea* hybrids and cultivars				17	14
507155	*Grevillea juniperina*	Prickly Spider-flower			2	2
501541	*Grevillea lavandulacea*	Lavender Grevillea			1	1
507157	*Grevillea robusta*	Southern Silky Oak			7	6
505748	*Hakea salicifolia* subsp. *salicifolia*	Willow-leaf Hakea			21	14
501599	*Hedera helix*	Ivy			53	26
505983	*Hedychium gardnerianum*	Ginger Lily			1	0
502511	*Helminthotheca echioides*	Ox-tongue			22	12
501692	*Holcus lanatus*	Yorkshire Fog			46	26

Code no.	Scientific name	Common name	Source	Missing since	No. SoBS	No. reserves
505578	*Homalanthus populifolius*	Bleeding Heart			7	6
501744	*Hypericum perforatum* subsp. *veronense*	St John's Wort			2	0
501745	*Hypericum tetrapterum* var. *tetrapterum*	Square-stem St John's Wort			12	6
501747	*Hypochaeris glabra*	Smooth Cat's Ear		2000	2	1
501748	*Hypochaeris radicata*	Cat's Ear			63	33
501759	*Ilex aquifolium*	Holly			10	6
501762	*Ipomoea indica*	Lear's Morning-glory			3	2
503784	*Iris pseudacorus*	Yellow Flag			1	1
501778	*Isolepis hystrix*	Awned Club-rush			1	0
500936	*Isolepis levynsiana*	Tiny Flat-sedge			16	8
505948	*Jasminum polyanthum*	Pink (or Winter) Jasmine			11	11
501806	*Juncus articulatus*	Jointed Rush			25	14
501811	*Juncus bulbosus*	Bulbous Rush			1	0
501813	*Juncus capitatus*	Dwarf Rush			9	3
501823	*Juncus imbricatus*	Folded Rush			2	0
501828	*Juncus microcephalus*	Tiny Rush			2	1
501844	*Juncus tenuis*	Slender Rush			2	0
501848	*Kennedia rubicunda*	Dusky Coral-pea			4	1
501860	*Lactuca serriola*	Prickly Lettuce			14	9
501869	*Lapsana communis* subsp. *communis*	Nipplewort			1	0
501895	*Leontodon saxatilis*	Lesser Hawkbit			26	13
501896	*Lepidium africanum*	Common Pepper-cress			1	1
502002	*Ligustrum lucidum*	Large-leafed Privet			20	12
504689	*Ligustrum vulgare*	European Privet			5	3
502018	*Linum trigynum*	French Flax			26	15
507270	*Lolium* × *hybridum*[31]	Hybrid Rye-grass			1	1
502035	*Lolium multiflorum*	Italian Rye-grass			1	1
502036	*Lolium perenne*	Perennial Rye-grass			14	8
502053	*Lonicera japonica*	Japanese Honeysuckle			38	22
502058	*Lotus corniculatus*	Bird's-foot Trefoil			4	3
505103	*Lotus preslii*	a bird's-foot trefoil			0	0
502060	*Lotus subbiflorus*	Hairy Bird's-foot Trefoil			19	12
502061	*Lotus uliginosus*	Greater Bird's-foot Trefoil			3	2
500223	*Lysimachia arvensis*	Pimpernel			28	13
500224	*Lysimachia minima*	Chaffweed			1	0
502091	*Lythrum junceum*	Mediterranean Loosestrife		1996	1	1
502118	*Malus pumila*	Domestic Apple			9	4
502122	*Malva parviflora*	Small-flowered Mallow	VBA	2006	2	0
502134	*Medicago arabica*	Spotted Medic		1999	3	1
502137	*Medicago lupulina*	Black Medic			3	2
502140	*Medicago polymorpha*	Burr Medic			8	4
502145	*Melaleuca armillaris*	Bracelet Honey-myrtle			3	3
502154	*Melaleuca parvistaminea*	Rough-barked Honey-myrtle			1	1
502161	*Melilotus indicus*	Sweet Melilot			1	1
502163	*Melissa officinalis*	Lemon Balm			1	1
502168	*Mentha* × *piperita*	Peppermint or Lemon Mint			4	4
502169	*Mentha pulegium*	Pennyroyal		2012	1	0
502171	*Mentha spicata*	Spearmint		2004	1	1
505868	*Mercurialis annua*	Annual Mercury			1	1
502213	*Modiola caroliniana*	Carolina Mallow			11	5

[31] Rye-grasses of various cultivars and hybrids are regularly planted along Maroondah's stream banks. They are often intermediate between *Lolium perenne*, *L. multiflorum* and the hybrid between them, *L.* × *hybridum*.

Code no.	Scientific name	Common name	Source	Missing since	No. SoBS	No. reserves
502214	*Moenchia erecta*	Erect Chickweed			1	1
502247	*Myosotis sylvatica*	Wood Forget-me-not			10	8
505789	*Nandina domestica*	Sacred Bamboo			3	3
503282	*Nassella neesiana*	Chilean Needle-grass			2	0
502263	*Nassella trichotoma*	Serrated Tussock		c. 2010	2	1
502947	*Nasturtium microphyllum*	One-row Watercress			1	1
502948	*Nasturtium officinale*	Watercress			14	9
503906	*Oxalis corniculata*	Creeping Wood-sorrel			4	2
502383	*Oxalis incarnata*	Pale Wood-sorrel			30	18
502384	*Oxalis latifolia*	Large-leaf Wood-sorrel		1996	1	1
502387	*Oxalis pes-caprae*	Soursob			18	12
502388	*Oxalis purpurea*	Large-flower Wood-sorrel			4	2
502399	*Pandorea pandorana*[32]	Wonga Vine			59	35
500169	*Paraserianthes lophantha* subsp. *lophantha*	Cape Wattle		2012	3	2
502430	*Paspalum dilatatum*	Paspalum			41	20
502431	*Paspalum distichum*	Water Couch			16	11
502432	*Passiflora caerulea*	Brazilian Passion-flower			1	0
502433	*Passiflora cinnabarina*	Red Passion-flower		2016	1	1
503932	*Passiflora tarminiana*	Banana Passionfruit			4	4
528484	*Persicaria capitata*	Pink-head Knotweed			1	1
502633	*Persicaria maculosa*	Persicaria			4	3
505547	*Persicaria odorata*	Vietnamese Mint			1	1
502476	*Phalaris aquatica*	Toowoomba Canary-grass			16	10
502510	*Phytolacca octandra*	Red-ink Weed			2	0
502372	*Piptatherum miliaceum*	Smilo Grass, Rice Millet			1	0
505796	*Pittosporum tenuifolium*	Kohuhu			2	1
502543	*Pittosporum undulatum*	Sweet Pittosporum			66	32
502553	*Plantago coronopus*	Buck's-horn Plantain			10	3
502561	*Plantago lanceolata*	Ribwort			54	27
502562	*Plantago major*	Greater Plantain			17	12
505196	*Plectranthus ecklonii*	Blue Spur-flower			1	1
502580	*Poa annua*	Annual Meadow-grass			18	11
502599	*Poa infirma*[33]	Early Meadow-grass			1	1
502611	*Poa trivialis*	Rough Meadow-grass			3	2
502622	*Polycarpon tetraphyllum*	Four-leafed Allseed			7	4
502624	*Polygala myrtifolia*	Myrtle-leaf Milkwort		1999	2	2
503954	*Polygonum arenastrum*	Wireweed			2	0
504000	*Polygonum aviculare*	Wireweed, Hogweed			6	4
502640	*Polypogon monspeliensis*	Annual Beard-grass			4	3
502679	*Populus alba*	White Poplar			1	1
501113	*Potentilla indica*	Indian Strawberry			6	5
502757	*Prunella vulgaris*	Self-heal			36	18
502758	*Prunus cerasifera*	Cherry-plum			39	22
502759	*Prunus laurocerasus*	Cherry Laurel		1997	2	1
502775	*Psoralea pinnata*	Blue Psoralea		1996	2	1
504878	*Pyracantha angustifolia*	Orange Firethorn			2	1
503955	*Pyracantha crenulata*	Nepal Firethorn	VBA	2000	1	1
502884	*Quercus robur*	English Oak		1998	6	2
502897	*Ranunculus muricatus*	Sharp Buttercup			7	4

[32] The first record of *Pandorea pandorana* in Maroondah was in 1990 at Hochkins Ridge, where it had been absent during two prior botanical surveys. Its population has since exploded and it is often smothering indigenous plants and seriously affecting the whole ecology of native vegetation. See also Chapter 10 (p. 33).

[33] *Poa infirma* is so similar to *Poa annua* that separate statistics cannot be provided.

Code no.	Scientific name	Common name	Source	Missing since	No. SoBS	No. reserves
502906	*Ranunculus repens*	Creeping Buttercup			31	17
502917	*Raphanus raphanistrum*	Wild Radish			8	5
505294	*Rhaphiolepis indica*	Indian Hawthorn			6	4
502939	*Ricinus communis*	Castor Oil Plant			1	1
502942	*Romulea rosea*	Common Onion-grass			38	22
502949	*Rorippa palustris*	Yellow Marsh-cress			1	0
502950	*Rosa rubiginosa*	Sweet Briar			14	5
502959	*Rubus anglocandicans*[34]	Blackberry			75	31
502969	*Rumex conglomeratus*	Clustered Dock			20	10
502970	*Rumex crispus*	Curled Dock			26	15
502985	*Sagina apetala*	Common Pearlwort			3	2
502989	*Salix babylonica / sepulcralis*	Weeping Willow			3	1
502990	*Salix cinerea*	Grey Sallow			3	3
503038	*Schoenoplectus tabernaemontani*[35]	River Club-rush			8	2
503132	*Senecio vulgaris*	Common Groundsel			2	1
503133	*Setaria parviflora*	Slender Pigeon Grass			7	5
503134	*Setaria pumila* subsp. *pumila*	Pale Pigeon-grass			1	1
503163	*Sisyrinchium iridifolium* s.l.[36]	Striped Rush-leaf			10	3
503995	*Solanum mauritianum*	Tobacco-bush			6	2
505322	*Solanum nigrum*	Black Nightshade			27	16
503168	*Solanum nodiflorum*	Glossy Nightshade			9	7
503187	*Solanum pseudocapsicum*	Madeira Winter-cherry			2	1
503194	*Soleirolia soleirolii*	Baby's Tears			6	5
503199	*Soliva sessilis*	Jo Jo			5	2
505712	*Sonchus asper*	Rough Sow-thistle			13	7
503204	*Sonchus oleraceus*	Sow-thistle			57	29
503209	*Sparaxis tricolor*	Harlequin-flower			1	0
503226	*Sporobolus africanus*	Rat-tail Grass			4	2
503240	*Stachys arvensis*	Stagger Weed			5	2
503251	*Stellaria media*	Chickweed			12	7
503260	*Stenotaphrum secundatum*	Buffalo Grass		2016	1	1
500297	*Symphyotrichum subulatum*	Aster-weed			29	20
500115	*Syzygium smithii*	Lilly Pilly			6	4
509122	*Taraxacum* sp.	Dandelion			32	20
503366	*Torilis arvensis*	Spreading Hedge-parsley			7	6
503416	*Tradescantia fluminensis*	Wandering Jew			33	19
503417	*Tragopogon porrifolius*	Salsify		2004	2	0
503425	*Trifolium campestre* var. *campestre*	Hop Clover			2	1
503427	*Trifolium dubium*	Suckling Clover			19	9
503428	*Trifolium fragiferum* var. *fragiferum*	Strawberry Clover			4	4
503435	*Trifolium repens* var. *repens*	White Clover			27	14
503440	*Trifolium subterraneum*	Subterranean Clover			5	1
504006	*Tropaeolum majus*	Nasturtium			7	6
503469	*Typha latifolia*	Great Reedmace			4	2
503471	*Ulex europaeus*	Gorse (Furze)			24	12
503496	*Verbena bonariensis*	Purple-top Verbena			8	4
503502	*Veronica arvensis*	Wall Speedwell			5	3

[34] Several other species of blackberry have been recorded once each in Maroondah, without any specimen being lodged with the National Herbarium of Victoria. Such records cannot be given much weight.

[35] Wild plants of *Schoenoplectus tabernaemontani* were first recorded in Maroondah in 2012, following extensive plantings in local wetlands. The species is steadily displacing indigenous wetland plants, some of them rare.

[36] Plants previously identified as *Sisyrinchium iridifolium* in Australia have recently been recognised to belong to two species – *S. micranthum* and *S. rosulatum*. Both those species are present in Maroondah.

Code no.	Scientific name	Common name	Source	Missing since	No. SoBS	No. reserves
503511	*Veronica persica*	Persian Speedwell			5	4
504042	*Viburnum tinus*	Laurustinus			10	9
503516	*Vicia hirsuta*	Tiny Vetch			14	10
505053	*Vicia sativa* subsp. *nigra*	Narrow-leaf Vetch			19	11
503519	*Vicia tetrasperma*	Slender Vetch			3	3
503524	*Vinca major*	Blue Periwinkle			8	6
503531	*Viola odorata*	Fragrant Violet			14	10
503544	*Vulpia bromoides*	Squirrel-tail Fescue			31	21
503549	*Vulpia myuros*	Rat's-tail Fescue			7	4
503562	*Watsonia meriana* var. *bulbillifera*	Bulbil Watsonia			21	13
505762	*Westringia fruticosa*	Coast Rosemary			3	2
503599	*Zantedeschia aethiopica*	White Arum Lily			14	9

Conifer

502539	*Pinus radiata*	Monterey Pine			56	27

Ferns

–	*Cyathea cooperi*	Cicatrice Tree-fern			1	1
501039	*Dicksonia antarctica*	Soft Tree-fern			2	2
505575	*Nephrolepis cordifolia*	Fishbone Fern			1	1
–	*Pteris cretica*	Cretan Brake			1	1
503097	*Selaginella kraussiana*	Garden Selaginella			2	1

Mosses

506074	*Brachythecium albicans*	Whitish Feather-moss			3	3
506575	*Pseudoscleropodium purum*	Neat Feather-moss			22	15

Appendix C - Inventory of Fungi and Lichens

The following list of fungi in Maroondah was extracted from the Atlas of Living Australia on 25th October 2018. It contains 118 species. The records of *Amanita muscaria* and *Cladia retipora* have been updated here to include the author's 2018 observations, and *Aseroe rubra* has been added on the basis of the author's observations in c. 2000.

Common name	Scientific name	Years
Agaricus xanthodermus	Yellowing Mushroom	2000–2009
Agrocybe		2015
Aleuria aurantia	Orange Peel Fungus	1963
Amandinea punctata		1899
Amanita muscaria	Fly Agaric	1996–2018
Amanita ochrophylla		1936, 1948
Amanita phalloides	Death Flycap	2006–2013
Amanita xanthocephala		1998–2000
Antrodiella citrea		1969
Aseroe rubra		c. 2000
Austroparmelina conlabrosa		1899
Boletus satanas		2012
Buellia		1899
Byssomerulius		1953
Calicium victorianum		1985
Cantharellus concinnus		2010
Ceriporia		1953
Cladia aggregata		1899
Cladia retipora		1951-2018
Cladonia cariosa		1951
Cladonia cervicornis subsp. *verticillata*		1885
Cladonia confusa		1951
Cladonia corniculata		1885
Cladonia floerkeana		1985
Cladonia macilenta		1951–1957
Cladonia praetermissa		1985
Cladonia rigida		1885–1951
Clathrus archeri	Devil's Fingers	1952–1999
Coprinellus		2015–2018
Coprinus comatus	Lawyer's Wig	1989–2011
Cordyceps brittlebankii		?
Corticium utriculicum		1972
Cyphelium		1985
Daldinia		2015
Descomyces		1993
Dichomitus leucoplacus		1953
Flavoparmelia rutidota		1899
Fuscoporia		1972
Geastrum floriforme		1966
Geoglossum glutinosum		1993
Geoglossum nigritum		1971
Gloeophyllum		2018
Glomus macrocarpum		1971
Gymnopilus		2015
Hexagonia vesparia		1948
Hjortstamia crassa		1969
Hygrocybe		2016
Hymenochaete separata		1972
Hymenogaster		1985
Hymenopellis radicata		2003–2011
Hyphodontia flavipora		1969–1972
Hyphodontia lanata		1972

Common name	Scientific name	Years
Hypocreomycetidae		2013
Hypogymnia billardierei		1899–1901
Hypogymnia subphysodes		1901–1951
Lactarius		1985
Lamprospora		1935
Lecanora		1899
Lecidea		1899
Lepiota		1970
Lepista nuda	Wood Blewit	1993–2004
Leratiomyces		2018
Lycoperdon scabrum		1967
Macrolepiota clelandii	Bush Parasol	2013
Marasmius		2015
Micromphale		1988
Morchella conica		1997
Omphalotus nidiformis		2000
Pannoparmelia angustata		1899
Pannoparmelia wilsonii		1899
Paraporpidia leptocarpa		1885
Parmotrema perlatum		1920
Peniophora crustosa		1972
Perenniporia ochroleuca		1969
Perenniporia		1953–1972
Pertusaria		1885
Phaeolus schweinitzii	Dyer's Mazegill	1995–2004
Phallaceae		2016
Phlebia subceracea		2004
Phlebiella		1972
Phlebopus marginatus		2001–2013
Phycomyces		2015
Phylloporus clelandii		2013
Physisporinus		1954
Pisolithus arhizus		2013
Pisolithus marmoratus		2016
Plectania melastoma		?
Podoscypha petalodes subsp. *floriformis*		1960
Podoscypha petalodes		2001
Polyporus arcularius		1951
Postia pelliculosa		2012
Protoglossum		1967
Punctelia subrudecta		1899
Radulodon calcareus		1972
Ramalinaceae		1899
Ramboldia laeta		1899
Ramboldia stuartii		1901
Ramsbottomia crechqueraultii		?
Raveneliaceae		1977
Rhizocarpon geographicum		1899
Rhizochaete filamentosa		1969
Rhizopogon luteolus	Yellow False Truffle	1970
Rhizopogon roseolus		1966–1970
Russula		2016
Sarcodontia		1973
Schizophyllum commune	Split Gill	?
Scleroderma		1981
Scutellinia vinosobrunnea		?
Scytinostroma		1972
Sphaeronaema		?
Stereum hirsutum	Hairy Curtain Crust	2004
Stereum illudens		1953

Common name	Scientific name	Years
Stereum ochraceoflavum		1953
Trametes versicolor	Turkeytail	2016
Tremella fuciformis		2004
Ustilaginales		2001
Venturia inaequalis		1925
Xerula		2011
Zelleromyces striatus		1967

Appendix D - Fauna Inventory

The following tables list Maroondah's wild vertebrate species and butterflies, excluding presumed aviary escapees.

Within each major group of fauna, species are ordered according to the taxonomic sequence presently used by the Department of Environment, Land, Water and Planning.

The columns of the lists contain the following information:

Column heading	Description
Code no.	Identifier given to each species by the Department of Environment, Land, Water and Planning.
Names	An asterisk before a species' common name indicates that it has arrived in Maroondah since European colonisation. Red text indicates there is a reasonable presumption that the species was once resident or at a least a regular visitor but is unlikely to return in the foreseeable future, except perhaps as transients or rare visitors.
Legal status	Protective measures under Australian law, indicated by combinations of these letters: C, E or V: Listed under the federal *Environmental Protection and Biodiversity Conservation Act 1999* as Critically endangered, Endangered or Vulnerable, respectively; L: Listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*; c, d, e, n or v: Listed in the *'Advisory List of Threatened Vertebrate Fauna in Victoria – 2013'* as critically endangered, data-deficient, endangered, near-threatened or vulnerable, respectively.
Treaties (for birds only)	International treaties regarding migratory species. 'B' refers to the 'Bonn Agreement'; 'C' to the China-Australia Migratory Bird Agreement; 'J' to the Japan-Australia Migratory Bird Agreement; and 'R' to the Republic of Korea – Australia Migratory Bird Agreement.
Missing since	The year of the most recent record, if the species has not been recorded since 2017.
No. SoBS	The number of 'sites of biological significance' (SoBS) in Volume 2 where each species has been recorded in the past 40 years.

Mammals

Code no.	Common name	Scientific name	Legal Status	Missing since	No. SoBS
5136	Platypus	*Ornithorhynchus anatinus*		2015	2
11003	Short-beaked Echidna	*Tachyglossus aculeatus*			10
11008	Spot-tailed Quoll	*Dasyurus maculatus maculatus*	ELe	1980	0
11162	Koala	*Phascolarctos cinereus*		2007	5
11113	Common Brushtail Possum	*Trichosurus vulpecula*			18
11138	Sugar Glider	*Petaurus breviceps*			6
11129	Common Ringtail Possum	*Pseudocheirus peregrinus*			17
11265	Eastern Grey Kangaroo	*Macropus giganteus*			9
11242	Black Wallaby	*Wallabia bicolor*			7
11280	*Grey-headed Flying-fox	*Pteropus poliocephalus*	VLv		0

Code no.	Common name	Scientific name	Legal Status	Missing since	No. SoBS
11324	White-striped Freetail Bat	*Tadarida australis*		2012	7
11349	Gould's Wattled Bat	*Chalinolobus gouldii*		2014	1
61341	Common Bent-wing Bat	*Miniopterus schreibersii*	L	1974	0
11335	Lesser Long-eared Bat	*Nyctophilus geoffroyi*		2002	3
11334	Gould's Long-eared Bat	*Nyctophilus gouldi*		2002	1
11811	Eastern Broad-nosed Bat	*Scotorepens orion*		2002	1
11381	Large Forest Bat	*Vespadelus darlingtoni*		1990	1
11378	Southern Forest Bat	*Vespadelus regulus*		2002	2
11379	Little Forest Bat	*Vespadelus vulturnus*		2002	2
11415	Australian Water Rat, Rakali	*Hydromys chrysogaster*			2
11412	*House Mouse	*Mus musculus*			2
11395	Bush Rat	*Rattus fuscipes*		1991–92	1
11398	Swamp Rat	*Rattus lutreolus*			2
11409	*Brown Rat	*Rattus norvegicus*		1991–92	2
11408	*Black Rat	*Rattus rattus*			2
528552	*Red Fox	*Vulpes vulpes*			18
11523	*Fallow Deer	*Cervus dama*		1983	0
11527	*Sambar	*Cervus unicolor*			2
11510	*European Rabbit	*Oryctolagus cuniculus*			19

Birds

Code no.	Common name	Scientific name	Legal Status	Treat-ies	Missing since	No. SoBS
10216	Blue-billed Duck	*Oxyura australis*	Le		2014	3
10203	Black Swan	*Cygnus atratus*			1995	1
10202	Australian Wood Duck	*Chenonetta jubata*				25
10948	*Northern Mallard	*Anas platyrhynchos*				4
10208	Pacific Black Duck	*Anas superciliosa*				29
903490	*Pacific Black Duck/Mallard Hybrid	*Anas superciliosa* × *platyrhynchos*			2008	0
10211	Grey Teal	*Anas gracilis*				5
10210	Chestnut Teal	*Anas castanea*				4
10215	Hardhead	*Aythya australis*	v			3
10061	Australasian Grebe	*Tachybaptus novaehollandiae*				8
10062	Hoary-headed Grebe	*Poliocephalus poliocephalus*			2015	1
10101	Australasian Darter	*Anhinga novaehollandiae*				3
10100	Little Pied Cormorant	*Microcarbo melanoleucos*				8
10099	Pied Cormorant	*Phalacrocorax varius*	n		2015	1
10097	Little Black Cormorant	*Phalacrocorax sulcirostris*				6
10096	Great Cormorant	*Phalacrocorax carbo*				2
10106	Australian Pelican	*Pelecanus conspicillatus*				2
10188	White-faced Heron	*Egretta novaehollandiae*				21
10189	White-necked Heron	*Ardea pacifica*				6
10187	Eastern Great Egret	*Ardea modesta*	Lv	C,J		4
10186	Intermediate Egret	*Ardea intermedia*	Le			1
10977	*Eastern Cattle Egret	*Ardea ibis*		C,J	1978–89	0
10192	Nankeen Night Heron	*Nycticorax caledonicus hillii*	n			3
10179	Australian White Ibis	*Threskiornis molucca*				13
10180	Straw-necked Ibis	*Threskiornis spinicollis*				5
10181	Royal Spoonbill	*Platalea regia*	n		1976	0
10182	Yellow-billed Spoonbill	*Platalea flavipes*				4

Code no.	Common name	Scientific name	Legal Status	Treat-ies	Missing since	No. SoBS
10232	Black-shouldered Kite	*Elanus axillaris*				6
10230	Square-tailed Kite	*Lophoictinia isura*	Lv		2013	0
10228	Whistling Kite	*Haliastur sphenurus*				1
10226	White-bellied Sea-Eagle	*Haliaeetus leucogaster*			2011	0
10221	Brown Goshawk	*Accipiter fasciatus*				7
10220	Grey Goshawk	*Accipiter novaehollandiae novaehollandiae*	Lv		2013	0
10222	Collared Sparrowhawk	*Accipiter cirrhocephalus*				1
10224	Wedge-tailed Eagle	*Aquila audax*				2
10239	Brown Falcon	*Falco berigora*			2008	0
10235	Australian Hobby	*Falco longipennis*				2
10237	Peregrine Falcon	*Falco peregrinus*				1
10240	Nankeen Kestrel	*Falco cenchroides*				1
10046	Buff-banded Rail	*Gallirallus philippensis*				5
10058	Purple Swamphen	*Porphyrio porphyrio*				9
10056	Dusky Moorhen	*Gallinula tenebrosa*				15
10059	Eurasian Coot	*Fulica atra*				9
10014	Painted Button-quail	*Turnix varia*			2016	0
10168	Latham's Snipe	*Gallinago hardwickii*				1
10144	Black-fronted Dotterel	*Elseyornis melanops*			1995	2
10133	Masked Lapwing	*Vanellus miles*				18
10125	Silver Gull	*Chroicocephalus novaehollandiae*				1
10957	*Rock Dove	*Columba livia*			2010	5
10989	*Spotted Dove	*Spilopelia chinensis*				45
10034	Common Bronzewing	*Phaps chalcoptera*				18
10035	Brush Bronzewing	*Phaps elegans*			2000	0
10043	*Crested Pigeon	*Ocyphaps lophotes*				13
10031	Diamond Dove	*Geopelia cuneata*	Ln		1980s	0
10267	Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*				19
10268	Gang-gang Cockatoo	*Callocephalon fimbriatum*				13
10273	Galah	*Eolophus roseicapillus*				24
10272	Long-billed Corella	*Cacatua tenuirostris*				0
10271	Little Corella	*Cacatua sanguinea*				16
10269	Sulphur-crested Cockatoo	*Cacatua galerita*				19
10254	Rainbow Lorikeet	*Trichoglossus haematodus*				36
10256	*Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*			1990	1
10258	Musk Lorikeet	*Glossopsitta concinna*				18
10260	Little Lorikeet	*Glossopsitta pusilla*				2
10259	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*				1
10281	Australian King-Parrot	*Alisterus scapularis*				24
10282	Crimson Rosella	*Platycercus elegans*				38
10288	Eastern Rosella	*Platycercus eximius*				41
10295	Red-rumped Parrot	*Psephotus haematonotus*				0
10337	Pallid Cuckoo	*Cacomantis pallidus*			2012	1
10338	Fan-tailed Cuckoo	*Cacomantis flabelliformis*				10
10342	Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*				3
10344	Shining Bronze-Cuckoo	*Chrysococcyx lucidus*				4
10347	Pacific (or Eastern) Koel	*Eudynamys orientalis*				0
10348	Channel-billed Cuckoo	*Scythrops novaehollandiae*			1983	0
10248	Powerful Owl	*Ninox strenua*	Lv			2
10246	Barking Owl	*Ninox connivens connivens*	Le			1
10242	Southern Boobook	*Ninox novaeseelandiae*				3
10249	Eastern Barn Owl	*Tyto delicatula*				1

Code no.	Common name	Scientific name	Legal Status	Treat-ies	Missing since	No. SoBS
10313	Tawny Frogmouth	*Podargus strigoides*				12
10317	Australian Owlet-nightjar	*Aegotheles cristatus*				1
10334	White-throated Needletail	*Hirundapus caudacutus*	v	C,J,R	2016	4
10335	Fork-tailed (or Pacific) Swift	*Apus pacificus*		C,J,R	2015	0
10319	Azure Kingfisher	*Alcedo azurea*	n		1988	0
10322	Laughing Kookaburra	*Dacelo novaeguineae*				34
10326	Sacred Kingfisher	*Todiramphus sanctus*				3
10558	White-throated Treecreeper	*Cormobates leucophaeus*				3
10560	Red-browed Treecreeper	*Climacteris erythrops*			1980s	0
10529	Superb Fairy-wren	*Malurus cyaneus*				20
10565	Spotted Pardalote	*Pardalotus punctatus punctatus*				34
10976	Striated Pardalote	*Pardalotus striatus*				3
10488	White-browed Scrubwren	*Sericornis frontalis*				19
10494	Large-billed Scrubwren	*Sericornis magnirostris*			1999	0
10504	Speckled Warbler	*Chthonicola sagittatus*	Lv		1909	0
10465	Weebill	*Smicrornis brevirostris*			2000	4
10475	Brown Thornbill	*Acanthiza pusilla*				37
10484	Buff-rumped Thornbill	*Acanthiza reguloides*			1980s	0
10486	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*			2012	4
10471	Yellow Thornbill	*Acanthiza nana*			2012	2
10470	Striated Thornbill	*Acanthiza lineata*				21
10638	Red Wattlebird	*Anthochaera carunculata*				51
10637	Little Wattlebird	*Anthochaera chrysoptera*				13
10645	Noisy Friarbird	*Philemon corniculatus*			2008	0
10603	Regent Honeyeater	*Anthochaera phrygia*	CLc		1917	0
10633	Bell Miner	*Manorina melanophrys*			2004	14
10634	Noisy Miner	*Manorina melanocephala*				37
10605	Lewin's Honeyeater	*Meliphaga lewinii*			1990–96	1
10614	Yellow-faced Honeyeater	*Lichenostomus chrysops*				4
10617	White-eared Honeyeater	*Lichenostomus leucotis*				1
10625	White-plumed Honeyeater	*Lichenostomus penicillatus*			2015	15
10583	Brown-headed Honeyeater	*Melithreptus brevirostris*				1
10578	White-naped Honeyeater	*Melithreptus lunatus*			2015	3
10630	Crescent Honeyeater	*Phylidonyris pyrrhoptera*			1910	0
10631	New Holland Honeyeater	*Phylidonyris novaehollandiae*				6
10591	Eastern Spinebill	*Acanthorhynchus tenuirostris*				28
10586	Scarlet Honeyeater (Myzomela)	*Myzomela sanguinolenta*				1
10377	Jacky Winter	*Microeca fascinans*			2014	1
10380	Scarlet Robin	*Petroica boodang*				3
10381	Red-capped Robin	*Petroica goodenovii*			1980s	0
10382	Flame Robin	*Petroica phoenicea*			2015	1
10384	Rose Robin	*Petroica rosea*			1990	1
10383	Pink Robin	*Petroica rodinogaster*			1990	1
10392	Eastern Yellow Robin	*Eopsaltria australis*				6
10421	Eastern Whipbird	*Psophodes olivaceus*			1897	0
10436	Spotted Quail-thrush	*Cinclosoma punctatum*	n		1924	0
10549	Varied Sittella	*Daphoenositta chrysoptera*				3
10416	Crested Shrike-tit	*Falcunculus frontatus*			1996	3
10398	Golden Whistler	*Pachycephala pectoralis*				13
10401	Rufous Whistler	*Pachycephala rufiventris*				7
10408	Grey Shrike-thrush	*Colluricincla harmonica*				12
10365	Leaden Flycatcher	*Myiagra rubecula*				1
10366	Satin Flycatcher	*Myiagra cyanoleuca*		B		1
10369	Restless Flycatcher	*Myiagra inquieta*			1980s	0

Code no.	Common name	Scientific name	Legal Status	Treat-ies	Missing since	No. SoBS
10415	Magpie-lark	*Grallina cyanoleuca*				37
10362	Rufous Fantail	*Rhipidura rufifrons*		B	2000	1
10361	Grey Fantail	*Rhipidura albiscapa*				24
10364	Willie Wagtail	*Rhipidura leucophrys*				19
10424	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*				18
10430	White-winged Triller	*Lalage sueurii*				1
10671	Olive-backed Oriole	*Oriolus sagittatus*				15
10544	Masked Woodswallow	*Artamus personatus*			2012	0
10545	White-browed Woodswallow	*Artamus superciliosus*			2012	1
10547	Dusky Woodswallow	*Artamus cyanopterus*				5
10702	Grey Butcherbird	*Cracticus torquatus*				52
10705	Australian Magpie	*Cracticus tibicen*				52
10694	Pied Currawong	*Strepera graculina*				33
10697	Grey Currawong	*Strepera versicolor*				17
10930	Australian Raven	*Corvus coronoides*			2006	4
10954	Little Raven	*Corvus mellori*				47
10693	White-winged Chough	*Corcorax melanorhamphos*			1996	1
10995	*House Sparrow	*Passer domesticus*			2006	6
10994	*Eurasian Tree Sparrow	*Passer montanus*			1976	0
10653	Zebra Finch	*Taeniopygia guttata*			2007	0
10662	Red-browed Finch	*Neochmia temporalis*				9
10997	*European Greenfinch	*Chloris chloris*				3
528559	*European Goldfinch	*Carduelis carduelis*				6
10564	Mistletoebird	*Dicaeum hirundinaceum*				4
10357	Welcome Swallow	*Hirundo neoxena*				25
10360	Fairy Martin	*Petrochelidon ariel*				0
903569	Australian Reed Warbler	*Acrocephalus australis*			2015	0
10522	Little Grassbird	*Megalurus gramineus*				1
10509	Rufous Songlark	*Cincloramphus mathewsi*			1907	0
10525	Golden-headed Cisticola	*Cisticola exilis*				4
10574	Silvereye	*Zosterops lateralis*				17
10779	Bassian Thrush	*Zoothera lunulata*			2000	0
10991	*Common Blackbird	*Turdus merula*				47
10992	*Song Thrush	*Turdus philomelos*			2015	3
10999	*Common Starling	*Sturnus vulgaris*			2016	29
10998	*Common Myna	*Acridotheres tristis*				48

Reptiles

Code no.	Common name	Scientific name	Legal Status	Missing since	No. SoBS
5134	Common Long-necked Tortoise	*Chelodina longicollis*	d		9
5135	*Murray River Turtle	*Emydura macquarii*	v		1
12126	*Marbled Gecko	*Christinus marmoratus*			1
12283	Lace Monitor or Tree Goanna	*Varanus varius*	e	1976	0
12682	Eastern Three-lined Skink	*Acritoscincus duperreyi*		1890	0
12407	Swamp Skink	*Lissolepis coventryi*	Lv		1
62938	Black Rock Skink	*Egernia saxatilis intermedia*		1908	0
62430	White's Skink	*Liopholis whitii*		1931	0

Code no.	Common name	Scientific name	Legal Status	Missing since	No. SoBS
12450	Delicate Skink	*Lampropholis delicata*			2
12451	Garden Skink	*Lampropholis guichenoti*			12
12444	McCoy's Skink	*Anepischtos maccoyi*		1992	1
12683	Glossy Grass Skink	*Pseudemoia rawlinsoni*	v	2013	1
12452	Weasel Skink	*Saproscincus mustelinus*			1
12578	Blotched Blue-tongued Lizard	*Tiliqua nigrolutea*			6
12580	Common Blue-tongued Lizard	*Tiliqua scincoides*			0
12973	Lowland Copperhead	*Austrelaps superbus*			5
12665	White-lipped Snake	*Drysdalia coronoides*		1994	2
12699	Eastern Brown Snake	*Pseudonaja textilis*		1906	0
12650	Eastern Small-eyed Snake	*Rhinoplocephalus nigrescens*		1970s	0

Frogs

Code no.	Common name	Scientific name	Legal Status	Missing since	No. SoBS
13134	Common Froglet	*Crinia signifera*			24
13033	Victorian Smooth Froglet	*Geocrinia victoriana*		1988	0
13058	Southern Bullfrog, Pobblebonk	*Limnodynastes dumerilii*			7
13061	Striped Marsh Frog	*Limnodynastes peronii*		2014	6
13063	Spotted Marsh Frog	*Limnodynastes tasmaniensis*			8
13125	Southern Toadlet	*Pseudophryne semimarmorata*	v	1890	0
13182	Southern Brown Tree Frog	*Litoria ewingii*			20
13204	*Peron's Tree Frog	*Litoria peronii*			3
13207	Growling Grass Frog	*Litoria raniformis*	VLe	1988	0
63906	Verreaux's Tree Frog	*Litoria verreauxii verreauxii*			0

Fish

Code no.	Common name	Scientific name	Legal Status	Missing since	No. SoBS
4696	Common Galaxias	*Galaxias maculatus*			2
4711	*Goldfish	*Carassius auratus*		2004	2
4713	*Carp or European Carp	*Cyprinus carpio*		1997	0
4718	*Roach	*Rutilus rutilus*		2000	1
528546	*Tench	*Tinca tinca*		1988	0
5060	Flathead Gudgeon	*Philypnodon grandiceps*		2000	1
4603	Short-headed Lamprey	*Mordacia mordax*		1968	0
4651	Shortfin Eel	*Anguilla australis*		2011	7
4680	*Brown Trout	*Salmo trutta*		1988	0
4725	*Oriental Weatherloach	*Misgurnus anguillicaudatus*		2000	2
4771	*Mosquitofish or Eastern Gambusia	*Gambusia holbrooki*			5
4888	*Redfin	*Perca fluviatilis*			1

Butterflies

Code no.	Common name	Scientific name	Missing since	No. SoBS
521347	Splendid Ochre, Symmomus Skipper	*Trapezites symmomus soma*		5
520137	Dispar (or Barred) Skipper	*Dispar compacta*		3
521328	Doubleday's Skipper, Lilac Grass-skipper	*Toxidia doubledayi*		3
521162	Bright Shield-skipper	*Signeta flammeata*	2007	0
520451	Spotted Skipper, Spotted Sedge-skipper	*Hesperilla ornata ornata*	2013	2
521233	White-banded Grass-dart	*Taractrocera papyria*	2013	0
520755	Yellow-banded Dart, Greenish Grass-dart	*Ocybadistes walkeri sothis*		9
519920	*Orange Palm-dart	*Cephrenes augiades sperthias*		0
520857	*Orchard Swallowtail or Orchard Butterfly	*Papilio aegeus*	1996	1
520856	*Dainty Swallowtail	*Papilio anactus*		6
19024	Imperial Jezebel	*Delias harpalyce*		4
519857	Caper White	*Belenois java teutonia*		3
19038	*Cabbage White	*Pieris rapae*		18
19069	Varied Swordgrass Brown	*Tisiphone abeona albifascia*	1996	2
19032	Ringed Xenica	*Geitoneura acantha*		19
19028	Klug's (or Marbled) Xenica	*Geitoneura klugii*		10
19030	Common Brown	*Heteronympha merope merope*		30
19027	Shouldered Brown	*Heteronympha penelope*	1996	1
520538	Meadow Argus	*Junonia villida*		5
19035	Australian Painted Lady	*Vanessa kershawi*		13
19037	Australian (or Yellow) Admiral	*Vanessa itea*		5
520094	*Monarch or Wanderer Butterfly	*Danaus plexippus*	2011	0
520867	Bright Copper	*Paralucia aurifer*	2009	1
520504	Moonlight (or Blue) Jewel	*Hypochrysops delicia*	1953	0
520535	Imperial Hairstreak	*Jalmenus evagoras*		4
521095	Silky Hairstreak	*Pseudalmenus chlorinda zephrys*	2016	1
521411	Common Grass-blue	*Zizina otis labradus*		13

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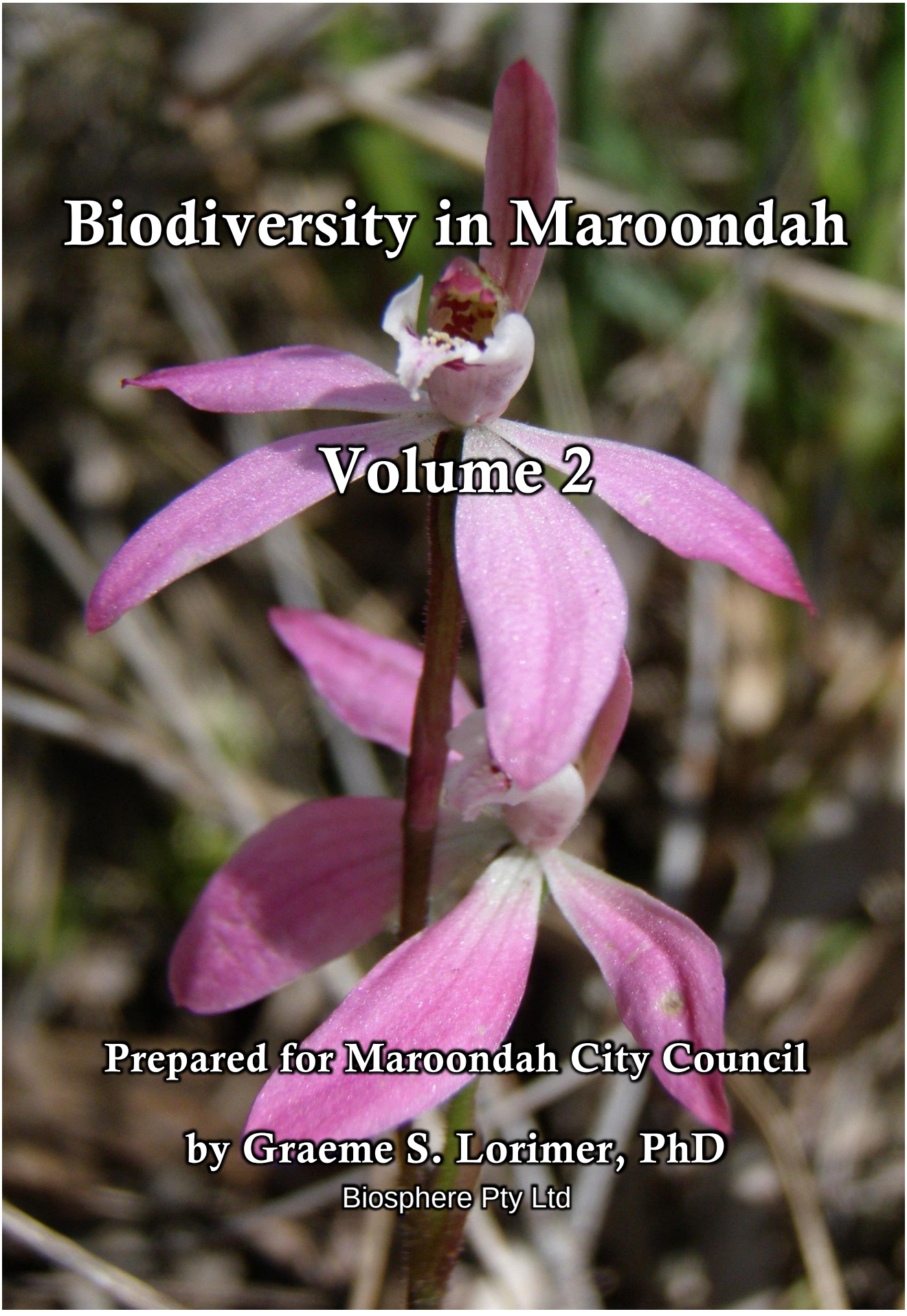

Biodiversity in Maroondah

Volume 2

Prepared for Maroondah City Council

by Graeme S. Lorimer, PhD
Biosphere Pty Ltd

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ABN 28 097 295 504

June 2020

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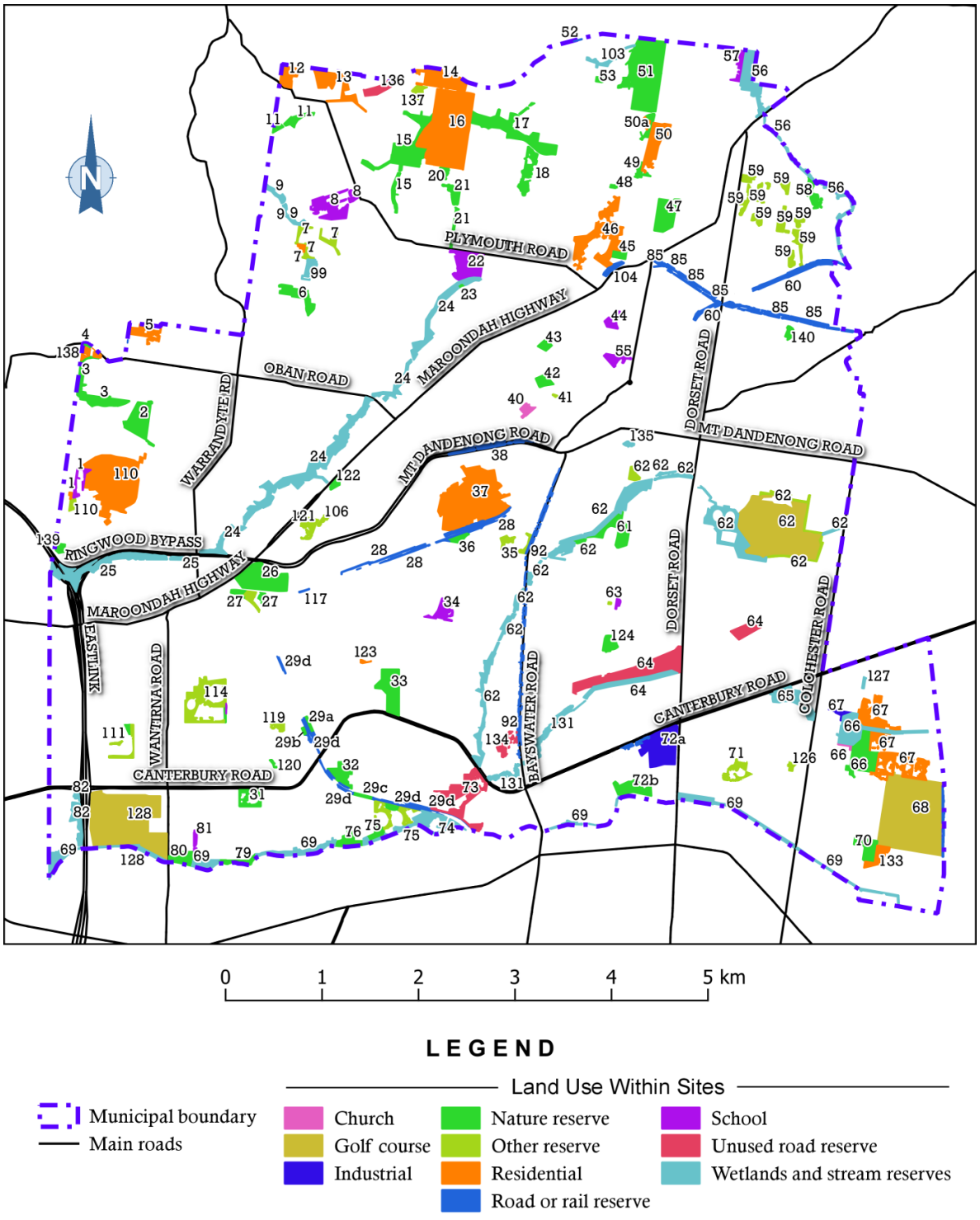
Key Map of Sites of Biological Significance

colour-coded by land use and labelled by site number.



Introduction to Volume 2

This volume contains an analysis of each site in Maroondah that meets the Victorian Government's criteria for 'sites of biological significance'. (The criteria are explained below.) There is also an analysis for each additional site that appeared in the *'Sites of Biological Significance in Maroondah'* report of Lorimer *et al.* (1997).

A key map of the sites appears on the previous page. A similar map with the sites colour-coded by significance level can be found in Figure 8 of Volume 1. The site numbering of Lorimer *et al.* (1997) has been retained.

Bibliographic citations refer to the Bibliography at the end of Volume 1.

Note that within a site, there can be considerable variability of biological significance, ecological threats, land uses, lot sizes and other factors. Therefore, in some cases, different planning controls are recommended for different parts of a single site. In addition, the recommended boundaries of planning overlay areas may extend further than, or not as far as, the area of significant habitat. These matters are discussed in Section 11.1.2 of Volume 1.

Outline of Information Provided for Each Site

The treatment of each site follows this structure:

Site name and level of biological significance
Details of site boundaries, land use and tenure, including a map overlaid on a 2017 aerial photograph
General description of the land, habitat and relevant historical information
Relationship to other land, to provide a landscape context and explain fauna movements
Descriptions of the various habitat types (vegetation and aquatic) in the site
Information about significant species of flora and fauna
Fauna habitat features
Ecological condition of the vegetation
Biological significance ratings by the state government's criteria
Other values of the site not assessed in the biological significance ratings
Changes in species present and the habitat's extent and condition (where apparent)
Threats facing the site's natural values
Strategic planning recommendations, e.g. whether an overlay is recommended
Any other recommendations
A list of the sources of information used in the assessment

Biological Significance Ratings

As explained in Section 8.1 of Volume 1, this report uses the state government's *'Standard Criteria for Sites of Biological Significance in Victoria'*[*]. These are referred to as simply the 'standard criteria' below. There are 104 standard criteria in all, each leading to one of four significance ratings: National, State, Regional and Local.

Unlike criteria prior to 2004, such as those used in *'Sites of Biological Significance in Maroondah'*, these ratings do not always indicate the size of the area within which a site stands out as exceptional. Rather, the ratings indicate the spatial scale within which a site 'makes a substantial contribution to the conservation' of nature. Consider the example of a small site that may be one of scores of similar or better examples of the endangered Valley Heathy Forest of the Gippsland Plain bioregion. Although the site is not outstanding,

[*] Amos N. (2004). *Standard Criteria for Sites of Biological Significance in Victoria*. Victorian Government, Department of Sustainability & Environment, Melbourne. iv + 53 pp.

the standard criteria may yield a 'State' rating because that vegetation type is so threatened and fragmented that the loss of almost any example is significant.

The standard criteria are grouped into a four-level hierarchy and are quite detailed. Rather than reproduce the details of all 104 criteria, an abridged summary of those met by sites in Maroondah follows:

1. Ecological integrity and viability

'1.2.6 Corridor or component of 'stepping stones' (includes riparian corridor, could include 'stepping stones' i.e. not necessarily continuous native habitat) … Local scale link between individual remnant habitat blocks or within subcatchment': *Local significance*';

'1.3.3 Site important for the restoration of disrupted ecological processes: Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor at a site which is [a] Site (or one of a group of such sites) to form a strategic corridor of local importance and scale: *Local significance*';

2. Richness and diversity

'2.1 'Sites with unusually high native species richness (for a given habitat type stated in habitat description). Where the site is in the top 5% of sites in terms of native species richness compared with similar sites regionally': *Regional significance*;

'2.2 Sites with endemic taxon or genetically distinctive form. Taxon or form known only from this site (would in most cases also qualify under type locality criterion; would also qualify under rarity of taxon)': *National significance*;

3. Rarity or conservation status of flora, fauna or ecological communities

'3.1.1 Known habitat for nationally listed threatened taxa. All sites for a taxon listed [as] critically endangered or endangered': *National significance*;

'3.1.2 Site is known habitat for a taxon which is FFG listed, or on the advisory lists of rare or threatened flora or fauna in Victoria:

- 'All sites for a taxon listed and critically endangered or endangered and endemic to Victoria': *National significance*; or
- 'All sites with populations of a taxon listed [as] critically endangered or endangered and not endemic to Victoria': *State significance*; or
- 'Other sites with populations of a taxon listed as vulnerable, conservation dependent, data deficient, rare or insufficiently known and endemic to Victoria': *State significance*;
- 'Other sites with populations of a taxon listed as vulnerable, conservation dependent, data deficient, rare or insufficiently known and not endemic to Victoria': *Regional significance*;

'3.1.5 Site is known habitat for a taxon that is considered to be threatened in the local area. An important site for population of the [locally threatened] taxon in the local area under consideration, or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. *Local significance*;

'3.2.3 An area that qualifies as a remnant patch under the *'Operational guidelines: applying net gain in the planning system'*[1] and … has a conservation significance rating[2] which is:

- 'Very High or High is present at the site': *State significance*;
- 'Medium is present at the site': *Regional significance*;
- 'Low is present at the site': *Local significance*;

5. Scientific and educational value

'5.1.2 A long-term ecological monitoring site/benchmark site for a long-term project to study local ecological variables and conditions': *Local significance*;

'5.2 The site is the type and extant locality for a taxon' (i.e. a species or other taxon is defined on the basis of a specimen from the site and the taxon still occurs there): *National significance*. The

[1] Defined thus: 'A patch is a continuous area of native vegetation that is at least 0.25 hectares in extent and indigenous native understorey cover is 10% or greater'. Understorey includes trees other than canopy species.

[2] As determined from Appendix 3 of *'Victoria's Native Vegetation Management – A Framework for Action'* of 2002 by using only the criteria listed in the columns headed 'conservation status' and 'habitat score'.

only species in this category in Maroondah are the Kilsyth South Spider-orchid and the flat-pea, *Platylobium infecundum*.

The overall significance rating of a site as a whole is the highest rating under any one criterion.

At the low end of the significance scale, any patch of native vegetation occupying at least 0.25 ha and with 10% or more native understorey cover is rated as 'Local' significance or higher under criterion 3.2.3.

Consistent with the standard criteria, all areas rated as 'Local' significance or above are treated as sites of biological significance.

The flora and fauna in a site rated 'Not significant' under the standard criteria for biological significance may still be important for reasons not considered by the criteria. For example, a park with tree cover and many birds can often be important for human health, wellbeing, quality of life and childhood development. Such values are worth protecting even if the standard criteria for biological significance do not take them into account.

Information Sources

The sources of information used for each site are stated at the end of the site's description. A broader explanation of the sources of information and the approach to gathering them is given in Chapter 2 of Volume 1.

Most of the information comes from the author's own work. His prior flora and fauna data from Maroondah totalled tens of thousands of records. For this study, he collected another 14,041 plant records and 1,934 fauna records, each with the species' name, abundance and often other information. His co-workers in 1995–1997 gathered over 4,500 additional records.

For some sites, the author's database of fauna data was supplemented by obtaining data from the eBird online resource, at various times during 2019. For a few sites, a small fraction of the flora or fauna data used in the assessment was obtained from the online 'Victorian Biodiversity Atlas' (VBA), which is © The State of Victoria, Department of Environment, Land, Water and Planning (among others). VBA data was downloaded at various times during 2018–2019. The Atlas of Living Australia website also provided small numbers of records.

It would take hundreds of pages to provide even summary lists of the species recorded at each site. Instead, as many species as possible are provided here in the most compact practicable format. Plant species are mentioned in the descriptions of vegetation communities and, in the case of the rarer ones, with additional detail under the heading, 'Significant plants'. Only the more notable fauna species are mentioned, mostly under the heading, 'Significant fauna'. The author's intention is for his data to be made available online.

The aerial photograph that appears for each site was taken in February 2017 and provided by Maroondah City Council. The property boundaries that are overlaid on the aerial photographs were downloaded in January 2019 from the Victorian Government's 'Data.Vic' website.

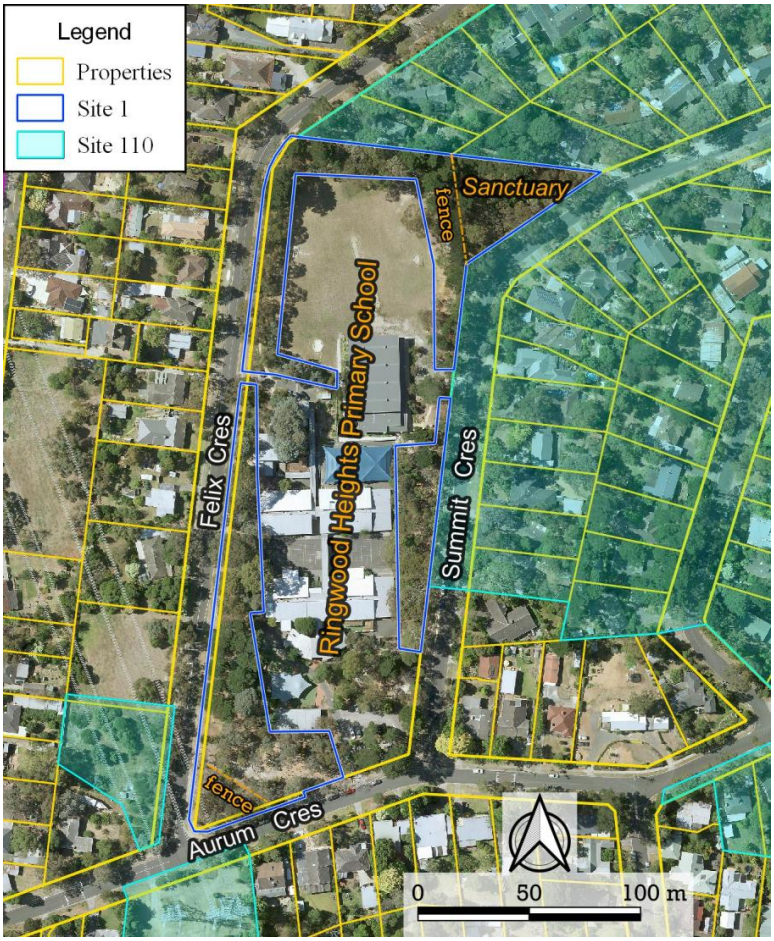
Site 1. Ringwood Heights Primary School, Ringwood North

Biological Significance Level: *State* due to the presence of a threatened vegetation type

Boundaries

The image at right shows an aerial photograph from February 2017 overlaid with relevant boundaries. Site 110 is shown for context. The blue boundary of Site 1 includes the land between the school fence and the Felix Crescent footpath as well as the land between the school fence and the Aurum Crescent footpath for a distance of 50 m from the school's southwest corner.

The area of Site 1 adopted here differs from the original version in the 1997 report, *'Sites of Biological Significance in Maroondah'* due to habitat improvements in the southwest and clearing in the southeast.



Land use & tenure

The 1.21 ha of the site, as outlined in blue above, includes parts of the 2.8-hectare state school plus narrow strips of Council roadside.

General description

Naturally occurring, indigenous trees, shrubs and groundcovers are present in various densities throughout the areas outlined in blue above. Planted Australian native trees are scattered through much of the schoolgrounds, augmenting the bird habitat provided by the naturally occurring, indigenous trees. As a result, the school is visited by more native forest bird species than most of Maroondah.

A substantial number of large Monterey Pines (*Pinus radiata*) grow in parts of the school. The pines take up so much space, sunshine, soil moisture and nutrients that they displace most indigenous flora. They also represent poor habitat for most indigenous fauna except Yellow-tailed Black-Cockatoos, which feed on the pinecones at certain times of the year.

Fifty-one naturally-occurring, indigenous plant species were observed in Site 1 during this study. The areas with the greatest diversity of plant species are fenced off from the rest of the schoolgrounds, in the

southwest and northeast corners. The northeastern area is signposted as the school's native vegetation sanctuary. There, Wonga Vine (*Pandorea pandorana*) is smothering many plants and threatening to permanently displace some of the indigenous plant species. The dense cover provided by Wonga Vine has substantially changed the vegetation structure in the sanctuary, impairing the habitat for local birdlife, lizards, insects and other invertebrates.

The fenced triangular area in the school's southwestern corner is substantially less affected by non-indigenous plants than the sanctuary. The vegetation has a fairly natural structure, with indigenous eucalypts, understorey trees, shrubs and groundcover species. Most of the cover of indigenous plants is natural but part of it is due to planting. It is surprising that even a species as sensitive as the Hyacinth Orchid (*Dipodium roseum*) still grows here.

A narrow strip of vegetation between the southern and western fences and the adjacent footpaths contains indigenous trees (some planted and some natural) and a surprising number of indigenous groundcover species. Among those species are some that do not occur within the schoolground.

Relationship to other land

Some sedentary animals such as lizards and certain insects would probably be able to persist at the school, regardless of the surrounding habitat. Many other animals – particularly birds – need a larger area of habitat. Some of that additional habitat is provided by Site 110, which is the cyan-tinted area on the aerial photograph above. Conversely, the fauna in Site 110 benefit greatly from the presence of the school's habitat.

The school's naturally-occurring indigenous plants, and those on nearby land, might well suffer inbreeding or poor reproduction if not for pollination occurring between properties. Perhaps the most important of these connections is between the school and parts of Site 110 under power transmission lines over the road from the school's southwest corner.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion).

Dominant canopy trees: *Eucalyptus goniocalyx, Eucalyptus macrorhyncha* and *Eucalyptus polyanthemos*, with smaller numbers of *Eucalyptus cephalocarpa*, *Eucalyptus melliodora*, *Eucalyptus obliqua* and *Eucalyptus radiata*. The presence of *Eucalyptus polyanthemos* is unusual for Valley Heathy Forest but can be explained by the proximity to the 'Highlands - Southern Fall' bioregion (400 m to the north), where *E. polyanthemos* is abundant. The presence of *Eucalyptus cephalocarpa* is a clear indicator of Valley Heathy Forest.

Lower trees: Dominated by *Exocarpos cupressiformis, Acacia mearnsii, Acacia melanoxylon, Acacia pycnantha*. *Acacia dealbata* is also locally dominant but apparently only due to proliferation following planting since the 1996 survey, when none of that species were observed.

Medium to large shrubs: Dominated by *Bursaria spinosa, Cassinia sifton, Daviesia latifolia, Kunzea leptospermoides*.

Ferns: *Pteridium esculentum* is the only fern species observed, and only in 1996 (not 2018–2019).

Climbers: The main indigenous vine species is *Clematis aristata*. *Clematis decipiens* has appeared since 1996, presumably as a result of the spread of that species out of its historical range. *Comesperma volubile* is scarce. The non-indigenous *Pandorea pandorana* is rampant in the sanctuary.

Groundcover: Dominant and characteristic species include *Acrotriche serrulata, Dillwynia cinerascens, Gahnia radula, Galium gaudichaudii, Gonocarpus tetragynus, Olearia myrsinoides, Platylobium obtusangulum, Rytidosperma pallidum* and *Rytidosperma penicillatum*. As in the case of *Eucalyptus polyanthemos*, the presence of *Hydrocotyle laxiflora* and *Poa sieberiana* can be explained by

proximity to the 'Highlands - Southern Fall' bioregion. Other groundcover species are too numerous to mention here.

Significant plants

None of the species recorded at the school are classed as rare or threatened throughout Victoria.

Red Stringybark (*Eucalyptus macrorhyncha*) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah because the local population has reduced by at least 80% over the past three generations of the species. A number of that species occur in the site, mainly close to Summit Crescent.

Hairy Speedwell (*Veronica calycina*) also falls into the 'critically endangered' category of dying out in Maroondah, because the author can find no local records in the past twenty years. It was found at the school in 1996 but not during the less intensive inspection of 2018–2019. It would be quite significant (if unlikely) that the species persists at the school.

The following locally uncommon plant species were observed in 2019:

- Hop Bitter-pea (*Daviesia latifolia*) – roughly ten were observed, mostly in the southwest, but it is uncertain how many have been planted and how many persist from the wild population observed in 1996.
- Hyacinth Orchid (*Dipodium roseum*) – a single plant producing seeds in the southwest fenced area;
- Variable Plantain (*Plantago varia*) – a small population in the sanctuary; and
- Kneed Wallaby-grass (*Rytidosperma geniculatum*) – a small population in the southwest fenced area and the adjacent nature strip.

Significant fauna

A teacher at the school – Robyn Bellamy – recorded seeing a Short-beaked Echidna there in 2013. Echidnas are clearly at risk of dying out in Maroondah. There is also a reasonable probability that Sugar Gliders occur at the school, as there is a known population of that uncommon species nearby in Site 110. The brevity of this study's ecological survey means that other significant species of fauna may have gone undetected.

Fauna habitat

- The presence of all strata of native vegetation represents good habitat for a range of forest birds, from the ground-feeding Common Bronzewing to the treetop-feeding Spotted Pardalote. It also provides habitat for insects, bats and other arboreal mammals;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1); and
- The large pines provide Yellow-tailed Black-Cockatoos with pine nuts.

Ecological condition

The ecological condition of the vegetation in the fenced southwest corner of the schoolground and the adjacent strips outside the school fence is in fair to good ecological condition (borderline 'B' / 'C' on the A–D scale of Lorimer *et al.* (1997)). There is a moderate number of indigenous plant species (including the Hyacinth Orchid) and a very low cover of introduced species.

The vegetation in the sanctuary contains a similar number of indigenous plant species but it is becoming seriously impaired by the spread of dense curtains and mats of the non-indigenous Wonga Vine (*Pandorea pandorana*). The ecological condition falls within the 'C' (or 'fair') category on the A–D scale.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The sanctuary and contiguous native vegetation toward the oval meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation belongs to an Ecological Vegetation Class listed as 'endangered' in the bioregion. As a consequence, the site meets standard criterion 3.2.3 for a site of **State** significance.

Locally threatened species

Red Stringybark is in the 'critically endangered' category of risk of dying out in Maroondah. The small number of Red Stringybarks in the schoolgrounds are part of a larger and probably viable population in the neighbourhood. These conditions meet standard criterion 3.1.5 for Local significance.

The Short-beaked Echidna is clearly threatened within Maroondah. If the individual seen at the school in 2013 continues to make use of the habitat, or if others do, standard criterion 3.1.5 applies: 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'low Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and recognition in the interim that the vegetation type is endangered.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation are enhanced by the presence of trees in the neighbourhood generally. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the school's vegetation and birdlife is expected to be beneficial to the wellbeing of the children and the development of their minds (Section 1.3 of Volume 1). The vegetation and birds represent good educational resources but the sanctuary appears to have received little such use recently.

The school's vegetation preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage to upcoming generations of school children, as well as the local community. It also contributes to the neighbourhood's 'green and leafy' character.

Changes

Construction of a hall removed 0.1 ha of native vegetation in 2010–2011.

Along the southernmost part of the Felix Crescent boundary, there is a substantial gap in the eucalypt canopy. The gap was not present in 2011, as indicated by an aerial photograph. The reason for the loss of eucalypts is unknown. Elsewhere in the schoolgrounds, aerial photographs show no evident change in the

health of the eucalypt canopy between 2001 and 2017. (Most other sites in Maroondah have shown a deterioration in eucalypt health.)

Using the A–D scale of ecological condition of Lorimer *et al.* (1997), the condition in the sanctuary in 1996 was 'B' (or 'good') and it has now fallen to 'C' (or 'fair'). The ecological condition in the site's southwest corner has not changed noticeably from borderline 'B' / 'C'. The rest of the site has also remained fairly unchanged, varying between 'C' and 'D' ('poor').

The site inspection in 2018–2019 was briefer and less intensive than the 1996 survey, so it is understandable that more species were found in 1996 (66 *versus* 57). On the other hand, some species found in 2018–2019 were not found in 1996. In the absence of a detailed ecological survey, it can only be conjectured that it is very likely that some indigenous plant species have died out, as they have across Maroondah. The most likely species to have died out are *Brunonia australis*, *Galium gaudichaudii*, *Olearia myrsinoides* and *Veronica calycina*. The sanctuary is where disappearances are most likely.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous flora and fauna by Wonga Vine in the sanctuary;
- Potential spread of Wonga Vine in the fenced southwestern corner;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Slow attrition of indigenous flora immediately outside the school fence along Felix Crescent and Aurum Crescent due to periodic cutting and consequent prevention of seed production.

Strategic planning

The whole site is affected by Schedule 3 of the Significant Landscape Overlay (SLO3) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. It is also covered by the Vegetation Protection Overlay (VPO) except for a strip along the northern boundary and the narrow strips around the outside of the school fence.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the areas outlined in mid-blue on the aerial photograph on p. 5. Clause 52.17 and SLO3 would remain over the whole of the school and its nature strips.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately two hours of inspection in 2018–2019, including compilation of a list of indigenous plant species and their abundances for the sanctuary and a separate list for the rest of the school and its nature strips – 57 species in total;
- Robyn Bellamy's record in the Victorian Biodiversity Atlas of a Short-beaked Echidna at the school on 22/11/13. The echidna would probably have entered the adjacent Site 110 on its way to or from the school;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated field data from the present author's flora and fauna survey in January 1996;
- The Victorian Government's Mapping of Ecological Vegetation Classes present in 2005 and 1750; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in eBird or the Atlas of Living Australia.

Site 2. B.J. Hubbard Reserve, Ringwood North

Biological Significance Level: *State* due to threatened vegetation types and a rare wattle

Boundaries

The image at right shows an aerial photograph from February 2017 overlaid with relevant boundaries. The mid-blue boundary of Site 2 corresponds to B.J. Hubbard Reserve minus sparsely-vegetated parcels of land abutting Evelyn Rd. Site 3 (Loughies Bushland) and Site 112 (Evelyn Rd Reserve) are shown for context.



Land use & tenure

The 7.1 ha of the site is a council reserve used partly for a scout hall (less than 0.2 ha) and mostly as a nature reserve. The creek and its banks are also managed for drainage. The former soccer pitch labelled above (0.6 ha) has been partly revegetated. The rest of the former soccer pitch remains grassed for recreational use, with a picnic shelter on it and a carpark and driveway to the east. Footpaths provide access through the reserve for recreation and to provide walking routes through the neighbourhood.

General description

Most of the reserve is covered by natural or semi-natural forest. As discussed below, both types of forest in the reserve belong to Ecological Vegetation Classes listed as 'endangered'.

Ninety-four naturally-occurring, indigenous plant species were observed in the reserve during this study's (non-exhaustive) ecological survey.

There is a perennial creek whose fringing native vegetation was substantially modified by the installation of underground pipes on multiple occasions until the 1990s. The creek and its gully are kept in an unnatural state because urbanisation of the catchment has changed the natural, fairly even flow of water to highly pulsed, polluted water. Apart from the creek area, most of the forest is in good or fair ecological condition.

Relationship to other land

The vegetation of B.J. Hubbard Reserve is mostly similar to Ringwood Heights Primary School (Site 1) and parts of Loughies Bushland (Site 3).

Residential blocks with negligible habitat value surround the reserve and act as a barrier to some of the original wildlife. The impediment to wildlife movement also represents a restriction on the flow of pollen and seeds that wildlife would otherwise carry. That has implications for the long-term viability of plant species.

Fortunately, the habitat gap between B.J. Hubbard Reserve and Loughies Bushland is less than 100 m – small enough not to completely deter a range of birds, bats, flying insects, frogs and echidnas. There is an even smaller gap between Loughies Bushland and a large area of semi-natural vegetation in the City of Manningham on the other side of Glenvale Rd. The author has also observed an echidna travelling as far into the neighbouring suburbia as the intersection of Kubis Drive and Oban Road in 2018.

There is a scattering of residential properties to the south and southwest with indigenous or Australian native trees. Those trees may entice birds, bats and flying insects to fly between B.J. Hubbard Reserve and Loughnan's Hill (Site 110).

B.J. Hubbard Reserve's narrow neck in the southeast provides an almost continuous tree canopy to Evelyn Road Reserve (Site 112). That is likely to encourage some birds, bats and flying insects to move between those reserves.

The movements of wildlife through the neighbourhood surrounding B.J. Hubbard Reserve greatly enhances the area's natural ambience, e.g. through birdsong. This no doubt benefits residents.

Some of the surrounding gardens provide good habitat for possums. Some residents may also be feeding the possums. These may be the causes of the gross overpopulation of Common Ringtail Possums observed in this study – 19 in approximately 1 ha (plus three brushtail possums). The prevalence of heavily chewed eucalypt leaves implicates possum overpopulation as one likely reason for the many eucalypts that have very sickly crowns or have died.

Bioregion: Gippsland Plain, bordering the Highlands - Southern Fall

Habitat types

The descriptions of vegetation below include only the more abundant or ecologically informative indigenous plant species. It is hoped that the full set of flora data will be made available online. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion) occupies the forested areas except in a narrow band along the creek. The ecological condition varies between good and poor (ratings 'B' to 'D' of *'Sites of Biological Significance in Maroondah'*).

Dominant canopy trees: On the western and southern sides of the reserve (but not close to the creek), the canopy is dominated by Red Box (*Eucalyptus polyanthemos*) either as a pure stand (near the reserve's southern boundary) or mixed with Red Stringybark (*E. macrorhyncha*) and Bundy (*E. goniocalyx*). The rest of the forest other than near the creek is dominated by Messmate Stringybark (*E. obliqua*), Narrow-leaved Peppermint (*E. radiata*) and Bundy (*E. goniocalyx*), mostly mixed with combinations of Red Stringybark (*E. macrorhyncha*), Mealy Stringybark (*E. cephalocarpa*), Yellow Box (*E. melliodora*) or Red Box (*E. polyanthemos*). The presence of *Eucalyptus polyanthemos* is unusual for Valley Heathy Forest but can be explained by the proximity to the 'Highlands - Southern

Fall' bioregion, where *E. polyanthemos* is abundant. The presence of *Eucalyptus cephalocarpa* is a clear indicator of Valley Heathy Forest.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*) with smaller numbers of Black Wattle (*Acacia mearnsii*) and Golden Wattle (*Acacia pycnantha*).

Medium to large shrubs: Quite dense, with abundant Sweet Bursaria (*Bursaria spinosa*), Dandenong Range Cinnamon Wattle (*Acacia stictophylla*), other wattles, Burgan (*Kunzea leptospermoides*) and cassinias (*Cassinia aculeata*, *C. longifolia* and *C. sifton*). Prickly Tea-tree (*Leptospermum continentale*) and Australian Dusty Miller (*Spyridium parvifolium*) are present but not dense.

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*), Grey Parrot-pea (*Dillwynia cinerascens*) and Hop Goodenia (*Goodenia ovata*) are numerous throughout. Common Beard-heath (*Leucopogon virgatus*) is scarce.

Ferns: Common Maidenhair (*Adiantum aethiopicum*) is dense on the south-facing slope and scattered elsewhere. Screw Fern (*Lindsaea linearis*) is in a small drainage line northwest of the former soccer pitch. Surprisingly, there is no bracken (*Pteridium esculentum*).

Climbers: Common Apple-berry (*Billardiera scandens*), Mountain Clematis (*Clematis aristata*), Small-leafed Clematis (*C. decipiens*) and Love Creeper (*Comesperma volubile*) are fairly abundant but the percentage cover of their foliage is very small. Wonga Vine (*Pandorea pandorana*) is also present but only as a result of the species expanding its range in the past two decades.

Groundcover: Mostly dense, with little exposed ground or leaf litter. This layer is dominated variously by lilies, grasses, grass-trees, mat-rushes or (to a small degree) Thatch Saw-sedge (*Gahnia radula*). Chocolate Lily (*Arthropodium strictum*) is the dominant species over a total area of thousands of square metres in spring, and there are occasional patches of dense Black-anther Flax-lily (*Dianella revoluta*) several metres across. There are a large number of species of lilies, which is characteristic of Valley Heathy Forest, although some species (e.g. *Bulbine bulbosa, Thysanotus tuberosus* and *Tricoryne elatior*) are scarce compared with their likely abundance prior to European settlement. The dominant native grasses are Silvertop Wallaby-grass (*Rytidosperma pallidum*), Veined Spear-grass (*Austrostipa rudis*), Weeping Grass (*Microlaena stipoides*), Grey Tussock-grass (*Poa sieberiana*) and various wallaby-grasses such as *R. tenuius, R. penicillatum, R. pilosum, R. racemosum* and *R. setaceum*. Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) occurs on the south-facing slope. Small Grass-tree (*Xanthorrhoea minor*), both subspecies of Wattle Mat-rush (*Lomandra filiformis*) and Spiny-headed Mat-rush (*L. longifolia*) are abundant. A small number of plants of Many-flowered Mat-rush (*L. multiflora*) are also present. Honey-pots (*Acrotriche serrulata*) and Common Raspwort (*Gonocarpus tetragynus*) are particularly abundant. Common Rice-flower (*Pimelea humilis*) and the sword-sedges *Lepidosperma laterale* and *L. gunnii* are moderately abundant, while Cranberry Heath (*Astroloma humifusum*) is much less so. Orchids, and particularly sun-orchids, were fairly abundant forty years ago but are now scarce. Small Poranthera (*Poranthera microphylla*) is abundant in most years but other native annuals are very scarce.

Swampy Riparian Woodland (EVC 83, **Endangered** in the bioregion), tending toward Creekline Herb-rich Woodland (EVC 164). In a narrow band lining the creek, all in poor ecological condition (rating 'D' of *'Sites of Biological Significance in Maroondah'*).

Dominant canopy trees: Swamp Gum (*Eucalyptus ovata*) dominates but is now much reduced in density by drainage engineering and modification of the natural hydrology. There is also a single Yellow Box (*E. melliodora*).

Lower trees: Blackwood (*Acacia melanoxylon*) is dense.

Shrubs: Prickly Currant-bush (*Coprosma quadrifida*) is dense in the more natural areas. There is a single Tree Everlasting (*Ozothamnus ferrugineus*) and a single Hop Goodenia (*Goodenia ovata*) but those species were once much more abundant. Prickly Moses (*Acacia verticillata*) and Manuka (*Leptospermum scoparium*) were also fairly abundant in 2003 but have now died out.

Ferns: The following species have been recorded: Common Maidenhair (*Adiantum aethiopicum*), Austral Bracken (*Pteridium esculentum*), Rough Tree-fern (*Cyathea australis*) and Mother Shield-fern (*Polystichum proliferum*). However, all but Austral Bracken have died out due to drought and continual scouring of the creek channel during high flows, as is happening throughout the district.

Climbers: Mountain Clematis (*Clematis aristata*) is fairly abundant.

Scramblers: Small-leafed Bramble (*Rubus parvifolius*) was formerly fairly abundant but has now died out.

Creepers: Bidgee-Widgee (*Acaena novae-zelandiae*) is scarce.

Other groundcover: The dominant indigenous groundcover species are Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) and Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*). Clustered Wallaby-grass (*Rytidosperma racemosum*) is fairly abundant. There are a few plants of Weeping Grass (*Microlaena stipoides*) and one Pale Rush (*Juncus pallidus*). In 2003, there were more rushes (*Juncus* species) as well as Shrubby Fireweed (*Senecio minimus*). Species that are only found within the creek channel (discussed below) are also commonly regarded as part of Swampy Riparian Woodland.

Perennial stream & stream channel (No EVC number). All in poor ecological condition.

Trees and shrubs: practically absent.

Non-woody species: Now sparsely vegetated due to erosion from pulsed flows. The indigenous species are Slender Knotweed (*Persicaria decipiens*), Angled Lobelia (*Lobelia anceps*), Green Rush (*Juncus gregiflorus*) and Bidgee-Widgee (*Acaena novae-zelandiae*). In 2003, there was also Loose-flower Rush (*Juncus pauciflorus*), Hollow Rush (*J. amabilis*) and ferns.

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. A brief search in B.J. Hubbard Reserve in 2019 located approximately a dozen.

Locally threatened

The following naturally-occurring plant species recorded in the reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – recorded in 1996 and not since;
- *Astroloma humifusum* (Cranberry Heath) – at least two plants grow on the south-facing slope;
- *Banksia marginata* (Silver Banksia) – apparently died out in the reserve between 1996 and 2003;
- *Chrysocephalum semipapposum* (Clustered Everlasting) – growing in small numbers on the south-facing slope;
- *Correa reflexa* (Common Correa), local form – the reserve has a small population as well as hybrids with garden varieties of Correa, indicating that the local form is at risk of dying out through hybridisation;
- *Corybas* ?*incurvus* (Slaty Helmet-orchid) – a colony of 24 plants grows on the south-facing slope. They have not been seen in flower so the identification relies on the leaf shape and colour and is therefore uncertain. There is no confirmed record of *Corybas incurvus* in Maroondah's history;
- *Eucalyptus macrorhyncha* (Red Stringybark) – still a dominant species in much of the reserve but now with perhaps as many recently dead and dying individuals as living;
- *Gompholobium huegelii* (Common Wedge-pea) – apparently died out in the reserve between 1996 and 2003;
- *Goodenia elongata* (Lanky Goodenia) – present in both intensive flora surveys (1996 and 2003). Not encountered in the brief site inspection for this study but possibly still present;
- *Hibbertia obtusifolia* (Grey Guinea-flower) – scarce in 2003 (halfway up the slope from Debbie Place). Not encountered in the brief site inspection for this study but possibly still present;
- *Lachnagrostis aemula* (Purplish Blown Grass) – recorded in small numbers in 1996 and 2003, not since;
- *Muellerina eucalyptoides* (Creeping Mistletoe) – recorded only in 2003, probably as one plant. Probably no longer present;

- *Poa tenera* (Slender Tussock-grass) – present in both intensive flora surveys (1996 and 2003). Not encountered in the brief site inspection for this study but possibly still present;
- *Polystichum proliferum* (Mother Shield-fern) – apparently died out in the reserve between 1996 and 2003 due to continual scouring of the creek channel during high flows;
- *Pterostylis alpina* (Mountain Greenhood) – a colony of five plants grows on the south-facing slope. The only other records of the species in Maroondah over the past twenty-five years are a single plant at Bungalook Conservation Reserves in 2016 and as volunteers in a hanging basket at a residential address on Loughnan Hill in c. 2010;
- *Senecio minimus* (Shrubby Fireweed) – recorded only in 2003 but may well reappear. This species is generally subject to large population fluctuations and may have been scarcer than usual during this study's flora survey due to drought conditions;
- *Thelymitra rubra* (Salmon Sun-orchid) – abundant in c. 1980, less so in 1996 and unable to be found in the intensive 2003 botanical survey or subsequently.

Significant fauna

A Koala was recorded in the reserve in 1999 as it moved through the area. Koalas are now presumed extinct in Maroondah.

At least one Short-beaked Echidna resides in the reserve and makes occasional excursions into the neighbourhood. That species is clearly at risk of dying out in Maroondah.

Fauna habitat

- The presence of all strata of native vegetation represents good habitat for a range of forest birds, bats, other arboreal mammals and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including microbats;
- Council has installed nest boxes to augment the natural tree hollows;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1); and
- The creek provides habitat for ducks, aquatic invertebrates and possibly Buff-banded Rails.

Ecological condition

The ecological condition of the vegetation is quite variable.

The most natural areas of forest are north and immediately west of the former soccer pitch. Those areas are in good to very good ecological condition ('B' to 'A' on the A–D scale of Lorimer *et al.* (1997)). The edges of the reserve are managed as firebreaks and are in poor ecological condition ('D', on the A–D scale). The ecological condition of most of the rest of the forest falls within the 'C' (or 'fair') category.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

Most of the Valley Heathy Forest easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley

Heathy Forest is listed as 'endangered' in the bioregion. As a consequence, the site meets standard criterion 3.2.3 for a site of **State** significance.

The Swampy Riparian Woodland probably also meets the definition of a 'patch' but there is a chance that the minimum area threshold is not met. If the threshold is met, the Swampy Riparian Woodland represents State significance by standard criterion 3.2.3.

Rare or threatened species

The section above headed 'Significant plants' provides details of threatened plants.

The reserve has an apparently quite viable population of Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

If the identity of the *Corybas* ?*incurvus* plants is confirmed, that will be the first record of the species in Maroondah's history. In any case, the only recognised species of *Corybas* in Maroondah (*viz. C. diemenicus*) is so rare in the municipality that any occurrence is important. The reserve therefore fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The colony of Mountain Greenhood (*Pterostylis alpina*) gives the reserve Local significance for very similar reasons to the *Corybas* colony.

Red Stringybark (*Eucalyptus macrorhyncha*) and Clustered Everlasting (*Chrysocephalum semipapposum*) are in the 'critically endangered' category of risk of dying out in Maroondah. The population of each of these species appears to be viable in its own right, and more likely so when taken in the context of other plants in nearby Loughies Bushland. They therefore fit the quote above from standard criterion 3.1.5, leading to Local significance.

The Short-beaked Echidna is clearly threatened within Maroondah. The individual(s) that occur at B.J. Hubbard Reserve and move through the neighbourhood are, in the terms of standard criterion 3.1.5, 'believed to be a viable population in its own right or … as part of a wider ranging population'. This represents Local significance under that criterion.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of the EVCs and Dandenong Range Cinnamon Wattle.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve as well as immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creek helps to stabilise the creek bed and banks and remove a small amount of water pollution.

The natural ambience of the reserve is expected to be beneficial to the wellbeing of visitors to the reserve. That may be particularly important for the scouts whose hall is in the reserve, as nature helps the

development of children's minds (Section 1.3 of Volume 1). The natural ambience also encourages people to get exercise by walking through the reserve.

The movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens spreads nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

The reserve's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation of the local community. It also contributes to the neighbourhood's 'green and leafy' character.

Changes

Change in the extent of habitat

Aerial photographs show that since 2001, the growth of eucalypt crowns has resulted in the area of habitat encroaching slightly into previously unvegetated areas around the scout hall, former soccer pitch and the Debbie Place entrance. Revegetation has slightly extended the area of habitat to Evelyn Rd in the southeast. That revegetation explains why the site is here delineated to include the narrow neck in the southeast even though it was not in the 1997 *'Sites of Biological Significance in Maroondah'* report.

Change in the species present

The section above headed 'Significant plants' demonstrates the reserve's serious rate of loss of plant species whose risk of dying out in Maroondah confidently falls into the 'critically endangered' category. The author's clear impression is that many other indigenous plant species have also declined in population. However, there are no quantitative data to support that impression.

There are probably some indigenous plant species that have arrived in the reserve since the last intensive flora survey in 2003, as they did between then and the previous survey in 1996. There are also probably some indigenous plant species whose population have increased. There is too little data to detect or quantify such changes. Nevertheless, the author's impression is that the number of new arrivals is far less than the number of disappearances.

Change in the ecological condition of habitat

The decline of eucalypt health and foliage cover is marked. A gross overpopulation of possums is a likely contributor. In other respects, the ecological condition of the vegetation has been generally stable since botanical surveys in 1996 and 2003. The loss of indigenous plant species appears to be more a matter of attrition resulting from actions taken before 1996 rather than a deterioration in conditions since then.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change;
- Wonga Vine (*Pandorea pandorana*) smothering and displacing indigenous plants; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The whole site is affected by Schedule 3 of the Significant Landscape Overlay (SLO3) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. It is also covered

by the Vegetation Protection Overlay (VPO) except for the narrow neck extending southeast to Evelyn Rd. That neck and the parcels that provide access from Debbie Place and Terrigal Drive are covered by Schedule 2 of the Design and Development Overlay (DDO2).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the areas outlined in mid-blue on the aerial photograph on p. 10.

Information sources

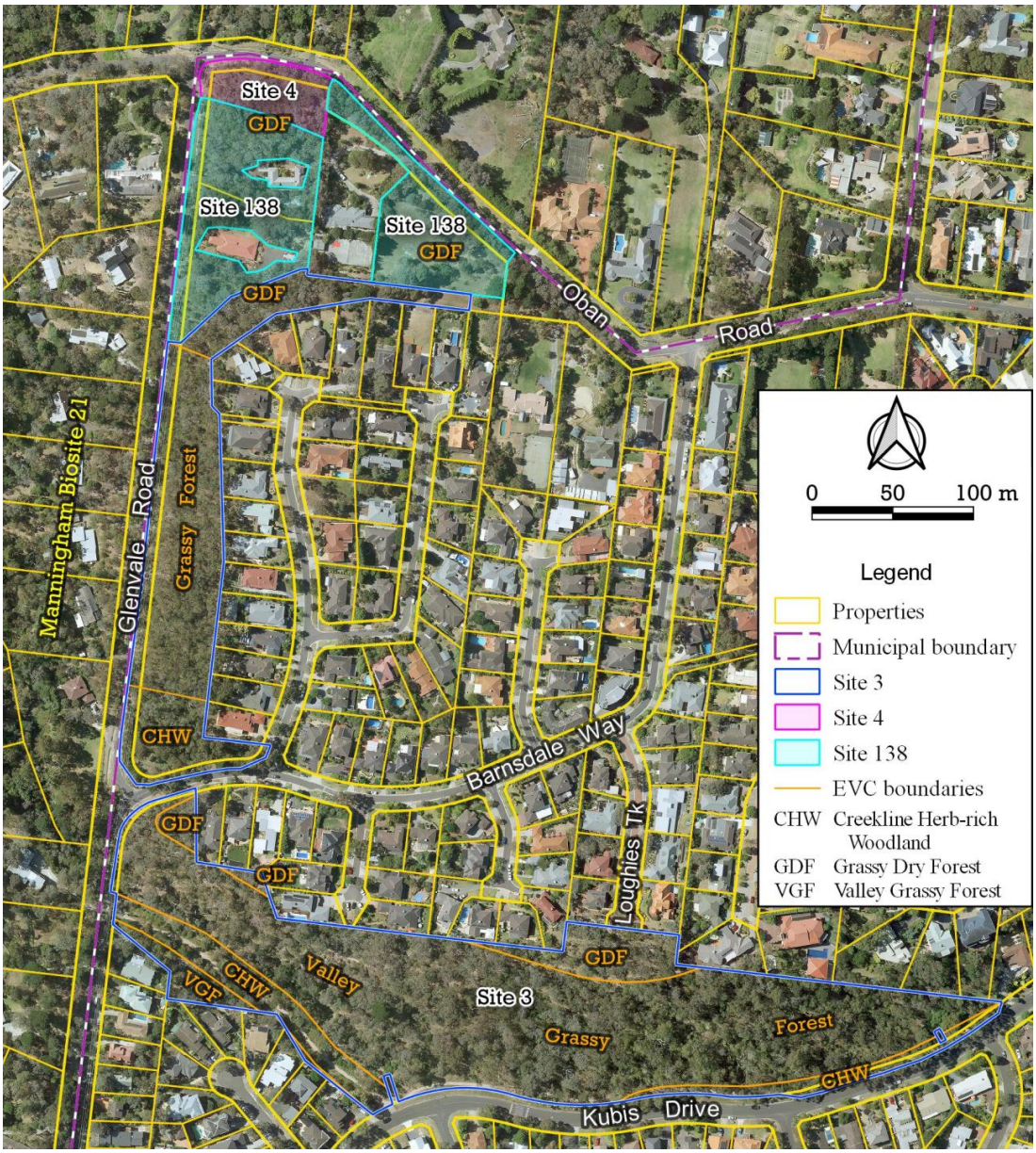
The author has periodically visited B.J. Hubbard Reserve for forty years. In that time, he has developed a familiarity with the reserve and its history and has made many incidental observations of flora and fauna. The analysis above draws on that knowledge as well as the following sources of information about the site:

- A total of approximately three hours of flora survey in the reserve during 2018 and 2019 to update information from the previous studies as required;
- Spotlighting for nocturnal wildlife for 35 minutes in April 2018;
- An intensive flora survey and brief fauna survey by the author for the *'B.J. Hubbard Reserve Bushland Management Plan, 2003'* (Lorimer 2003), including monitoring photographs;
- A 1999 record of a Koala, by Peter Menkhorst, stored in the Victorian Biodiversity Atlas (VBA);
- A bird list from a brief inspection by a Birds Australia member in 1999;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on the following sources plus roughly fifty hours of fieldwork: a full flora survey, brief bird surveys, incidental fauna observations, a mammal hair survey and 2–3 hours of spotlighting;
- An intensive flora survey and brief fauna survey by the author for the *'B.J. Hubbard Reserve Bushland Management Plan 1997'* (Lorimer 1997a), including monitoring photographs;
- A 'preliminary listing' of plant species compiled by Eva Buchanan in 1992, expanded by the present author later that year; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the VBA. Note that most of the VBA's data points mapped in the reserve are wrongly mapped. The associated mapping of EVCs shows a band of Swampy Riparian Complex which should be much narrower. The classification as Swampy Riparian Complex is presumably because, in the absence of the mappers doing any site inspection, they could not narrow the identity down further to Swampy Riparian Woodland.

Site 3. Loughies Bushland, Ringwood North

Biological Significance Level: *State* due to the presence of vulnerable vegetation types, the rare Dandenong Range Cinnamon Wattle and the endangered Barking Owl



Boundaries

The image above shows an aerial photograph from February 2017 overlaid with relevant boundaries. Site 3 has two polygons. The one north of Barnsdale Way occupies all but the northeastern extremity of a single property, plus abutting road verge. The part south of Barnsdale Way comprises a single property plus parts of its road verges. Sites 4 and 138 are included on the image to show landscape context; they are described and assessed later in this volume.

Land use & tenure

The 5.8 ha of the two properties that make up most of Site 3 are council reserves managed for nature conservation except for a retarding basin (c. 0.07 ha) and a sewer pumping station (c. 0.02 ha). The abutting roads are council roads. The sections of road verge within the site are managed as if they are parts of the reserves. Vegetation management is done by Maroondah City Council, council contractors and the Friends of Loughies Bushland. Footpaths provide access for passive recreation through the part of the site south of Barnsdale Way. There are no well-defined paths north of Barnsdale Way but there is a small amount of pedestrian use for recreation or to walk through the neighbourhood.

General description

Most of the part of Site 3 south of Barnsdale Way was purchased and reserved by Ringwood City Council in 1993 and officially named Loughies Bushland the following year. Some abutting land was added a few years later in association with subdivision of neighbouring land. The name of the part of the site north of Barnsdale Way is unclear: The state government's online 'Vicnames – register of geographic place names' shows Loughies Bushland as including both parts of Site 3 but it gives the address of only the southern part. The northern part is alternatively known as the Glenvale Road Reserve but that name is not officially registered.

Site 3 is one of Maroondah's top few sites for biodiversity and threatened bird species. It has some very natural habitat near Loughies Track and on the south-facing slope north of Barnsdale Way. Although the site is much smaller than some others in this report, it is part of a larger expanse of habitat that extends north and west of Site 3 to the Yarra River. The total area is so large and ecologically well-connected to other habitat that birdlife is rich, echidnas and wallabies reside and one can still find such rare bird species as the Powerful Owl and Barking Owl.

The Kubis Drive frontage was once the bank of a creek, now called the 'Glenvale Road Drain'. The creek also flowed along what is now a walkway through Loughies Bushland between Kubis Drive and Glenvale Road. Where a small pond now sits beside the walkway, the creek was dammed by wealthy landowner Tony Loughnan ('Loughie') early in the 20th Century. That created 'Lake Loughnan', which extended halfway to Kubis Drive (as seen in the 1945 government aerial photograph, 'Ringwood A2D').

In the 1970s, the lake and creek were filled and Kubis Drive was built over the top. Pipes were laid to carry sewage and the creek's water. Only vestiges remain of the creek bank's original 'Creekline Herb-rich Woodland' vegetation, such as some Swamp Gums (*Eucalyptus ovata*) and rushes. However, some additional aspects of the former environment have been reconstructed along the walkway: Maroondah City Council has constructed a swale and the pond mentioned above, and they and the Friends of Loughies Bushland have planted species that probably once grew there naturally.

Another creek flowed down what is now Barnsdale Way until the mid-1990s when it, too, was replaced by a pipe beneath a road. A short, heavily modified section of the gully remains within Site 3, immediately north of Barnsdale Way. It is used as a retarding basin, with Glenvale Road crossing the dam wall. The vegetation there includes some Swamp Gums and other indigenous species that remain from the original Creekline Herb-rich Woodland, as well as some planted indigenous species and some introduced species that have volunteered themselves.

Creekline Herb-rich Woodland is listed by the state government as a 'vulnerable' Ecological Vegetation Class (EVC). That is in part because of the prevalence of creeks being destroyed in the way just described.

North of the retarding basin, there is a south-facing slope where 108 naturally-occurring indigenous plant species were found during this study's ecological survey. Five of those species are in the 'critically endangered' category of risk of dying out in Maroondah. To have so many plant species is somewhat surprising, considering that the abovementioned aerial photograph shows most of the slope to have had very few trees or shrubs in 1945. The EVC that has regrown – 'Grassy Forest' – is listed by the state government as 'vulnerable'. The Powerful Owl and Barking Owl were both heard there during this study: The former is listed as 'vulnerable' in Victoria and the latter as 'endangered' (the next-highest category).

A quite different EVC (but again 'vulnerable') occurs on the south-facing slope that occupies most of the site south of Barnsdale Way: Valley Grassy Forest. The 1945 aerial photograph shows it as a forest of trees with crowns typically 6–8 m in diameter, suggesting regrowth at most a few decades old. There appears to have been no widespread clearing there since. This study's ecological survey found 109 naturally-occurring, indigenous plant species in the Valley Grassy Forest.

The areas marked as 'Grassy Dry Forest' on the aerial photograph of p. 18 are the most elevated parts of Site 3. The segment of Grassy Dry Forest closest to Barnsdale Way and the segment closest to Loughies Track partly contain vegetation in excellent ecological condition, with many wildflower species.

Altogether, 192 naturally-occurring, indigenous plant species were observed in Site 3 during this study.

Relationship to other land

The mixtures of plant species in Site 3 show interesting differences and relationships with the rest of Maroondah's native vegetation. The vegetation on the south-facing slope beside Kubis Drive is best classified as a form of Valley Grassy Forest but the strong dominance of Red Box (*Eucalyptus polyanthemos*) sets that slope apart from other Valley Grassy Forest in Maroondah. That may be due to the slope's history of clearing. The vegetation of the north-south strip beside Glenvale Road is best classified as Grassy Forest, of which the closest other occurrences are at The 100 Acres in Park Orchards (2 km north) and Grandfill Reserve in Croydon (5 km east). The Grassy Dry Forest is more typical of its type.

Site 3 is effectively just one part of a much larger site encompassing Site 4, Site 138 and a string of Manningham City Council's 'Biosites' (numbers 16–21 of Foreman 2004) that extend from Glenvale Road to the Yarra River. This continuity of habitat facilitates circulation of mobile fauna such as wallabies, echidnas, birds, bats and flying insects. The presence of a creek on the opposite side of Glenvale Road can be presumed to provide a wildlife corridor connected to Site 3, based on the considerations of Section 7.9 of Volume 1. That is a likely reason for the presence of the Powerful Owl and Barking Owl on the western edge of Site 3 during this study.

The movements of birds and insects through the landscape is important not only for the needs of those animals but also for the pollen and seeds that the animals may disperse as they go. Wallabies may also disperse seeds.

Without Loughies Bushland, B.J. Hubbard Reserve (Site 2, 75 m to the southeast) would be much more of an ecological island. That would be expected to significantly diminish B.J. Hubbard Reserve's ecological viability and values.

Site 3 provides high-quality habitat for its Black Wallabies and reasonable habitat for echidnas. During this study, both those species have been observed moving around inferior habitat on nearby private land – even an echidna travelling as far as the intersection of Kubis Drive and Oban Road. Without the habitat of Site 3, those animals would be unlikely to persist in the local area and would therefore not visit the surrounding streets and residences. The same applies to bird species such as the Common Bronzewing and Gang Gang.

The movements of wildlife through the neighbourhood greatly enhances the area's natural ambience, e.g. through birdsong. This no doubt benefits residents.

Bioregion: Highlands - Southern Fall

Habitat types

The descriptions of vegetation below include only the more abundant or ecologically informative indigenous plant species. It is hoped that the full set of flora data will be made available online. 'EVC' means 'Ecological Vegetation Class'.

Grassy Dry Forest (EVC 22, 'Least concern' in the bioregion). 148 indigenous plant species were recorded in this study. The ecological condition south of Barnsdale Way varies between excellent and

fair (ratings 'A' and 'C' of *'Sites of Biological Significance in Maroondah'*). North of Barnsdale Way, the condition varies between excellent (rating 'A') next to 160–166 Glenvale Rd and fair (rating 'C') at the site's northeastern extremity.

Canopy trees: Dominated by Red Box (*Eucalyptus polyanthemos*) and Red Stringybark (*E. macrorhyncha*). The only other eucalypt is Bundy (*E. goniocalyx*), which is moderately abundant.

Lower trees: Dominated variously by Cherry Ballart (*Exocarpos cupressiformis*), Black Wattle (*Acacia mearnsii*) and Golden Wattle (*A. pycnantha*).

Large shrubs: Patchy, sparse to dense, with abundant Sweet Bursaria (*Bursaria spinosa*), Shiny Cassinia (*Cassinia longifolia*), Sifton bush (*C. sifton*) and Austral Dusty Miller (*Spyridium parvifolium*). Plum-leafed Pomaderris (*Pomaderris prunifolia*) is notably present.

Medium shrubs: Not dense, represented mostly by Hop Bitter-pea (*Daviesia latifolia*) and Narrow-leaf Bitter-pea (*Daviesia leptophylla*).

Small shrubs: Not dense, represented mostly by Grey Parrot-pea (*Dillwynia cinerascens*) and Common Flat-pea (*Platylobium obtusangulum*). Common Beard-heath (*Leucopogon virgatus*) is somewhat less common. The presence of small numbers of Grey Guinea-flower (*Hibbertia obtusifolia*) is notable.

Ferns: Absent.

Climbers: Small-leafed Clematis (*Clematis decipiens*) is abundant. The following species are fairly common: Common Apple-berry (*Billardiera scandens*), Downy Dodder-laurel (*Cassytha pubescens*) and Love Creeper (*Comesperma volubile*). Other climbers are scarce.

Creepers: Fairly abundant, the most abundant species being Thin-leaf Wattle (*Acacia aculeatissima*), Kidney-weed (*Dichondra repens*), Purple Coral-pea (*Hardenbergia violacea*) and the wood-sorrel *Oxalis exilis / perennans*. The presence of Cranberry Heath (*Astroloma humifusum*) is notable.

Other groundcover: The liverwort, Green Worms (*Chiloscyphus semiteres*) and the introduced moss *Pseudoscleropodium purum* are dense over substantial areas. The mosses *Campylopus clavatus* and *Hypnum cupressiforme* are also fairly abundant. The dominant grassy species are variously Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Red-anther Wallaby-grass (*Rytidosperma pallidum*) and Small Grass-tree (*Xanthorrhoea minor*). Variable Sword-sedge (*Lepidosperma laterale*), Velvet Wallaby-grass (*Rytidosperma pilosum*) and Clustered Wallaby-grass (*R. racemosum*) are fairly abundant. Other abundant species are Chocolate Lily (*Arthropodium strictum*), Blue Pincushion (*Brunonia australis*), Milkmaids (*Burchardia umbellata*), Black-anther Flax-lily (*Dianella revoluta*), Scented Sundew (*Drosera aberrans*), Common Raspwort (*Gonocarpus tetragynus*) and localised patches of Early Nancy (*Wurmbea dioica*).

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion). 109 indigenous plant species were recorded in this study. The ecological condition varies between good and fair (ratings 'B' and 'C' of *'Sites of Biological Significance in Maroondah'*).

Canopy trees: Dominated by Red Box (*Eucalyptus polyanthemos*). Bundy (*E. goniocalyx*), Red Stringybark (*E. macrorhyncha*), Yellow Box (*E. melliodora*) and Narrow-leaved Peppermint (*E. radiata*) are also present, along with some Swamp Gums (*E. ovata*) as outliers from the adjacent Creekline Herb-rich Woodland.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*) and Black Wattle (*Acacia mearnsii*). There are moderate numbers of Blackwood (*Acacia melanoxylon*) and Golden Wattle (*Acacia pycnantha*). Lightwood (*Acacia implexa*) is confined to the southernmost point of Loughies Bushland.

Medium to large shrubs: Quite dense, with abundant Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*) and Austral Dusty Miller (*Spyridium parvifolium*). Common Cassinia (*Cassinia aculeata*), Austral Indigo (*Indigofera australis*), Snowy Daisy-bush (*Olearia lirata*) and Burgan (*Kunzea* sp.) are scattered. Plum-leafed Pomaderris (*Pomaderris prunifolia*) is represented by a wild stand near Glenvale Road and some planted individuals further east. The presence of Shrubby Fireweed (*Senecio minimus*) helps distinguish the Valley Grassy Forest from Grassy Dry Forest.

Small shrubs: Sparse, represented mostly by Common Heath (*Epacris impressa*), Common Flat-pea (*Platylobium obtusangulum*), Grey Parrot-pea (*Dillwynia cinerascens*) and Hop Goodenia

(*Goodenia ovata*) are numerous throughout. Common Beard-heath (*Leucopogon virgatus*) is somewhat less common.

Ferns: Common Maidenhair (*Adiantum aethiopicum*) is dense over substantial areas – a feature of the EVC. There are no other ferns, not even bracken (*Pteridium esculentum*).

Climbers: Common Apple-berry (*Billardiera scandens*), Coarse Dodder-laurel (*Cassytha melantha*), Mountain Clematis (*Clematis aristata*) and Love Creeper (*Comesperma volubile*) are moderately abundant but the percentage cover of their foliage is very small. Other climbers are scarce.

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is fairly abundant – a good indicator of the EVC.

Creepers: Kidney-weed (*Dichondra repens*) is abundant. Bidgee-widgee (*Acaena novae-zelandiae*), Stinking Pennywort (*Hydrocotyle laxiflora*), Purple Coral-pea (*Hardenbergia violacea*), Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel *Oxalis exilis / perennans* are common. Other creepers are scarce.

Other groundcover: Moss is dense, particularly *Hypnum cupressiforme* and the introduced *Pseudoscleropodium purum*, as well as many patches of *Ptychomnion aciculare*. The dominant grassy species are Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*L. longifolia* subsp. *longifolia*) and Weeping Grass (*Microlaena stipoides*). Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) is common on the lower slope. Notably, Small Grass-tree (*Xanthorrhoea minor*) and Red-anther Wallaby-grass (*Rytidosperma pallidum*) are very scarce and four other wallaby-grass species are more common. The lilies, Chocolate Lily (*Arthropodium strictum*) and Black-anther Flax-lily (*Dianella revoluta*) are abundant, as are Common Raspwort (*Gonocarpus tetragynus*) and Small Poranthera (*Poranthera microphylla*).

Grassy Forest (EVC 128, **Vulnerable** in the bioregion). 108 indigenous plant species were recorded in this study. The ecological condition varies between excellent and good (ratings 'A' and 'B' of *'Sites of Biological Significance in Maroondah'*). The lowest part of the slope shows similarities with Lowland Forest (e.g. the presence of *Xanthosia dissecta*) and Herb-rich Foothill Forest but it is still closer to Grassy Forest.

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) and Red Stringybark (*E. macrorhyncha*). Bundy (*E. goniocalyx*) and Red Box (*E. polyanthemos*) are less abundant.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*), Golden Wattle (*Acacia pycnantha*) and Burgan (*Kunzea leptospermoides*). There are moderate numbers of Blackwood (*Acacia melanoxylon*). Black Wattle (*Acacia mearnsii*) is quite scarce, contrasting with the adjacent Grassy Dry Forest.

Medium to large shrubs: Sparse apart from localised patches, which are mostly dominated by Plum-leafed Pomaderris (*Pomaderris prunifolia*) or Austral Dusty Miller (*Spyridium parvifolium*). Golden Bush-pea (*Pultenaea gunnii*) is widespread and moderately abundant.

Small shrubs: Sparse, represented mostly by Grey Parrot-pea (*Dillwynia cinerascens*), Common Heath (*Epacris impressa*), Common Beard-heath (*Leucopogon virgatus*) and Common Flat-pea (*Platylobium obtusangulum*).

Ferns: None.

Climbers: Love Creeper (*Comesperma volubile*) is abundant; the following species rather less so: Common Apple-berry (*Billardiera scandens*), Downy Dodder-laurel (*Cassytha pubescens*), Mountain Clematis (*Clematis aristata*) and Small-leafed Clematis (*Clematis decipiens*).

Creepers: Ivy-leaf Violet (*Viola hederacea*) is abundant; the following species less so: Thin-leafed Wattle (*Acacia aculeatissima*), Kidney-weed (*Dichondra repens*) and the wood-sorrel *Oxalis exilis / perennans*. Other creepers are scarce.

Other groundcover: Moss is dense, particularly *Hypnum cupressiforme* and *Dicranoloma billarderi*. The other dominant species are Thatch Saw-sedge (*Gahnia radula*), Red-anther Wallaby-grass (*Rytidosperma pallidum*) and, in season, Scented Sundew (*Drosera aberrans*). Although not dominant, the following species are still abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*), Soft Tussock-grass (*Poa morrisii*), Clustered Wallaby-grass (*Rytidosperma racemosum*), Chocolate Lily (*Arthropodium strictum*), Milkmaids (*Burchardia umbellata*), Black-anther Flax-lily (*Dianella revoluta*) and Small Poranthera (*Poranthera microphylla*). The following species are moderately abundant and they are indicative of the conditions: Wiry Buttons (*Leptorhynchos*

tenuifolius), Twining Fringe-lily (*Thysanotus patersonii*), Common Bog-rush (*Schoenus apogon*), Small Grass-tree (*Xanthorrhoea minor*) and Cut-leaf Xanthosia (*Xanthosia dissecta*).

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the bioregion). Varying in ecological condition from fair to poor (ratings 'C' to 'D' of *'Sites of Biological Significance in Maroondah'*).

Canopy trees: Swamp Gum (*Eucalyptus ovata*) dominates. Eucalypts of adjacent EVCs are also present as outliers.

Lower trees: Blackwood (*Acacia melanoxylon*) dominates. Black Wattle (*Acacia mearnsii*) is also abundant at the retarding basin and the filled-in lake, probably due to the history of clearing and soil disturbance.

Shrubs: Dominated by Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*), Sweet Bursaria (*Bursaria spinosa*) and Common Cassinia (*Cassinia aculeata*). The last two of these probably reflect the history of disturbance. Although less abundant, Prickly Moses (*Acacia verticillata*) and Tree Everlasting (*Ozothamnus ferrugineus*) are better environmental indicators.

Ferns: Common Maidenhair (*Adiantum aethiopicum*) is moderately common. The only other fern species is Rough Tree-fern (*Cyathea australis*), which is only represented by three individuals.

Climbers: Mountain Clematis (*Clematis aristata*) is abundant; other species considerably less so.

Scramblers: Small-leafed Bramble (*Rubus parvifolius*) is present but localised and not abundant.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*), Kidney-weed (*Dichondra repens*) and Ivy-leaf Violet (*Viola hederacea*) are present in modest numbers.

Other groundcover: The liverworts *Lunularia cruciata* and *Chiloscyphus semiteres* are abundant. Among the grassy species, Thatch Saw-sedge (*Gahnia radula*) and Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) dominate, followed by Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) and Slender Wallaby-grass (*Rytidosperma penicillatum*). The presence of nine indigenous species of rush (*Juncus* species) is testament to the seasonally wet soil conditions, as is Hairy Willow-herb (*Epilobium hirtigerum*).

Non-perennial stream & stream channel (No EVC number). Fair to poor ecological condition (and only reaching fair because of planted species). The following deals only with wild, indigenous plants.

Trees and shrubs: Absent.

Non-woody species: Rush species (*Juncus*), Hairy Willow-herb (*Epilobium hirtigerum*) and Small Loosestrife (*Lythrum hyssopifolia*).

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. The Grassy Forest beside Glenvale Road is one of many locations within the species' range to have a substantial and apparently quite viable population of the species.

A subspecies of Veined Spear-grass (namely *Austrostipa rudis* subsp. *australis*) is represented by approximately six thriving plants near the entrance to Loughies Bushland close to the Kubis Drive – Werac Drive corner. The subspecies is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Apparently died out in Maroondah

Two or three plants of the Small Spider-orchid (*Caladenia parva*) were seen in Loughies Bushland around the start of this century – the last records in Maroondah.

The Blue Caladenia (*Cyanicula caerulea*) was recorded a short distance north of Barnsdale Way in c. 1985 by local resident Margaret Williams. The only other record in Maroondah's history is a 1927 herbarium specimen from Ringwood or Ringwood North.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in the site can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – one plant at the site's northwest corner;
- *Astroloma humifusum* (Cranberry Heath) – three grow in the Grassy Forest and a substantially larger number grow in Grassy Dry Forest in the part of the reserve that lies south of Barnsdale Way;
- *Caladenia carnea* (Pink Fingers) – recorded in 1995 at what was to become the end of Loughies Track. Possibly also seen nearby later that decade but not found in subsequent inspections;
- *Caladenia catenata* (White Caladenia) – a single, recently discovered plant grows in the Grassy Forest;
- *Chrysocephalum semipapposum* (Clustered Everlasting) – scattered around the upper slopes above Kubis Drive, possibly some of them planted;
- *Correa reflexa* var. *reflexa* (Common Correa) – scattered widely;
- *Crassula sieberiana* or *C. tetramera* (Sieber Crassula) – recorded in 1995–1996 on the slope above Kubis Drive without an indication of population or precise location; not recorded since;
- *Cynoglossum suaveolens* (Sweet Hound's-tongue) – a large patch grows in Grassy Dry Forest near Barnsdale Way. Because the species suckers, the patch may contain one plant or quite a few;
- *Daucus glochidiatus* (Austral Carrot) – the author recorded a small number in 1995 or 1996 just southeast of the corner of Glenvale Road and Barnsdale Way but he has seen none there or elsewhere in Maroondah for at least twenty years;
- *Diuris sulphurea* (Tiger Orchid) – the author recorded a small number on the slope above Kubis Drive in 1995 or 1996 but he has seen none there for at least twenty years;
- *Echinopogon ovatus* (Common Hedgehog-grass) – only two plants could be found in this study, both in the Valley Grassy Forest. In 1995, it was also recorded just south of Barnsdale Way;
- *Eucalyptus macrorhyncha* (Red Stringybark) – one of the dominant species in much of the site but generally not in good health (perhaps due, in part, to the large possum population in the neighbourhood);
- *Gompholobium huegelii* (Common Wedge-pea) – unspecified numbers were recorded in 1995–1996 in the east-west section at the site's northern extremity and at a single location halfway up the slope from Werac Drive. The only plants remaining appear to have been planted recently;
- *Hibbertia obtusifolia* (Grey Guinea-flower) – the only substantial population in Maroondah is in Loughies Bushland near the dead end of Loughies Track;
- *Kennedia prostrata* (Running Postman) – this study found two in the Grassy Forest and 1–3 near the dead end of Loughies Track;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – a modest number grows in a small area in the fenced enclosure at the dead end of Loughies Track;
- *Lobelia gibbosa* (Tall Lobelia) – in summer 1995–1996, the author recorded an unspecified (but probably small) number in the site's far north and on the slope above Kubis Drive. None have been recorded there for at least twenty years;
- *Microseris walteri (*Murnong) – the author recorded an unspecified (but probably small) number in the site's far north in 1995 but has seen none there in subsequent visits;
- *Pentapogon quadrifidus* var. *quadrifidus* (Five-awned Spear-grass) – the author recorded an unspecified (but probably small) number in the Grassy Forest in 1995 but has seen none there in subsequent visits;
- *Persoonia juniperina* (Prickly Geebung) – the author recorded an unspecified (but probably small) number in 1995 halfway up the slope from Werac Drive but he has seen none there in recent years;
- *Pimelea curviflora* (Curved Rice-flower) – a few grow near the corner of Glenvale Road and Barnsdale Way. Warranwood Reserve is the only other place in Maroondah where the species has ever been recorded;
- *Poa tenera* (Slender Tussock-grass) – a small number grow not far north of the retarding basin;

- *Senecio minimus* (Shrubby Fireweed) – in this study, four were found in the Valley Grassy Forest and one in the far northeast of the site but the species is opportunistic and could appear anywhere from time to time;
- *Veronica calycina* (Hairy Speedwell) – the author recorded an unspecified (but probably small) number in 1995 in the far north of the site and near what is now the dead end of Loughies Track. He does not recall seeing it more recently;
- *Veronica derwentiana* (Derwent Speedwell) – recorded in 1995–1996 midway along the Kubis Drive frontage, where it died some years later. Some have since been planted closer to Glenvale Road.

Significant fauna

Threatened in Victoria

- Barking Owl – Endangered in Victoria: Through the course of this study, people living on Glenvale Road opposite Site 3 periodically heard a Barking Owl around their home. The bird(s) were within Site 3 some of the time but it is uncertain how often. It appears that Site 3 is the southeasterly limit of the bird's range.
- Powerful Owl – Vulnerable in Victoria: As for the Barking Owl except that the calls were heard more often.

Apparently died out in Maroondah

- A Koala was recorded in the reserve in 1995 as it moved through the area. Koalas are now presumed extinct in Maroondah.

Rare or threatened with dying out in Maroondah

- Varied Sittella: last reported in 2015;
- Black Wallabies and Sugar Gliders are resident in the site.

Fauna habitat

- The presence of all strata of native vegetation represents good habitat for a range of forest birds, bats, other arboreal mammals and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including microbats;
- Council has installed nest boxes to augment the natural tree hollows;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The abundance of possums observed during this study's spotlighting represents a good food source for Powerful Owls;
- The near-continuity of treed habitat that extends northwestward from Site 3 along the Glenvale Road Drain valley greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the vegetation varies across all categories of the A–D scale of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The ratings for each EVC are provided with the descriptions of the EVCs, above.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The areas of Valley Grassy Forest and Grassy Forest easily meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The habitat score easily exceeds 0.3 almost throughout those EVCs. The EVCs are listed by the state government as 'vulnerable'. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Rare or threatened species

The Barking Owl is listed as 'Endangered' in the state government's 'Advisory List of Threatened Vertebrate Fauna in Victoria – 2013'. It occurs in Site 3 and its distribution is not confined to Victoria. It follows that the site meets standard criterion 3.1.2 for a site of **State** significance.

The Powerful Owl is listed as 'Vulnerable' in the state government's 'Advisory List of Threatened Vertebrate Fauna in Victoria – 2013'. It occurs in Site 3 and its distribution is not confined to Victoria. It follows that the site meets standard criterion 3.1.2 for a site of Regional significance.

The reserve has a substantial and apparently quite viable population of Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a small but probably viable population in Loughies Bushland. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Red Stringybark and fourteen other plant species seen in Site 3 during this study can be confidently taken to be in the 'critically endangered' category of risk of dying out in Maroondah. Most of those species fit the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Site 3 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' significance rating differs from the 'Regional' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Grassy Forest, Grassy Forest and Dandenong Range Cinnamon Wattle.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the site and also immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creek in the retarding basin helps to stabilise the soil and remove a small amount of water pollution.

The natural ambience of the site is expected to be beneficial to the wellbeing of visitors to the site. The natural ambience also encourages people to get exercise by walking through Loughies Bushland.

While the Friends of Loughies Bushland provides ecological benefits to the bushland, the bushland reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens spreads nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. It also contributes greatly to the neighbourhood's 'green and leafy' character.

Changes

Change in the extent of habitat

At the time of the 1997 report, *'Sites of Biological Significance in Maroondah'*, Site 3 included additional land along Loughies Track, Oban Woods and Greenhill Rise. Those areas had just been subdivided and were soon used for housing. Hardly any habitat has been retained on the subdivided land, resulting in the loss of 3.5 ha of habitat. That outcome is consistent with the so-called 'Villawood' principle in case law that subdivisions with lots smaller than 4,000 m² cannot be relied upon to retain any native vegetation.

Within the revised bounds of Site 3 adopted here, the only change in the extent of habitat since 1997 is a very small increase due to revegetation beside the walkway between Kubis Drive and Glenvale Road.

Change in the ecological condition of habitat

Since 1997, many large pine trees have been removed, allowing indigenous plants to regenerate and provide wildlife habitat. Council and the Friends of Loughies Bushland have put considerable effort into weed control and revegetation, which has significantly reduced the cover of introduced plants in all but the easternmost corner. As a result, Boneseed, Blackberry, Sweet Pittosporum and seven other introduced plant species that the present author classified as 'very serious' in the *'Loughie's Bushland Management Plan, 1997'* (Lorimer 1997b) have all been reduced to the 'potential threat' category.

Council has also undertaken niche planting of locally threatened plants but it appears that not many have reproduced before they died.

Despite the very positive results of weed control and revegetation, the overall ecological condition of the habitat has not significantly improved since 1997. That is because a significant number of indigenous plant species have disappeared (see below), leaving the habitat less diverse and possibly less resilient. The losses of species are probably due in part to the Millennium Drought and in part due to the legacy of environmental degradation that occurred scores of years earlier.

Changes in the species present

The following indigenous plant species are suspected to have died out since 1997 at least temporarily (with significant species underlined):

Pteridium esculentum	*Galium gaudichaudii*	*Microseris walteri*
Caladenia carnea	*Glyceria australis*	*Opercularia ovata*
Caladenia parva	*Gompholobium huegelii*	*Pentapogon quadrifidus*
Centella cordifolia	*Goodenia lanata*	*Persoonia juniperina*
Crassula sieberiana / tetramera	*Hydrocotyle hirta*	*Rytidosperma semiannulare*
Daucus glochidiatus	*Juncus fockei*	*Tricoryne elatior*
Dianella tasmanica	*Juncus planifolius*	*Veronica calycina*
Diuris sulphurea	*Lobelia gibbosa*	*Veronica derwentiana*

The following indigenous plant species were not recorded in Site 3 in 1995–1997 but were found during the present study and are likely to have regenerated or arrived by natural means in the interim:

Acacia genistifolia	*Glossodia major*	*Olearia myrsinoides*
Acacia implexa	*Juncus amabilis*	*Pterostylis nutans*
Acacia stricta	*Juncus subsecundus*	*Rytidosperma geniculatum*
Caladenia catenata	*Kennedia prostrata*	*Solanum laciniatum*
Daviesia latifolia	*Lepidosperma gunnii*	*Solenogyne dominii*
Diuris orientis	*Leptospermum scoparium*	*Solenogyne gunnii*
Diuris pardina	*Lyperanthus suaveolens*	

The following fauna species were resident or regular visitors in Site 3 in 1997 and are presumed to have died out, relocated or ceased to visit since then:

Bell Miner	Grey Shrike-thrush	European Rabbit
Rufous Whistler	Common Starling	

The following fauna species were not observed in Site 3 in the 1990s and are believed to have since established themselves as residents or regular visitors:

Common Bronzewing	Barking Owl	Common Froglet
Galah	Little Wattlebird	Southern Bullfrog
Little Corella	Pied Currawong	
Powerful Owl	Black Wallaby	

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change;
- Orchid poachers;
- Displacement of indigenous plants by garden plants spreading from abutting homes;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The Vegetation Protection Overlay (VPO) applies to most of Site 3 but not the road verges or the narrow strip in the northeast abutting 239 & 247 Oban Road. It also applies to some private properties on Greenhill Rise, Barnsdale Way, Loughies Track and Oban Woods, even though those properties were cleared approximately twenty years ago.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the areas outlined in mid-blue on the aerial photograph on p. 18. This will provide greater consistency with the Environmental Significance Overlay that already applies to the opposite side of Glenvale Road, in Manningham. If desired, the overlay could be extended to the municipal boundary in the middle of the road.

Removal of native vegetation in Site 3 is also regulated under the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. Removal of trees (native or otherwise) is further regulated under Schedule 3 of the Significant Landscape Overlay.

The Bushfire Management Overlay (BMO) applies to all the site north of Barnsdale Way and to the northwestern quarter of the part south of Barnsdale Way. The BMO requires a permit for works associated

with leisure or recreation, which may affect future plans for the site. Other requirements of the BMO have negligible effect on the site.

Schedule 2 of the Design and Development Overlay applies restrictions on subdivision of the retarding basin area and the road verge of Kubis Drive but subdivision is very unlikely to occur.

Information sources

The author has periodically visited Loughies Bushland for 26 years, including several ecological surveys. In that time, he has developed a familiarity with the reserve and its history and has made many incidental observations of flora and fauna. The analysis above draws on that knowledge as well as the following sources of information about the reserve:

- 35 hours of flora survey specifically for this study in all seasons between July 2016 and October 2018. This work produced 13 lists of plant species and their abundances for different parts of the site (plus an incidental record of *Caladenia catenata*);
- Incidental fauna observations during the work just described (three lists);
- Four nights of spotlighting specifically for this study (20–50 minutes duration, some with owl call playback);
- Records of Barking Owl and Powerful Owl by local residents during 2017–2018;
- Bird lists from 2014–2017 compiled by Michael Honeyman, including while leading walks with the Friends group;
- A list of fauna observed month by month in 1998, compiled by Carol Clarke of the Friends group with contributions by other group members;
- Maroondah City Council's records of planting in the reserve;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on some tens of hours of the current author's fieldwork: a full flora survey, brief bird surveys, a 20-minute bird census, incidental fauna observations, mammal hair survey and spotlighting;
- *'Loughie's Bushland Management Plan 1997'* (Lorimer 1997b), which involved the current author extending the fieldwork he did for *'Sites of Biological Significance in Maroondah'*;
- An observation of a Koala in 1995 by Bradley Curtis of Maroondah City Council;
- A plant list compiled at Loughies Bushland on 27th January 1993 by Eva Buchanan, Beth Armstrong and John Armstrong;
- A list of orchids observed by local resident Margaret Williams, including species in the Grassy Forest during 1980–1991;
- Flora data from a quadrat surveyed by a state government botanist on 11th December 1986 (but with unreliable entries, e.g. an implausible record of *Austrostipa elegantissima*);
- Aerial photographs from 1945, 2001, 2011 and 2017.
- A photograph of Lake Loughnan from early in the 20th Century.

No other useful information could be found in the Victorian Biodiversity Atlas. Note that the state government's vegetation mapping is quite inaccurate regarding the extent and EVCs of vegetation in Site 3.

Acknowledgements

Thanks to Jenna Rose (a Glenvale Rd resident) for her observations of Barking Owl and Powerful Owl during 2017–2018.

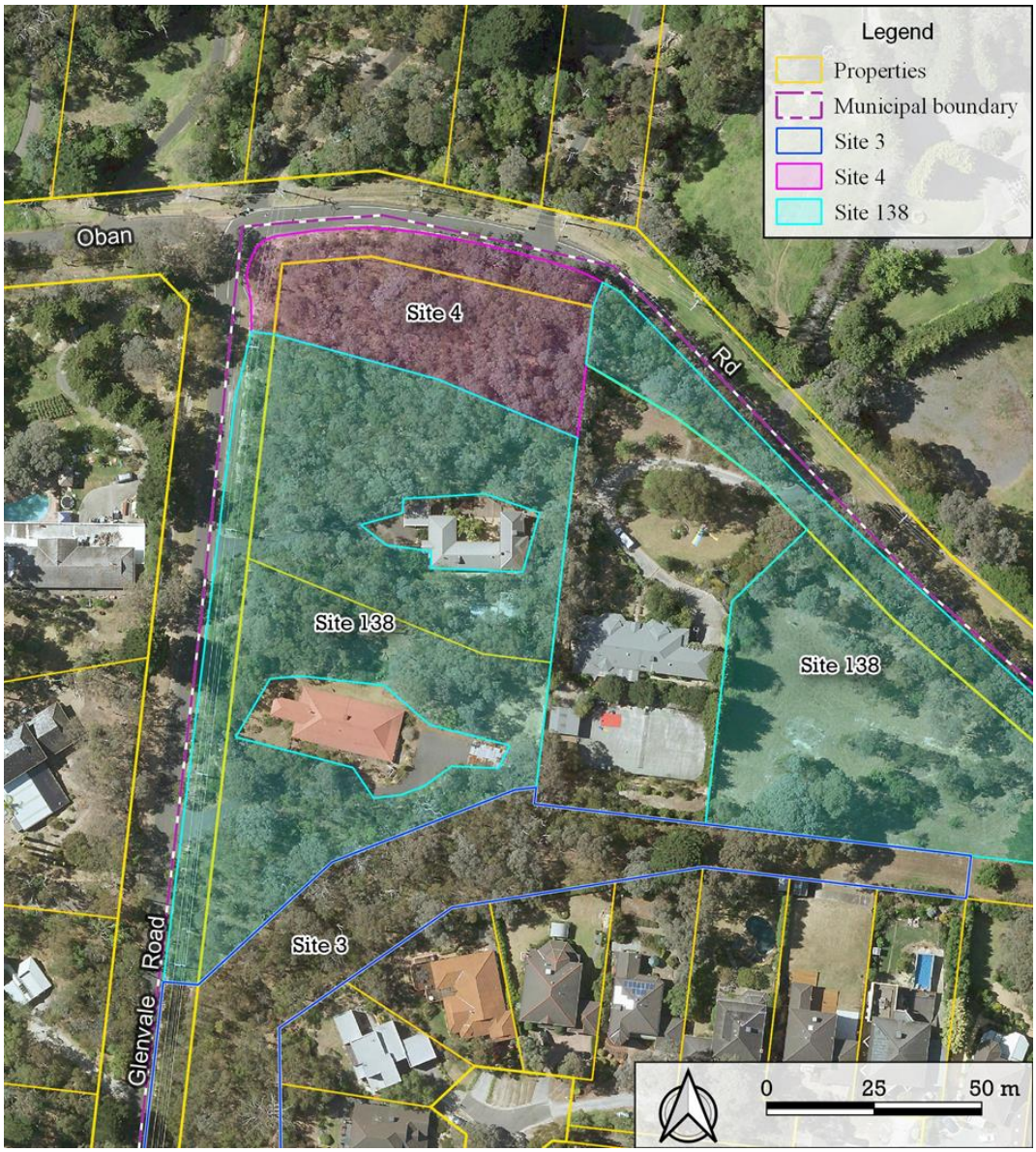
Thanks to Margaret and Derek Williams (Glenvale Rd residents) for their records and recollections of flora, fauna and history of the site since the 1960s.

Thanks to Carol Clarke of the Friends of Loughies Bushland for passing on her knowledge of the site and its history, and records of flora and fauna.

Thanks to bird observer Michael Honeyman for his bird lists in eBird and from leading walks with the Friends group during 2014–2016.

Site 4. Oban Rd / Glenvale Rd Reserve, Ringwood North

Biological Significance Level: *Local* due to the presence of native vegetation and locally threatened plants



Boundaries, land use and tenure

The aerial photograph above shows Site 4 tinted magenta, with neighbouring sites for context. The site includes a council nature reserve of 0.17 ha, the abutting roadside batters and table drains (0.25 ha total). The southern and eastern site boundaries are property boundaries. The other boundaries follow the edges of the abutting road pavement. The roads are council roads.

Vegetation management is done by Maroondah City Council. The reserve is also used for unauthorised dumping of garden waste. Lack of a footpath or easy access up the steep roadside batters means the reserve receives negligible recreational use.

General description

This tiny nature reserve is on a gentle slope toward the north-northwest. The road verges are battered steeply down to the road gutters, inhibiting visitors.

The site supports regrowth of 'Grassy Dry Forest' that may be as young as forty years old, judging by the eucalypt trunk diameters. The 1945 government aerial photograph, 'Ringwood A2D', shows the roadside being treed and the reserve being devoid of shrubs and trees.

Maroondah City Council first recognised the reserve's conservation significance in 1995. The present author and council officer Helen Moss conducted botanical surveys that year and the site has been managed as a nature reserve since then.

Despite the former absence of woody vegetation, the site now supports many indigenous trees – so dense that not all of them can reach maturity. There is also a patchy shrub layer and many wildflowers in a grassy ground layer. Among the wildflowers and trees are species whose risk of dying out in Maroondah falls into the 'critically endangered' category.

Relationship to other land

Although Site 4 is so small, the only substantially larger example of Grassy Dry Forest in Maroondah's reserves is at Warranwood Reserve, which does not have some of the plant species at Site 4. Warrandyte State Park has much larger areas of Grassy Dry Forest, including substantial areas with a richer understorey than Site 4.

Site 4 is effectively just one part of a much larger area of native vegetation encompassing Site 3, Site 138 and a string of Manningham City Council's 'Biosites' that extend from Glenvale Road to the Yarra River. (Those Biosites are numbered 16–21 by Foreman 2004.) This continuity of habitat facilitates circulation of mobile fauna such as wallabies, echidnas, birds, bats and flying insects.

The movements of birds and insects through the landscape is important not only for the needs of those animals but also for the pollen and seeds that the animals may disperse as they go. Wallabies may also disperse seeds.

A mature Black Wallaby was observed in this study spending hours in Site 4. It is probably the same animal seen repeatedly during this study's surveys of Loughies Bushland (Site 3). A juvenile wallaby was also reported in the area in 2018 by a local resident.

The wallabies and birds that make use of habitat in Site 4 and nearby forest also traverse other land during their movements. In doing so, they bring nature into the lives of local residents.

Bioregion: Highlands - Southern Fall

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Grassy Dry Forest (Ecological Vegetation Class no. 22, 'Least concern' in the bioregion). 71 indigenous plant species were recorded in this study; 92 over all flora surveys from 1995.

Canopy trees: Strongly dominated by Red Box (*Eucalyptus polyanthemos*). There are also a few Red Stringybark (*E. macrorhyncha*) and Bundy (*E. goniocalyx*).

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*) and Golden Wattle (*Acacia pycnantha*). Blackwood (*Acacia melanoxylon*) is scarce.

Medium to large shrubs: Patchy. Dominated by Sifton bush (*Cassinia sifton*), followed by Burgan (*Kunzea leptospermoides*). Common Cassinia (*C. aculeata*) and Shiny Cassinia (*C. longifolia*) are moderately abundant. Other medium or large shrubs are scarce.

Small shrubs: Not dense, represented mostly by Grey Parrot-pea (*Dillwynia cinerascens*), Common Heath (*Epacris impressa*) and Common Flat-pea (*Platylobium obtusangulum*). There are five plants of Common Beard-heath (*Leucopogon virgatus*).

Ferns: Absent.

Climbers: Small-leafed Clematis (*Clematis decipiens*) is so abundant as to be smothering and killing many other indigenous plants, particularly in the site's northeast. Common Apple-berry (*Billardiera scandens*) and Downy Dodder-laurel (*Cassytha pubescens*) are moderately abundant. Coarse Dodder-laurel (*C. melantha*) and Love Creeper (*Comesperma volubile*) are scarce.

Creepers: Fairly abundant, the most abundant species being Creeping Bossiaea (*Bossiaea prostrata*), Purple Coral-pea (*Hardenbergia violacea*) and the wood-sorrel *Oxalis exilis / perennans*. There are also three plants of Cranberry Heath (*Astroloma humifusum*).

Other groundcover: Dominated in different areas by Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Grey Tussock-grass (*Poa sieberiana*) and Red-anther Wallaby-grass (*Rytidosperma pallidum*). Other abundant species include Tall Spear-grass (*Austrostipa pubinodis*), Leafy Wallaby-grass (*Rytidosperma fulvum*) and Purplish Wallaby-grass (*R. tenuius*). Characteristically of Grassy Dry Forest, the following species are moderately abundant: Honey-pots (*Acrotriche serrulata*), Blue Pincushion (*Brunonia australis*), Scented Sundew (*Drosera aberrans*), Tall Sundew (*D. auriculata*) and the fireweed, *Senecio phelleus/prenanthoides*. Other groundcover species are scarce.

Significant plants

The following naturally-occurring plant species recorded in the site can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Astroloma humifusum* (Cranberry Heath) – three grow close to Glenvale Road;
- *Correa reflexa* var. *reflexa* (Common Correa) – three grow close to Glenvale Road;
- *Eucalyptus macrorhyncha* (Red Stringybark) – scarce in Site 4, northern outliers of a much larger population in Sites 138, 3 and beyond.

The 46 (approximately) plants of the locally rare orchid *Lyperanthus suaveolens* (Brown Beaks) may well be the largest such population in Maroondah.

Fauna habitat

- The low frequency of human presence in the reserve is probably an attraction to fauna such as the Black Wallaby;
- Patches of dense shrubs provide good cover for Black Wallabies (as was observed during this study) and certain species of birds;
- The presence of all strata of native vegetation represents good habitat for a range of forest birds, bats, other arboreal mammals and invertebrates;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the vegetation varies from excellent in the western third to fair in the eastern third (categories 'A' to 'C' of the A–D scale of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997)). The main factors limiting the ecological condition are:

- Low diversity of indigenous plant species in the east;

- Displacement of some indigenous plants by introduced plants and the problematic indigenous Small-leafed Clematis (*Clematis decipiens*);
- Absence of large eucalypts; and
- Overabundance of young eucalypts and consequent poor health and structure of those trees.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local. This is the equivalent of the 'Municipal rating in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997).

Presence of a patch of native vegetation

In combination with Site 138 (which abuts to the south), Site 4's native vegetation easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The present author estimates that little if any of that vegetation has a habitat score of 0.6 or above. Combining that assessment with the 'Least concern' status of Grassy Dry Forest, the native vegetation would have a 'Low' conservation significance under the 'Native Vegetation Framework'. Standard criterion 3.2.3 then leads to a rating of Local significance.

Locally threatened species

The three species listed in the section above headed 'Significant plants' can be confidently taken to be in the 'critically endangered' category of risk of dying out in Maroondah. Although their populations in this tiny site are small, they are just parts of much larger populations extending through Site 138, Site 3 and Manningham City Council's 'Biosites' 16–21. In the context of the larger populations, the plants in Site 4 probably have a viable future. They therefore meet standard criterion 3.1.5 for a site of Local significance.

The 46 (approximately) plants of the locally rare orchid *Lyperanthus suaveolens* (Brown Beaks) may well be the largest such population in Maroondah, rivalled only by Hochkins Ridge Nature Conservation Reserve (Site 51 on p. 386). Site 4 is therefore an 'important site' for the species in Maroondah. This is a feature of Local significance under standard criterion 3.1.5.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit a few immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens spreads nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. It also contributes to the neighbourhood's 'green and leafy' character.

Changes

Change in the extent of habitat

There has been no material change to the extent of habitat since its habitat values were first documented in 1995.

Changes in the Species Present

The following indigenous plant species are suspected to have died out since 1997 at least temporarily (with significant species underlined):

Acacia mearnsii	*Diuris pardina*	*Ranunculus lappaceus*
Acaena novae-zelandiae	*Eucalyptus melliodora*	*Rytidosperma pilosum*
Caesia parviflora	*Geranium ?potentilloides*	*Senecio glomeratus*
Centella cordifolia	*Juncus amabilis*	*Veronica gracilis*
Coronidium scorpioides	*Lomandra longifolia*	
Dipodium roseum	*Microtis parviflora*	

The following indigenous plant species were not recorded in Site 4 in 1995–1997 but were found during the present study and are likely to have regenerated or arrived by natural means in the interim:

Bursaria spinosa	*Clematis decipiens*	*Rytidosperma racemosum*
Cassinia longifolia	*Comesperma volubile*	*Senecio hispidulus*

Note that the arrival of *Clematis decipiens* has led to the decline and perhaps disappearance of other indigenous species through smothering. The arrival of *Cassinia longifolia* has a similar potential. Overall, there has been a significant net decline in the number of indigenous plant species and the new arrivals are, on average, of significantly less conservation value than the species lost.

The Bell Miner was resident or a regular visitor to Site 4 in 1995. It has since ceased to reside anywhere in Maroondah. There is too little data to infer other changes in the site's fauna.

Change in the ecological condition of habitat

The significant net loss of indigenous plant species noted above indicates a loss of ecological condition of the habitat. This has been most apparent in the site's eastern third, where garden plants from neighbouring properties have encroached, Small-leafed Clematis (*Clematis decipiens*) has become rampant and indigenous plants have dwindled.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by garden plants spreading from abutting homes, including in garden waste dumped in the reserve;
- Smothering and killing of groundcover, shrubs and small trees by Small-leafed Clematis (*Clematis decipiens*);
- Debilitation of indigenous plants, particularly eucalypts, by over-competition from the unnaturally high densities of eucalypts. Over-competition will have its worst effects during drought, which is predicted to worsen with climate change; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Site 4 is in the Low Density Residential Zone.

The reserve (but not the road verge) is covered by the Vegetation Protection Overlay (VPO). Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole site, i.e. the area tinted magenta on the aerial photograph on p. 18. This will provide greater consistency with the Environmental Significance Overlay that already applies to the opposite sides of Oban Road and Glenvale Road, in Manningham. If desired, the overlay could be extended to the municipal boundary on the road centrelines.

Removal of native vegetation in Site 3 is also regulated under the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. Removal of trees (native or otherwise) is further regulated under Schedule 3 of the Significant Landscape Overlay.

The Bushfire Management Overlay (BMO) applies to the whole site. The BMO requires a permit for works associated with leisure or recreation, which may affect future plans for the site. Other requirements of the BMO have negligible effect on the site.

Information sources

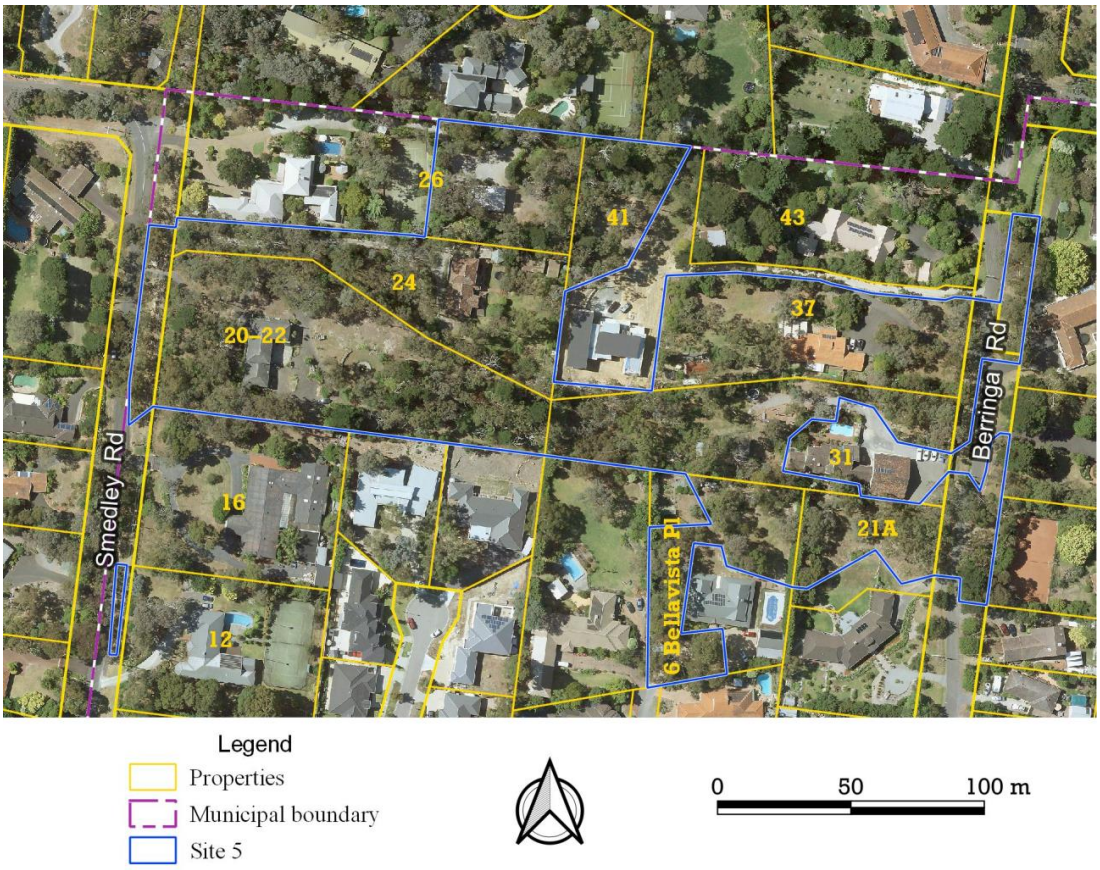
This assessment is based on the following information sources, which were based on the present author's work except for the last two items:

- A total of four hours of flora survey specifically for this study on 24/8/17, 16/9/17, 27/9/17 and 3/4/18. This work produced a comprehensive list of indigenous and introduced flora species and their abundances, including mosses and liverworts;
- Incidental fauna observations during the work just described;
- A less detailed flora survey on 22/5/06 during a site inspection regarding a (subsequently abandoned) proposal to widen Oban Road into the reserve;
- An incidental record of the highly seasonal plant species, Early Nancy, during an inspection on 22/9/01;
- The information in the *'Oban Road Reserve Management Plan 1998'* (Lorimer 1998h), whose preparation involved a full survey of indigenous and introduced vascular flora in June 1998;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997);
- A full survey of indigenous and introduced vascular flora on 21/5/95 and 9/12/95, including quadrat data;
- A brief report about the site by Helen Moss of Maroondah City Council in May 1995, including a list of indigenous vascular flora she had seen that month (without abundance data);
- Victorian Department of Lands and Survey – Aerial Survey of Victoria – Photomap Ringwood A2D dated 2nd October 1947 (the aerial photographing having been taken in 1945 by Adastra Airways).

No useful information could be found in the Victorian Biodiversity Atlas. Note that the state government's vegetation mapping only depicts native vegetation in approximately one-third of the site.

Site 5. Smedley Rd – Berringa Rd, Ringwood North

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundaries, land use and tenure

The image above shows an aerial photograph from February 2017 overlaid with relevant boundaries. Much of the site boundary follows property boundaries or the pavement of Smedley and Berringa Roads. The remainder comprises straight-line segments that approximate the edges of native vegetation. The small strip in the southwest extends from the road pavement to an informal path on the nature strip.

The private lots each contain a house, except that the southeastern corner has recently become subdivided from 21 Berringa Road and is now a vacant residential bush block. The roads are council roads.

The area of Site 5 adopted here (3.0 hectares) is smaller than the original version in the 1997 report, *'Sites of Biological Significance in Maroondah'*. That is partly due to loss of habitat from residential development and partly because this report aims to more precisely exclude areas without habitat.

General description

The site's native vegetation is patchy in distribution and ecological condition due to domestic uses and multiple episodes of clearing over many years. The 1945 government aerial photograph, 'Ringwood A2D', shows the whole site having young regrowth with tree crowns 5–8 m diameter and a quite open understorey. Residential development of the neighbourhood appears to have commenced around the 1960s and has involved increasing subdivision density until the present. That process has led to Site 5's extent being reduced in this report compared with its original circumscription in the 1997 *'Sites of Biological*

Significance in Maroondah' report. Apart from 21A Berringa Road, the properties that remain in the site have avoided subdivision since 1997.

The site's most natural vegetation is along Smedley Road and abutting parts of 20–24 Smedley Roads. 21A Berringa Road is also fairly natural. The rest of the site mostly has an indigenous eucalypt canopy and an understorey that varies between moderate density and absent. In most of the site, shrubs are much sparser than the natural condition due to mowing.

Relationship to other land

Site 5 is effectively part of a much larger area of somewhat fragmented native vegetation that is mostly located across the site's northern and western edges in the municipality of Manningham. The Manningham component is covered by an Environmental Significance Overlay, as recommended below for Site 5. Although the habitat across the larger area is patchy and fragmented, it is sufficiently large and ecologically connected to attract a good range of forest birds and insects. Sugar Gliders are present close by on Smedley Road (and possibly even within Site 5) and a Koala was photographed on a Smedley Road property in recent years.

The movement of indigenous pollinating birds and insects around the larger area of habitat is important for the reproduction and survival of Site 5's indigenous flora, particularly the many orchids.

The fauna that make use of habitat in Site 5 and nearby forest also traverse other land during their movements. In doing so, they bring nature into the lives of local residents.

Bioregion: Gippsland Plain (abutting the Highlands - Southern Fall to the west)

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion). 127 naturally-occurring, indigenous plant species have been recorded, nearly all of them since 2015.

Canopy trees: Dominated by *Eucalyptus macrorhyncha* and *Eucalyptus goniocalyx*, as well as *Eucalyptus obliqua* in part of the site. There are smaller numbers of *Eucalyptus cephalocarpa*, *Eucalyptus melliodora* and *Eucalyptus radiata*. *Eucalyptus polyanthemos* is notably very scarce.

Lower trees: *Exocarpos cupressiformis* dominates, along with *Acacia pycnantha* in part of the site. *Acacia melanoxylon* is moderately common. The less abundant sub-canopy trees are *Acacia dealbata, Acacia implexa* and *Acacia mearnsii*.

Medium to large shrubs: *Bursaria spinosa* is fairly abundant. *Acacia stricta* and *Daviesia leptophylla* are moderately abundant in small areas. Other medium to large shrubs are scarce, largely due to mowing.

Ferns: None seen.

Climbers: *Billardiera mutabilis* is moderately dense in one area but scarce overall, as are other vine species.

Creepers: *Acacia aculeatissima, Dichondra repens, Geranium* sp. 2 and *Hardenbergia violacea* are moderately abundant in small areas. *Bossiaea prostrata*, *Oxalis exilis/perennans* and *Viola hederacea* are scarce.

Other groundcover: There are unusually many species of grass, orchid and lily in the more natural parts of the site. Dominant and characteristic species include *Acrotriche serrulata*, *Dillwynia cinerascens*, *Gahnia radula, Galium gaudichaudii*, *Gonocarpus tetragynus, Lomandra filiformis* subsp. *coriacea, Lomandra filiformis* subsp. *filiformis*, *Olearia myrsinoides*, *Platylobium obtusangulum*, *Pterostylis melagramma*, *Pterostylis nutans*, *Poa morrisii*, *Poa sieberiana*, *Rytidosperma pallidum*, *Rytidosperma penicillatum, Stylidium graminifolium, Xanthorrhoea minor* and *Xanthosia dissecta*.

Significant plants

The following naturally-occurring plant species recorded in Site 5 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Diuris sulphurea* (Tiger Orchid) – one individual was recorded by Alice Ewing in 2015 as being present on 20–24 Smedley Road;
- *Eucalyptus macrorhyncha* (Red Stringybark) – a dominant species across the site – part of a much larger population extending to the west and north;
- *Pimelea linifolia* (Slender Rice-flower) – scattered around 20–22 Smedley Road, its nature strip and 24 Smedley Road. The only other known remaining occurrence in Maroondah is in Site 12, where three plants grow;
- *Pterostylis nana* (Dwarf Greenhood) – approximately 300 were recorded by Alice Ewing in 2015 as being present on 20–24 Smedley Road – by far the largest population in or near Maroondah;
- *Senecio minimus* (Shrubby Fireweed) – recorded by Alice Ewing in 2015 as being present on 20–24 Smedley Road (population unknown).

Diuris pardina (Leopard Orchid) has only been recorded at four other locations in Maroondah since 2000, mostly represented by only a few plants. In spring 2016, the present author counted approximately 50 plants looking into the front garden of 20–22 Smedley Road and another 217 plants on the adjacent nature strip. Even in the unlikely event that there were no other individuals out of sight on the private land, this population represents a substantial fraction of the total number of the species in Maroondah.

There is a single individual of the hybrid eucalypt, *Eucalyptus macrorhyncha* × *obliqua* (also named *Eucalyptus* × *brevirostris*) on 24 Smedley Road. Although *Eucalyptus* × *brevirostris* is listed by the state government as 'Rare' in Victoria, that status was conferred in the erroneous belief that the name refers to a hybrid between *Eucalyptus macrorhyncha* and *Eucalyptus muelleriana*.

Fauna habitat

- The canopy of remnant eucalypts and the presence of native understorey in substantial parts of the site represents good habitat for a range of forest birds, bats, other arboreal mammals (e.g. Sugar Gliders) and invertebrates;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the vegetation is very patchy, as expected for residential properties in this size range. The condition is excellent (rating 'A' in the A–D scale of *'Sites of Biological Significance in Maroondah*') within an area of 0.4 ha in the west. Approximately 0.1 ha is in good condition (rating 'B'), shared between 20–24 Smedley Road and 21A Berringa Road. An estimated 0.3 ha is in fair condition (rating 'C') but the uncertainty is substantial due to difficulty seeing into private land from nature strips. The remaining 1.7 ha of habitat is in poor ecological condition (rating 'D').

A 'habitat hectare' assessment of the area in condition 'A' in 2015 yielded 'habitat scores' ranging between 60/100 and 67/100. These scores are very high for residential land in Victoria other than in some heavily forested areas.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The endangered Valley Heathy Forest vegetation on 20–24 Smedley Road, together with that of the nature strip and the western part of 31–35 Berringa Road, easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Consequently, that area meets standard criterion 3.2.3 for a site of **State** significance.

Without gaining access to inspect understorey at the rear of 26 Smedley Road and 41 Berringa Road, it is not possible to determine whether the vegetation there also qualifies as a 'patch'. If so, that area also reaches State significance.

The areas of native vegetation elsewhere within the site are so fragmented by houses and their appurtenances that they do not meet the minimum area requirement for standard criterion 3.2.3.

Locally threatened plant species

Referring to the discussion under the preceding heading, 'Significant plants', the populations of *Pimelea linifolia* and *Pterostylis nana* are quite possibly the last plants of their species in Maroondah, and apparently numerous enough to be viable for the foreseeable future. *Eucalyptus macrorhyncha* is much less outstanding but the population appears viable as part of the much larger and more widespread population that extends into Manningham. As these species are all in the 'critically endangered' category of risk of dying out in Maroondah, they meet standard criterion 3.1.5 for Local significance. The solitary recorded plant of *Diuris sulphurea* and the transient *Senecio minimus* are also 'critically endangered' in Maroondah but their apparently poor viability falls short of standard criterion 3.1.5. However, a more detailed flora survey may show those species to be more abundant and viable than existing data suggests.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to more information becoming available, differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit residents of the properties and (to a lesser degree) abutting properties. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site and neighbouring areas is expected to be beneficial to the health, wellbeing, childhood development and quality of life of the residents and neighbours. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the site.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. It also contributes to the neighbourhood's 'green and leafy' character.

Changes

Changes in the vegetation since 1945 are described beneath the heading, 'General description', above.

Comparison of the aerial photographs from 2001 and 2017 indicates that:

- Approximately 0.5 ha of forest within the site has been cleared;

- The density of trees within the forest has generally thinned.

Changes in the condition and composition of the understorey cannot be assessed due to paucity of prior data and inability to enter the private land.

Threats

This study has identified the following threats to the site's biodiversity:

- Future development of the recently-created lot, 21A Berringa Road, which is vacant, well-vegetated and zoned for residential use;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continuing eucalypt deaths, mainly during droughts, which are predicted to worsen with climate change;
- Possible future building or works;
- Displacement of indigenous plants by garden plants;
- Removal of native vegetation associated with domestic uses of the land; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success.

Strategic planning

All of Site 5 is in the Low Density Residential Zone. The Vegetation Protection Overlay (VPO) covers the private land but not the sections of road reserve. The VPO also extends to abutting land that has been cleared and developed.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole site, i.e. the area outlined in blue on the aerial photograph on p. 37. An option is to apply the overlay to the whole of each affected lot, as for the current VPO and as Manningham City Council has done in the abutting ESO. It may also be sensible to extend the western boundaries the few extra metres to abut Manningham's ESO. If not for the municipal border, it seems certain that Manningham's ESO would have circumscribed Maroondah's Site 5.

Removal of native vegetation in most of the site is also regulated under the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. The exception is the recently-created 21A Berringa Road, whose subdivision has made it smaller than the threshold of 0.4 ha for clause 52.17 to apply.

Removal of trees (native or otherwise) is further regulated under Schedule 3 of the Significant Landscape Overlay, throughout the site.

The Bushfire Management Overlay (BMO) applies to the whole site.

Information sources

The author lives within 250 m of Site 5 and has been familiar with the area for forty years by walking through it periodically. His assessment of the site is also based on:

- A site inspection and flora survey for this study conducted from the road reserves on 24/8/17, 15/7/18 and 8/10/18;
- Detailed ecological reports and surveys about 20–24 Smedley Road by Alice Ewing, Lincoln Kern and the present author in 2015 in regard to a development proposal;
- Photographs taken in 2015 by local resident, Janice Hazell, of wildflowers (particularly orchids) involved in the same proposed development;
- A site inspection and flora survey by the present author for *'Sites of Biological Significance in Maroondah'* in December 1995 and January 1996; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas. Note that the state government's vegetation mapping of the area is insufficiently precise to show the extent of native vegetation within individual properties. The state government's mapping of the bioregional boundary within the site is inconsistent with the mapping of EVCs.

Site 6. Monterey Bush Park, Ringwood North

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundary, land use & tenure

The 3.8 ha of the site is a council reserve used mostly as a nature reserve. A gully in the east is also managed for drainage. Footpaths provide access through the park for recreation and to provide walking routes through the neighbourhood. The Ellie V. Pullin kindergarten to the west is excluded from the site.

The site boundary adopted here differs slightly from the version in the 1997 report, *'Sites of Biological Significance in Maroondah'*, due to growth of trees around the perimeter and deletion of a firebreak.

General description

The western half of the site is on a broad, low ridge. The eastern half is a valley, down which a creek once flowed northward. The southeastern tip of the site contains a dam constructed on the creek at least eighty years ago and more recently used to receive urban stormwater. The rest of the original creek has been replaced by a pipe beneath a weedy floodway that is mostly mown regularly.

The park's western third has a very gentle gradient of 1:20 to 1:40. It contains the site's most natural vegetation, though less so near the perimeter. It is one of the better examples of the endangered 'Valley

Heathy Forest' type in Maroondah. The trunk diameters of the eucalypts are overwhelmingly less than 40 cm. By comparison, an aged tree of the same species would be expected to have a trunk diameter of at least 70 cm (the 'benchmark' for Valley Heathy Forest). It follows that the park's eucalypts are much younger than would have once occurred on the site. They are also much denser, though they will thin themselves (and the understorey) out as the trees mature and compete more strongly for resources. Unfortunately, young trees have been planted into this area, exacerbating the over-competition and accelerating tree deaths. Among the planted trees are Red Box (*Eucalyptus polyanthemos*) and Candlebark (*Eucalyptus rubida*), neither of which occur naturally in such vegetation.

The central third of the site is on the western slope of the valley. This is reflected in an east-west transition in plant species, with increasing densities of Yellow Box (*Eucalyptus melliodora*), Mountain Clematis (*Clematis aristata*) and Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) as one moves downhill. Close to the valley floor, the vegetation composition approaches Valley Grassy Forest. The ecological condition of the site's central third is poorer than the western third, affected by many large Monterey Pines. Maroondah City Council has been progressively removing pines throughout the park, particularly in the west.

Only vestiges remain of the 'Swampy Riparian Complex' vegetation that once lined the creek.

When the dam was examined in 1996 for *'Sites of Biological Significance in Maroondah'*, it was densely populated with indigenous aquatic plants, frogs and pond life. A 2011 aerial photograph shows it to have been fully vegetated then, too. Around 2015–2016, the pond was dredged to remove silt (according to Maroondah City Council). Probably soon after, many plants were planted around the edge of the water, including the aggressive, non-indigenous species, River Club-rush (*Schoenoplectus tabernaemontani*). In March 2019, only about quarter of the dam is vegetated. The surviving indigenous plants are now having to compete with the planted species and the non-indigenous Kikuyu (*Cenchrus clandestinus*) and Water Couch (*Paspalum distichum*).

The largest trees in the site are around the dam. Their hollows and broad crowns are probably important for wildlife. Unfortunately, many young trees have been planted recently beneath their crowns, competing with the large trees and threatening their long-term survival. There are also many large pines in that part of the site, creating further competition for the indigenous flora.

Altogether, eighty-seven naturally-occurring, indigenous plant species were observed in the park during this study.

Relationship to other land

The site's Valley Heathy Forest vegetation is quite similar to the Yarra Valley Grammar School bushland (Site 22), 1.5 km to the east-northeast. It also has similarities to parts of B.J. Hubbard Reserve (Site 2, 1.8 km southwest) and Bungalook Conservation Reserves (Site 66, 7 km southeast).

Apart from the abutting kindergarten and the Australian native trees on nearby nature strips, the residential area surrounding Monterey Bush Park is sparsely treed and forms poor habitat for indigenous fauna. Nevertheless, forest birds such as Australian King-Parrots were observed in the park, even though they cannot meet all their habitat needs within the park. They, and a range of insects, must fly to the park from other areas of habitat. The nearest patches of habitat are Site 99 (seen at the top of the aerial photograph on p. 43), Quambee Reserve (Site 7, abutting Site 99) and Mahon Reserve (Site 116, 400 m southwest). The aggregate of these sites (and others) evidently satisfies the birds' habitat needs even though no one of them could do so on its own.

The movements of wildlife through the neighbourhood enhances the area's natural ambience, e.g. through birdsong. This no doubt benefits residents.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion). Approximately 3.4 ha. 71 naturally-occurring, indigenous species were found in March 2019 (a poor time of year for detection).

Canopy trees: Dominated by Red Stringybark (*Eucalyptus macrorhyncha*), Silver-leafed Stringybark (*E. cephalocarpa*) and Bundy (*E. goniocalyx*). The other wild canopy species are Messmate Stringybark (*E. obliqua*), Narrow-leaved Peppermint (*E. radiata*) and – in the east –Yellow Box (*E. melliodora*).

Lower trees: Dominated variously by Cherry Ballart (*Exocarpos cupressiformis*), Lightwood (*Acacia implexa*) and Blackwood (*A. melanoxylon*). There are also substantial numbers of Golden Wattle (*Acacia pycnantha*) but they are mostly immature.

Medium to large shrubs: Mostly quite dense, dominated variously by Sweet Bursaria (*Bursaria spinosa*) or Burgan (*Kunzea leptospermoides*). Cassinias (*Cassinia aculeata* and *C. longifolia*) are slightly less abundant, followed by Prickly Currant-bush (*Coprosma quadrifida*). Other species are scarce.

Small shrubs: Surprisingly, the most abundant small shrub is Silky Daisy-bush (*Olearia myrsinoides*) – a species that is uncommon in Maroondah but represented here by ~100 plants. Common Flat-pea (*Platylobium obtusangulum*) and Grey Parrot-pea (*Dillwynia cinerascens*) are moderately common.

Ferns: Absent except near the former creek, where there are patches of Bracken (*Pteridium esculentum*) and some Common Maidenhair (*Adiantum aethiopicum*); however, the latter was not observed during this study due to drought conditions and a March survey.

Climbers: Common Apple-berry (*Billardiera scandens*) is abundant throughout and Mountain Clematis (*Clematis aristata*) is abundant in the site's central third. Wonga Vine (*Pandorea pandorana*) and Small-leafed Clematis (*Clematis decipiens*) are also moderately common despite being absent in 1996 – consistent with those species' rapid spread and tendency to displace indigenous flora.

Creepers: Thin-leaf Wattle (*Acacia aculeatissima*), Kidney-weed (*Dichondra repens*) and Purple Coral-pea (*Hardenbergia violacea*) are fairly abundant in the most natural areas.

Other groundcover: The cover of Thatch Saw-sedge (*Gahnia radula*) was very dense throughout until Council staff thinned it by brushcutting in recent years, but it remains the dominant species. The other abundant grassy species are Wattle Mat-rush (*Lomandra filiformis*, both subspecies) and Purplish Wallaby-grass (*Rytidosperma tenuius*). Other species that are moderately abundant or good environmental indicators include Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Veined Spear-grass (*Austrostipa rudis*), Pale Flax-lily (*Dianella longifolia*), Black-anther Flax-lily (*Dianella revoluta*), Rosy Hyacinth-orchid (*Dipodium roseum*), the sword-sedges *Lepidosperma laterale* and *L. gunnii*, Common Rice-flower (*Pimelea humilis*), Soft Tussock-grass (*Poa morrisii*), Small Poranthera (*Poranthera microphylla*), Silvertop Wallaby-grass (*Rytidosperma pallidum*), Slender Wallaby-grass (*R. penicillatum*), Velvet Wallaby-grass (*R. pilosum*), Rough Fireweed (*Senecio hispidulus*), Shrubby Fireweed (*Senecio minimus*) and Small Grass-tree (*Xanthorrhoea minor*).

Swampy Riparian Complex (EVC 126, **Endangered** in the bioregion), present as vestiges only, totalling roughly 0.2 ha. 12 naturally-occurring, indigenous species were seen in March 2019.

Canopy trees: Swamp Gum (*Eucalyptus ovata*) and Yellow Box (*E. melliodora*), outnumbered by pines.

Lower trees: Blackwood (*Acacia melanoxylon*) would form a conspicuous layer of understorey trees but hardly any remain.

Shrubs: Extremely scarce – just a few outliers from the adjacent Valley Heathy Forest.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense in small areas at the edges of this EVC, extending into the Valley Heathy Forest.

Groundcover: Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is dense at the western edge of this EVC and into the adjacent Valley Heathy Forest. The high density is probably due in

part to planting. Pale Rush (*Juncus pallidus*) is represented by a fairly dense patch but that may be the result of planting.

Wetland habitat at the dam (EVC 74). 0.25 ha. 10 naturally-occurring, indigenous species were seen in March 2019.

Trees and shrubs: Absent.

Non-woody species: Dominated in different areas by Slender Knotweed (*Persicaria decipiens*), Green Rush (*Juncus gregiflorus*) or the cumbungi, *Typha orientalis*. Broom Rush (*J. sarophorus*) and Swamp Club-rush (*Isolepis inundata*) are also abundant at water's edge. Other moderately abundant, characteristic species include Water Plantain (*Alisma plantago-aquatica*), Tall Spike-rush (*Eleocharis sphacelata*) and Common Duckweed (*Lemna disperma*). Only one very young plant of Slender Joint-leaf Rush (*Juncus fockei*) was found.

Significant plants

The following naturally-occurring plant species recorded in the park can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – perhaps the most abundant canopy tree species in the Valley Heathy Forest, and uncommonly healthy for the district;
- *Juncus flavidus* (Gold Rush) – five plants grow 10 m from the kindergarten's rear fence, an unusually dry habitat for the species;
- *Juncus fockei* (Slender Joint-leaf Rush) – one juvenile plant was found in 2019 near the inlet of the dam;
- *Senecio minimus* (Shrubby Fireweed) – over 15 individuals were found scattered through the park's western third, particularly where pine trees have been removed. This species is generally subject to large population fluctuations and may have been scarcer than usual during this study's March 2019 flora survey due to drought conditions.

Lomandra multiflora (Many-flowered Mat-rush) has only been recorded at five other sites in Maroondah, at any stage in history. The number of individuals at Monterey Bush Park and in most other sites is hard to estimate outside flowering season due to similarity to some plants of *L. filiformis* and *L. longifolia* subsp. *exilis*. If better data were available from surveys in flowering season (late September to early October), a 'critically endangered' rating might result.

The presence of roughly 100 individuals of *Olearia myrsinoides* (Silky Daisy-bush) – the largest population in Maroondah – is also notable. That species is quite uncommon in Maroondah and may well fall into the 'endangered' category of risk of dying out in Maroondah, if it were formally assessed.

Fauna habitat

- The presence of all strata of native vegetation represents good habitat for a range of forest birds, bats, other arboreal mammals and invertebrates;
- The dense layer of large shrubs and small trees is believed to help avoid an overabundance of Noisy Miners;
- Tree hollows (mainly near the dam) offer nest sites for some animals and roost sites for bats;
- The native vegetation and its litter provide food and cover for a range of invertebrates (e.g. a Rhinoceros Beetle was seen), some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1);
- Pines provide seeds that are eaten by Yellow-tailed Black-Cockatoos, but they also displace and debilitate native vegetation that would provide habitat for a much wider range of fauna;
- The dam provides habitat for waterbirds, frogs, aquatic invertebrates and (at least in years past) tortoises; and

- The dam also provides an option for birds and other animals to drink when the landscape is otherwise dry, as in the case of droughts. However, the stormwater discharged into the dam is rather polluted.

Ecological condition

Approximately 0.6 ha in the site's western third is in excellent ecological condition – rating 'A' on the A–D scale of Lorimer *et al.* (1997). A similar amount in the central third is in good condition (rating 'B'). An additional 1.2 ha of Valley Heathy Forest is in fair condition (rating 'C') and 1.0 ha in poor condition (rating 'D').

The vestiges of Swampy Riparian Complex occupy roughly 0.2 ha, all in poor condition.

At water's edge of the dam and just below the dam, there is approximately 0.1 ha of wetland vegetation in good condition.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

Nearly all the Valley Heathy Forest easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed as 'endangered' in the bioregion. As a consequence, the site meets standard criterion 3.2.3 for a site of **State** significance.

The vestiges of Swampy Riparian Complex do not meet the definition of a 'patch' and thereby do not meet standard criterion 3.2.3, at any level of significance.

Locally threatened plant species

Each of the six plant species discussed in the section above headed 'Significant plants' are believed to be threatened in Maroondah. Apart from *Juncus fockei* and possibly *Lomandra multiflora*, the species appear to have quite viable populations. Such populations meet standard criterion 3.1.5 for Local significance.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve as well as immediate neighbours, particularly the Ellie V. Pullin Kindergarten. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the park is expected to be beneficial to the wellbeing of visitors and those who walk through for exercise or to get from place to place. The ambience may also attract people to get exercise in the park.

Natural environments have also been shown to aid childhood development (Section 1.3 of Volume 1). Children at the Ellie V. Pullin Kindergarten are exposed to the birds, insects, sights, sounds and smells of the park's bushland, which can only be beneficial to the children's development. The park may also be an educational resource for small excursions from the kindergarten. The presence of a canopy of Australian native trees in the kindergarten's grounds must help bring the natural experiences closer to the children.

The movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens spreads nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

The reserve's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation of the local community. The neighbourhood has very few other reference points for local natural heritage.

Changes

Change in the extent of habitat

Aerial photographs show that since 2001, the growth of eucalypt crowns around the edges of the bushland has resulted in the area of habitat encroaching slightly into previously unvegetated areas. The increase is probably less than 0.1 ha. The dam was fully vegetated until c. 2015 and only quarter of it is vegetated in 2019; however, the rest of the dam is open water that suits some waterbirds (despite poor water quality).

Change in the species present

There has been little change in the plant species present in Monterey Bush Park since 1996. Comparing the species of naturally-occurring, indigenous plants recorded by the author on 11th January 1996 and 5th–6th March 2019:

- 12 species seen in 1996 were not seen in 2019 (*Acacia myrtifolia, Adiantum aethiopicum, Correa reflexa, Deyeuxia quadriseta, Epacris impressa, Hydrocotyle hirta, Isolepis platycarpa, Leptospermum continentale, Lobelia anceps, Ozothamnus ferrugineus, Senecio linearifolius* and *Triglochin striata*); and
- 17 species seen in 2019 were not seen in 1996 (*Acacia aculeatissima, Clematis decipiens, Coronidium scorpioides, Euchiton japonicus, Hovea heterophylla, Indigofera australis, Juncus amabilis, J. flavidus, J. fockei, Lepidosperma gunnii, L. laterale, Pandorea pandorana, Persicaria decipiens, Poa morrisii, Rytidosperma* ?*setaceum, Senecio quadridentatus* and *Solanum laciniatum*).

Many of the differences can be explained by the low detectability of the species in unexhaustive surveys such as these, particularly considering the drought conditions in the March 2019 survey. However:

- *Ozothamnus ferrugineus* has very likely died out, at least temporarily;
- *Solanum laciniatum* has very likely arrived since 1997, as it has done in many other parts of Maroondah; and
- *Clematis decipiens* and *Pandorea pandorana* have almost certainly arrived since 1997 (as they have done in most forested areas of Maroondah) and now represent threats to the pre-existing flora.

Change in the ecological condition of habitat

Since the 1996 flora survey, the ecological condition of the vegetation in the western third of the site has improved slightly. That is attributable mainly to weed removal (particularly pines) and thinning of unnaturally dense Thatch Saw-sedge (*Gahnia radula*). On the other hand, planting of trees within the forest (including non-indigenous species) is exacerbating the ecological problem of unnaturally dense trees.

No overall change in ecological condition can be discerned in the site's central third, as Council's weed removal has been counterbalanced by the increasing size of pines and the associated steady attrition of the native vegetation beneath the pines.

The dam's ecological condition deteriorated when it was dredged in c. 2015 and it has not fully recovered.

Changes in the ecological condition of the rest of the site's eastern third have been mixed. Recent revegetation has added native understorey species in part of the area but it may have displaced some uncommon indigenous species that grew there prior. Some mature, hollow-bearing, naturally-occurring eucalypts have been threatened by young trees that have been planted densely within their root zones.

Note that in *'Sites of Biological Significance in Maroondah'*, the estimated numbers of hectares of Valley Heathy Forest in different categories of ecological condition were mostly overestimated. That can be attributed to the difficulty of mapping and calculating the areas of forest before the age of Global Positioning Systems and Geographic Information Systems.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Displacement and debilitation of native vegetation by pines;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Debilitation of indigenous plants, particularly eucalypts, by over-competition from the unnaturally high densities of eucalypts and (to a lesser degree) Lightwoods (*Acacia implexa*) in the western two-thirds of the site. Over-competition will have its worst effects during drought, which is predicted to worsen with climate change;
- The exacerbation of the preceding problem by recent planting of more Lightwoods and eucalypts (including non-indigenous species) within the forest and around the dam;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Pollution of the stormwater discharged into the dam, and consequential weed growth, toxicity problems and loss of native vegetation and habitat when silt has to be removed;
- Displacement of indigenous wetland plants by Kikuyu, Water Couch and the aggressive non-indigenous species, River Club-rush (*Schoenoplectus tabernaemontani*), which has been planted at the dam; and
- Displacement of indigenous plants by introduced species other than those mentioned above, as well as by *Clematis decipiens* and *Pandorea pandorana*, but these threats are being well managed by Council.

Strategic planning

The whole site is affected by Schedule 4 of the Significant Landscape Overlay (SLO4) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. It is also covered by the Vegetation Protection Overlay (VPO).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the original version of Site 6 (in *'Sites of Biological Significance in Maroondah*) and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in blue on the aerial photograph on p. 43. The area could be expanded to include any additional area that Council prioritises for revegetation; e.g. the lawn at the end of Gillard Place. However, from a biodiversity perspective, pine removal is more urgent than revegetation.

Information sources

This assessment is based on the following sources of information sources, which were based on the present author's work except for the last two items:

- A total of 3½ hours of flora survey specifically for this study on 5–6 March 2019. This work produced a moderately comprehensive list of indigenous flora species and their abundances, including mosses and liverworts. It also assessed vegetation condition and mapped the locations of significant species and boundaries of native vegetation and EVCs. Herbarium specimens were taken of *Juncus flavidus* and *Einadia trigonos*;

- Maroondah City Council's records of planting in the reserve;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997), whose assessment of this reserve was based on a low-level fauna survey and a flora survey of similar intensity and nature to the 2019 one (but without the inclusion of mosses, liverworts or abundance data);
- A 'Frogwatch' record of Pobblebonk in 2017, lodged at the Atlas of Living Australia; and
- Aerial photographs taken in 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas or eBird. Note that the state government's vegetation mapping evidently involved no fieldwork in Monterey Bush Park, as it wrongly indicates that the Swampy Riparian Complex vegetation never extended that far upstream.

Site 7. Quambee Reserve & 34 Quamby Road, Ringwood North

Biological Significance Level: *State* in the east and *Local* in the west



Aerial photograph taken February 2017

Boundary, land use & tenure

This site comprises two segments totalling 3.1 ha. The eastern segment, around the tennis club, measures 1.2 ha and is part of the Quambee Reserve property, which is council land. The western segment comprises (from north to south):

- 0.7 ha to the north and west of the pony club's area, occupied mainly by revegetation and a footpath;
- 0.1 ha of the road reservation for Quamby Road (but closed to through traffic by a gate near Bowen Court), containing a mixture of remnant native vegetation and revegetation;
- 0.4 ha of 34–42 Quamby Road – a residential property with remnant trees over mown grass and a pond;
- 0.4 ha of Quambee Reserve between the western oval and 34–42 Quamby Road, occupied by native vegetation, revegetation and a footpath; and
- 0.2 ha of Crown land (part of the former Parkwood Secondary College) south and southwest of the western oval, abutting the fence around Site 99. This area is managed as if it is part of Quambee Reserve. It includes native vegetation in the west, revegetation on an embankment of the oval, and mown grass in the middle.

The public land is managed for recreation. Some of the most significant vegetation, to the east and southeast of the tennis club area, is also managed to minimise fire hazard by slashing.

The eastern segment of the site closely matches the original site delineated in the 1997 report, *'Sites of Biological Significance in Maroondah'*. The other segment has been added because growth of trees has raised its significance and to recognise the existence of a wildlife corridor. The environmental benefit of using revegetation to create such a corridor was mentioned in the 1997 report and has come to fruition.

General description

Although Quambee Reserve is managed principally for sport, the parts that form Site 7 include areas of revegetation and native vegetation with value for nature conservation.

The most natural area is to the south of the tennis courts and east of the driveway to the courts. Forty naturally-occurring, indigenous plant species were observed around the tennis courts during a brief inspection on 20th December 2018, which was an inopportune time of year. It was also unfortunate that part of the area had just been slashed while the ground was boggy, resulting in extensive soil disturbance. The summer-flowering Rosy Hyacinth Orchid (*Dipodium roseum*) was seen and other orchids might be detectable at a better time or year and in the absence of recent slashing.

Pines are significantly suppressing indigenous plants south of the tennis courts.

The vegetation immediately west and southwest of the tennis courts comprises a mixture of naturally-occurring indigenous plants, revegetation and introduced plants that have volunteered themselves.

The part of the site to the north and west of the pony club area contains revegetation with a mixture of indigenous tree species and other Australian native tree species. There is very little native understorey. During this study's fieldwork, Australian King Parrots were observed moving through those trees between Sites 9 and 99.

The King Parrots were also observed moving further southeast through the remainder of the site toward Site 99. There is very little understorey on 34–42 Quamby Road or the narrow strip outside its northern fence but there is a substantial number of eucalypts that remain from the endangered Valley Heathy Forest. Among those eucalypts is an unusually large, old Red Box (*Eucalyptus polyanthemos*) not far from the gate across Quamby Road. There is also a large, old Yellow Box (*E. melliodora*) just outside the eastern fence of 34–42 Quamby Road.

The site's southwestern corner includes an area with all strata of Valley Heathy Forest, though only twelve indigenous plant species were seen there when inspected in March 2019.

Altogether, forty-one naturally-occurring, indigenous plant species were observed in Site 7 during this study's (non-exhaustive) ecological survey.

There is revegetation of indigenous and Australian native trees immediately west and south of the western oval, and a gap to the southwest. The gap appears to present a good opportunity for revegetation to improve the habitat connectivity to Site 99.

There is regrowth of native vegetation abutting the eastern oval to its south and southwest. That area is excluded from Site 7 because it does not seem to meet any of the standard criteria for a site of biological significance.

Relationship to other land

Few if any birds can fulfil all their habitat needs within the site, so those present must move in and out. The Australian King-Parrots that were observed are probably indicative of a wider range of forest birds that move through the western and southwestern parts of the site *en route* between habitat to the north (e.g. Sites 8 and 9) and south (Sites 99 and 6).

Without this ecological connection, one would expect less birdlife in all the sites just mentioned. That would also affect the birdlife and birdsong that the area's residents currently enjoy.

The 1997 report, *'Sites of Biological Significance in Maroondah'*, mentioned a somewhat tenuous habitat connection between the tennis court area and Site 8 via Bridget Court. Most of the land that formed the connection has since been cleared and developed.

Bioregions: Gippsland Plain; Highlands - Southern Fall

The interface between the Gippsland Plain bioregion and the Highlands - Southern Fall bioregion passes through Quambee Reserve. There is too little vegetation left to draw a precise boundary and the state government's mapping is quite imprecise.

The presence of Silver-leafed Stringybark (*E. cephalocarpa*) as a dominant species in the southwest is a reliable indicator of Valley Heathy Forest and the Gippsland Plain bioregion. Around the tennis courts, there are only one or two Silver-leafed Stringybarks and the vegetation could be classified as either Valley Heathy Forest (as part of the Gippsland Plain bioregion) or Valley Grassy Forest (as part of the Highlands - Southern Fall bioregion).

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the Gippsland Plain bioregion). Approximately 0.8 ha in and abutting 34–42 Quamby Road. 12 naturally-occurring, indigenous species were found on 8th March 2019 (a poor time of year for detection).

Canopy trees: Dominated by Silver-leafed Stringybark (*Eucalyptus cephalocarpa*) and Yellow Box (*E. melliodora*). Also present is Red Box (*E. polyanthemos*) and fewer Bundy (*E. goniocalyx*).

Lower trees: Blackwood (*Acacia melanoxylon*) is the only sub-canopy tree in substantial numbers. There are also one or two Black Wattles (*Acacia mearnsii*).

Medium to large shrubs: Sweet Bursaria (*Bursaria spinosa*) is moderately dense in the southwestern corner (where the vegetation is closest to a natural state). Sifton Bush (*Cassinia sifton*) is present in the same area and near the Quamby Road gate.

Small shrubs: Missing.

Ferns: Missing.

Climbers: Mountain Clematis (*Clematis aristata*) is fairly abundant in the southwestern corner.

Creepers: Thin-leaf Wattle (*Acacia aculeatissima*), Kidney-weed (*Dichondra repens*) and Purple Coral-pea (*Hardenbergia violacea*) are fairly abundant in the most natural areas.

Other groundcover: Thatch Saw-sedge (*Gahnia radula*) is dense in the southwestern corner. With it, is Veined Spear-grass (*Austrostipa rudis* subspecies *rudis*) and Weeping Grass (*Microlaena stipoides*). All other groundcover species that could be detected were introduced but more indigenous species might be detected at a better time of year or without slashing or if 34–42 Quamby Rd were to be surveyed.

Valley Heathy Forest / Valley Grassy Forest (**Endangered / Vulnerable**). Approximately 1 ha around the tennis club. 40 naturally-occurring, indigenous species were found on 20th December 2018.

Canopy trees: Dominated by Red Box (*Eucalyptus polyanthemos*). Messmate Stringybark (*E. obliqua*) and Bundy (*E. goniocalyx*) are moderately abundant. There are also smaller number of Yellow Box (*E. melliodora*) and only one or two of each of Silver-leafed Stringybark (*Eucalyptus cephalocarpa*) and Red Stringybark (*E. macrorhyncha*).

Lower trees: Black Wattle (*Acacia mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*) dominate. Blackwood (*A. melanoxylon*) is moderately abundant. There is also a cluster of Golden Wattle (*Acacia pycnantha*) and there are three Lightwoods (*Acacia implexa*).

Medium to large shrubs: Patchy in density, the denser areas being dominated by Yarra Burgan (*Kunzea leptospermoides*). Other species present include Hop Wattle (*Acacia stricta*), Sweet Bursaria (*Bursaria spinosa*) and Sifton Bush (*Cassinia sifton*). Myrtle Wattle (*Acacia myrtifolia*), Common Cassinia (*C. aculeata*), Common Correa (*Correa reflexa*), Narrow-leaf Bitter-pea (*Daviesia*

leptophylla) and Tree Everlasting (*Ozothamnus ferrugineus*) were present in 1996 but could not be found in 2018.

Small shrubs: Hop Goodenia (*Goodenia ovata*) is moderately abundant but localised. Other small shrubs have become very scarce; e.g. one Grey Parrot-pea (*Dillwynia cinerascens*) and one Common Heath (*Epacris impressa*). Silky Daisy-bush (*Olearia myrsinoides*) and Common Flat-pea (*Platylobium obtusangulum*) appear to have died out since 1996.

Ferns: Bracken (*Pteridium esculentum*) was present in 1996 but could not be found in 2018, perhaps due to slashing.

Climbers: Common Apple-berry (*Billardiera scandens*), Mountain Clematis (*Clematis aristata*) and Downy Dodder-laurel (*Cassytha pubescens*) were present in 1996 but could not be found in 2018.

Creepers: Thin-leaf Wattle (*Acacia aculeatissima*) and Bidgee-Widgee (*Acaena novae-zelandiae*) were found in 1996. They were not found in 2018, perhaps due to recent slashing. The wood-sorrel, *Oxalis exilis/ perennans* is scarce.

Other groundcover: Clustered Wallaby-grass (*Rytidosperma racemosum*) is abundant in the more regularly mown areas. The following additional grassy species are moderately abundant: Black-anther Flax-lily (*Dianella revoluta*), Brown's Love-grass (*Eragrostis brownii*), Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subspecies *coriacea*), Weeping Grass (*Microlaena stipoides*), Grey Tussock-grass (*Poa sieberiana* subspecies *sieberiana*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Purplish Wallaby-grass (*R. tenuius*) and Common Bog-rush (*Schoenus apogon*). Few other species were detected in 2018, notably including Rosy Hyacinth-orchid (*Dipodium roseum*).

Revegetation (not representative of any EVC).

Trees: Mixtures of indigenous trees (eucalypts, wattles, Swamp Paperbark) and non-indigenous eucalypts.

Shrubs: Very scarce.

Groundcover: Negligible indigenous groundcover.

Significant plants

The Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) was recorded near the tennis courts in 1996, numbers unstated. It appears to have died out. The species is listed by the state government as rare (but not otherwise threatened) within Victoria.

The Red Stringybark (*Eucalyptus macrorhyncha*) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. One or two plants were observed, near the tennis courts, in poor health.

There is an unusually large, old Red Box (*Eucalyptus polyanthemos*) near the Quamby Road gate.

There is an unusually large, old Yellow Box (*Eucalyptus melliodora*) just outside the eastern fence of 34–42 Quamby Road.

Significant fauna

A neighbour reports seeing a Short-beaked Echidna southeast of the tennis courts in January 2018. An echidna could only find a small fraction of its habitat needs within the site, so it was presumably moving through or seeking new habitat.

Fauna habitat

- The areas of native vegetation near the tennis courts and in the southwestern corner have eucalypt cover, understorey trees, a few shrubs and some indigenous groundcover. The presence of all those strata represents good habitat for a range of forest birds, bats, other arboreal mammals and invertebrates. However, the potential habitat vale for ground-dwelling fauna are diminished in this site because: (a) the area near the tennis courts is modest in size, subjected to slashing and separated from other habitat;

and (b) the area in the southwestern corner is small, disrupted by past slashing and has few plant species; and

- The tree canopy in the rest of the site represents habitat for native forest birds and flying insects, particularly as it provides a connection to better-quality habitat to the north and south.

Ecological condition

The ecological condition of the 1.2 ha of the site around the tennis club is divided approximately equally between ratings 'C' and 'D' on the A–D scale of Lorimer *et al.* (1997), i.e. fair and poor, respectively. 0.1 ha in the site's southwestern corner is also in rating 'C'. The condition of approximately 1.6 ha elsewhere in the site is poor (rating 'D').

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State in the eastern segment; Local in the western segment

Presence of a patch of native vegetation

The vegetation east and southeast of the tennis club meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The present author estimates that approximately 0.3 ha of that vegetation has a habitat score of 0.3 or above. Combining that assessment with the 'vulnerable' status of Valley Grassy Forest *or* the 'endangered' status of Valley Heathy Forest, the vegetation would have a 'High' or 'Very High' conservation significance under the 'Native Vegetation Framework'. In either case, standard criterion 3.2.3 then leads to a rating of **State** significance.

The remaining native vegetation in the site does not meet the relevant definition of a 'patch' and thereby does not meet standard criterion 3.2.3, at any level of significance.

Ecological corridor

The western segment of Site 7 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site. The specific 'remnant habitat blocks' in this case include Sites 6, 8, 9 and 99.

To the extent that there are small gaps in that habitat link and the understorey is mostly sparse or absent, the following description from standard criterion 1.3.3 applies: "Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor… Site (or one of a group of such sites) to form a strategic corridor of local importance and scale". That description applies to a site of Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest and Valley Grassy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation

benefit users of the reserve, immediate neighbours and the residents of 34–42 Quamby Road. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site is expected to be beneficial to the enjoyment and wellbeing of visitors and those who walk or run through for exercise or to get from place to place. The ambience may also attract people to get exercise in the park.

The site supports the presence of birds, butterflies and other mobile fauna in the neighbourhood generally, not just within the site's bounds. In doing so, it increases the numbers of such wildlife in neighbouring streets and gardens. That, in turn, is expected to benefit the health, wellbeing, childhood development and quality of life of the local community.

Changes

Change in the extent of habitat

Aerial photographs show that since 2001, the extent of habitat has not contracted significantly anywhere and that growth of the crowns of trees (particularly planted trees) has expanded the available habitat to a small degree that is hard to quantify.

Change in the species present

Forty naturally-occurring, indigenous plant species recorded near the tennis club in 2018, compared with 47 in 1996. It is very likely that some of the species recorded in 1996 have died out, at least temporarily. Some other species may well have been overlooked in 2018 due to recent slashing and the associated churning of soil. Conversely, some species seen in 2018 were quite possibly not present in 1996 (e.g. *Bursaria spinosa*) and others overlooked (e.g. *Dipodium roseum*).

It is therefore hard to say how much genuine change in plant species has occurred near the tennis club since 1996 other than that some species appear to have died out. The most likely cause of those species dying out is slashing that has been conducted at times, and in ways, that favour introduced plants. An example is the instance of slashing during boggy conditions that occurred just prior to this study's inspection on 20th December 2018.

There is no prior data from the rest of the site, so no changes can be determined.

Change in the ecological condition of habitat

There is inadequate data from the 1996 ecological survey of the area around the tennis club to make a meaningful determination of change in ecological condition.

Threats

This study has identified the following threats to the site's biodiversity:

- Slashing at times of the year that favour introduced plants over indigenous plants, particularly during September to mid-December and any time when the ground is boggy;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continuing eucalypt deaths, mainly during droughts, which are predicted to worsen with climate change;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Displacement of indigenous plants by pines south of the tennis courts.

Revegetation Opportunities

The strength of the wildlife corridor through the site's western segment could be strengthened by broadening the revegetation to the west of the pony club and along the Quamby Road reservation, and by filling the gap on the embankment southwest of the western oval.

Filling the gap in tree cover to the north of the pony club pavilion is expected to decrease the ecological isolation of the site's eastern segment. Increasing the movements of insect-eating forest birds and beneficial insects may improve the health of the vegetation around the tennis club and improve the natural ambience. The additional shade may also benefit the pony club.

Strategic planning

34 Quamby Road, the Quamby Road reservation and most of Site 7's eastern segment are covered by Schedule 1 of the General Residential Zone (GRZ1). The rest of Quamby Reserve comes under the Public Park and Recreation Zone (PPRZ).

The whole site is affected by Schedule 4 of the Significant Landscape Overlay (SLO4) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. Most of the eastern segment of the site is also covered by the Vegetation Protection Overlay (VPO).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the original version of Site 7 (in *'Sites of Biological Significance in Maroondah*) and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in blue on the aerial photograph on p. 51. The area could be expanded to include any additional area that Council prioritises for revegetation to increase wildlife movement, e.g. by joining the site's western and eastern segments.

An important distinction of ESO1 from existing planning provisions affecting 34–42 Quamby Road is that it would require nature conservation to be taken into account in the event of a subdivision application.

Information sources

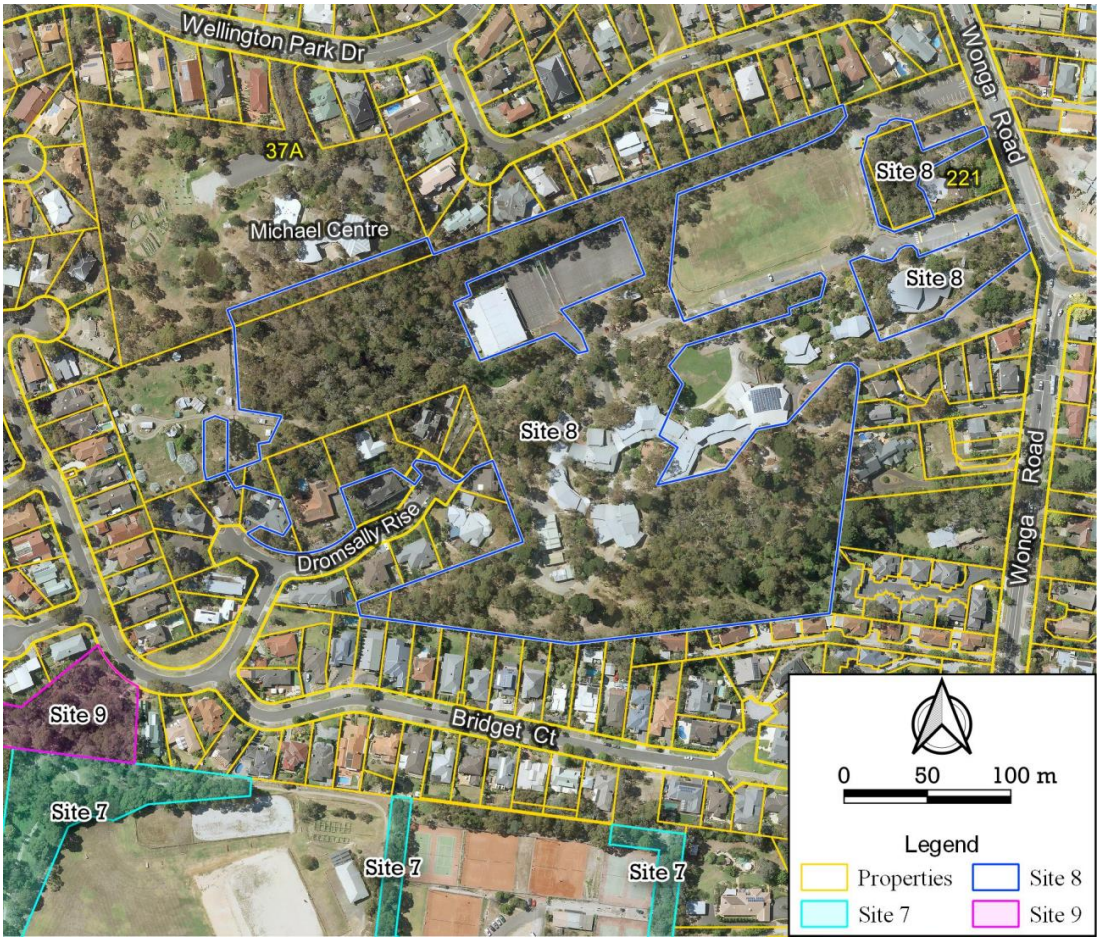
This assessment is based on the following sources of information about the site:

- A site inspection for this study from outside the fences on 18/1/19 and 8/3/19, totalling approximately half an hour;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site produced two plant lists – one for the aquatic environment and one for dry land; and
- Aerial photographs taken in 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas (VBA), the Atlas of Living Australia or eBird. Note that a series of plant lists mapped in the VBA next to Site 99 and attributed to the present author are misrepresented. They are not from that location and at least some of them are not from the present author.

Site 8. Melbourne Rudolf Steiner School & adjacent land, Warranwood

Biological Significance Level: *State* due to the presence of threatened vegetation types



Aerial photograph taken February 2017

Boundary, land use & tenure

This 6.8 ha site comprises:

- Parts of the Melbourne Rudolf Steiner School that contain native vegetation;
- Part of the Melbourne Therapy Centre (221 Wonga Rd) that contains native vegetation;
- Part of the Dromsally Rise subdivision that contains native vegetation, including residences and a reserve with a walkway to the school; and
- A narrow strip of native vegetation on 37A Wellington Park Drive abutting the school.

37A Wellington Park Drive is the address of the Michael Centre and the Melbourne Rudolf Steiner Seminar.

The site boundary has contracted significantly from the version in the 1997 report, *'Sites of Biological Significance in Maroondah'*. That is partly due to residential development (Dromsally Rise and 191 Wonga Rd) and partly because this report aims to more precisely exclude areas without habitat.

General description

No flora or fauna survey was conducted specifically for this study, so the following description relies substantially on information from the author's studies in 1996–1997.

Relationship to other land

The site's Valley Heathy Forest vegetation is quite similar to the Yarra Valley Grammar School bushland (Site 22), 1.5 km to the east-northeast. It also has similarities to parts of B.J. Hubbard Reserve (Site 2, 1.8 km southwest) and Bungalook Conservation Reserves (Site 66, 7 km southeast).

Apart from the abutting kindergarten and the Australian native trees on nearby nature strips, the residential area surrounding Monterey Bush Park is sparsely treed and forms poor habitat for indigenous fauna. Nevertheless, forest birds such as Australian King-Parrots were observed in the park, even though they cannot meet all their habitat needs within the site. They, and a range of insects, must fly to the park from other areas of habitat. The nearest patches of habitat are Site 99 (seen at the top of the aerial photograph on p. 43), Quambee Reserve (Site 7, abutting Site 99) and Mahon Reserve (Site 116, 400 m southwest). The aggregate of these sites (and others) evidently satisfies the birds' habitat needs even though no one of them could do so on its own.

The movements of wildlife through the neighbourhood enhances the area's natural ambience, e.g. through birdsong. This no doubt benefits residents.

Bioregion: Gippsland Plain and Highlands - Southern Fall

Habitat types

The state government's vegetation mapping depicts the following Ecological Vegetation Classes (EVCs):

Valley Grassy Forest (EVC 47, **Vulnerable** in the Highlands - Southern Fall);

Valley Heathy Forest (EVC 127, **Endangered** in Gippsland Plain bioregion). Imprecision in the government's mapping of the bioregional boundary has caused a small part of this EVC to be erroneously shown as being in the Highlands - Southern Fall bioregion, where it is listed as Vulnerable;

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the Highlands - Southern Fall).

Significant plants

Acacia stictophylla (Dandenong Range Cinnamon Wattle) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. The species was recorded as growing wild in the schoolgrounds up to the most recent flora survey in 1996, population size unstated.

Pultenaea pedunculata (Matted Bush-pea): The only plants ever recorded in Maroondah's history are in the schoolgrounds. Two small patches of this mat-forming species were inspected by the author on 20th December 2018 and seeds were collected for propagation and re-planting.

The following additional naturally-occurring plant species recorded in the site can be confidently regarded as being in the 'locally extinct' or 'critically endangered' category of dying out in Maroondah:

<u>Seen in 1981 and not in the subsequent surveys of the 1990s:</u>

Amyema pendula (Drooping Mistletoe)
Asplenium flabellifolium (Necklace Fern)
Caladenia moschata (Musky Caladenia)
Calochilus robertsonii (Purplish Beard-orchid)
Corunastylis despectans (Sharp Midge-orchid)
Gompholobium huegelii (Common Wedge-pea)
Kennedia prostrata (Running Postman)
Muellerina eucalyptoides (Creeping Mistletoe)
Wahlenbergia gymnoclada (Naked Bluebell)

Seen in the most recent flora surveys (1990s):

- *Eucalyptus macrorhyncha* (Red Stringybark) – one of the dominant canopy species, present in the schoolgrounds and the Dromsally Rise subdivision;
- *Eucalyptus rubida* (Candlebark) – scarce, in the schoolgrounds and the Dromsally Rise estate;
- *Pimelea linifolia* subsp. *linifolia* (Slender Rice-flower) – scarce in the schoolgrounds and one plant in the Dromsally Rise estate;
- *Polystichum proliferum* (Mother Shield-fern) – recorded in the school up to the most recent flora survey in 1996, population size unstated;
- *Poa tenera* (Slender Tussock-grass) – in the schoolgrounds and the Dromsally Rise subdivision;
- *Senecio minimus* (Shrubby Fireweed) – in the schoolgrounds and the Dromsally Rise subdivision.

Significant fauna

The Bell Miner was a common bird in Maroondah until c. 2000 but has rarely been reported in Maroondah since 2012. Birdlife Australia reports that a single bird was seen sitting on a nest in the Melbourne Rudolf Steiner School on 29th August 2018. It is very unusual for this species to be solitary, particularly when nesting. Perhaps this observation is a sign of disfunction in a species that is close to local extinction.

Fauna habitat

- The presence of all strata of native vegetation represents good habitat for a range of forest birds, bats, other arboreal mammals and invertebrates;
- The layer of large shrubs and small trees is believed to help avoid an overabundance of Noisy Miners;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1); and
- The gully provides habitat for waterbirds, frogs and aquatic invertebrates.

Ecological condition

Botanist, David Cameron, mapped vegetation condition in the schoolgrounds in the 1980s or 1990s. It is unknown how much the condition has changed since, except that multiple strata of plants are visible on aerial photographs.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The area mapped by the Victorian Government as Valley Heathy Forest to the southeast of the main school buildings easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed as 'endangered' in the relevant bioregion (the Gippsland Plain). As a consequence, the site meets standard criterion 3.2.3 for a site of **State** significance.

The government's mapping also depicts Valley Heathy Forest along the school's northwestern boundary. It is debatable which bioregion should be associated with that occurrence, but it is mapped as the Highlands - Southern Fall. Valley Heathy Forest is listed as Vulnerable in the Highlands - Southern Fall. It seems highly likely that over 0.3 ha of the Valley Heathy Forest near the northwestern boundary meets the relevant definition of a 'patch' and has a habitat score of 0.3 or above. Combining

that presumption with the 'vulnerable' status of Valley Heathy Forest in the Highlands - Southern Fall, the vegetation would have a 'High' or 'Very High' conservation significance under the 'Native Vegetation Framework'. In either case, standard criterion 3.2.3 then leads to a rating of **State** significance.

There is a small chance that the Valley Heathy Forest near the northwest boundary has deteriorated in condition since the last flora survey to the point that there is less than 0.25 ha with a habitat score of 0.3 or above. In that case, the conservation significance under the Native Vegetation Framework would fall to 'Medium' and the significance of that area under standard criterion 3.2.3 would fall to Regional. However, that would not change the site's overall State rating associated with the Valley Heathy Forest southeast of the main school buildings.

Creekline Herb-rich Woodland is listed as 'vulnerable' but it is unclear whether any of it within this site qualifies as a 'patch' under standard criterion 3.2.3.

It is also unclear whether native vegetation on any of the private land within the site qualifies as a 'patch', and hence what (if any) significance rating applies under standard criterion 3.2.3.

Threatened plant species

The Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. It does not occur outside Victoria. It was recorded in the schoolgrounds up to the most recent flora survey, which was in 1996. If a viable population exists there now, it meets standard criterion 3.1.2 for a site of **State** significance.

As the Matted Bush-pea (*Pultenaea pedunculata*) has never been recorded anywhere else in Maroondah, the population near the school buildings is particularly important. The presence of the plants therefore meets standard criterion 3.1.5 for a site of Local significance.

Any of the other species discussed in the section above headed 'Significant plants' also represent Local significance under standard criterion 3.1.5 as long as they have viable populations or are deemed to represent 'an important site' in Maroondah. Red Stringybark (*Eucalyptus macrorhyncha*) probably meets those conditions and it is unclear about the others.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest, Valley Grassy Forest and Dandenong Range Cinnamon Wattle.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the school community and residents within (and abutting) the site. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

Natural environments have also been shown to aid childhood development (Section 1.3 of Volume 1). Children at the school are exposed to the birds, insects, sights, sounds and smells of the school's bushland, which can only be beneficial to the children's development. The forest is also be an educational resource for the school. Similar benefits may be expected for children living in the residential part of the site.

The natural ambience of the site is expected to be beneficial to the broader wellbeing and health of the school community and residents. The movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens spreads nature's benefits to the local community.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation of the local community.

Changes

The extent of habitat within the site has reduced since the 1996 survey due to the Dromsally Rise development in c. 2001 (0.5 ha) and construction of school buildings (0.2 ha). There has also been an increase of approximately 0.2 ha in other parts of the schoolgrounds due to planting and growth of tree crowns.

There is inadequate recent information to determine other changes.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement and debilitation of indigenous flora by introduced plants ('environmental weeds');
- Loss of indigenous flora and habitat on the residential land due to domestic activity;
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Possible future construction of new school buildings or other facilities.

Strategic planning

The site's zoning comes under Schedule 4 of the Neighbourhood Residential Zone (NRZ4) except for the narrow strip on 37A Wellington Park Drive, which falls under Schedule 1 of the General Residential Zone (GRZ1). The whole site is affected by the Vegetation Protection Overlay (VPO), Schedule 4 of the Significant Landscape Overlay (SLO4) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the original version of Site 8 (in *'Sites of Biological Significance in Maroondah*) and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the areas outlined in blue on the aerial photograph on p. 58. The areas could be expanded to include the whole of each affected property if that is seen to be a better approach.

Information sources

This assessment is based on the following sources of information about the site:

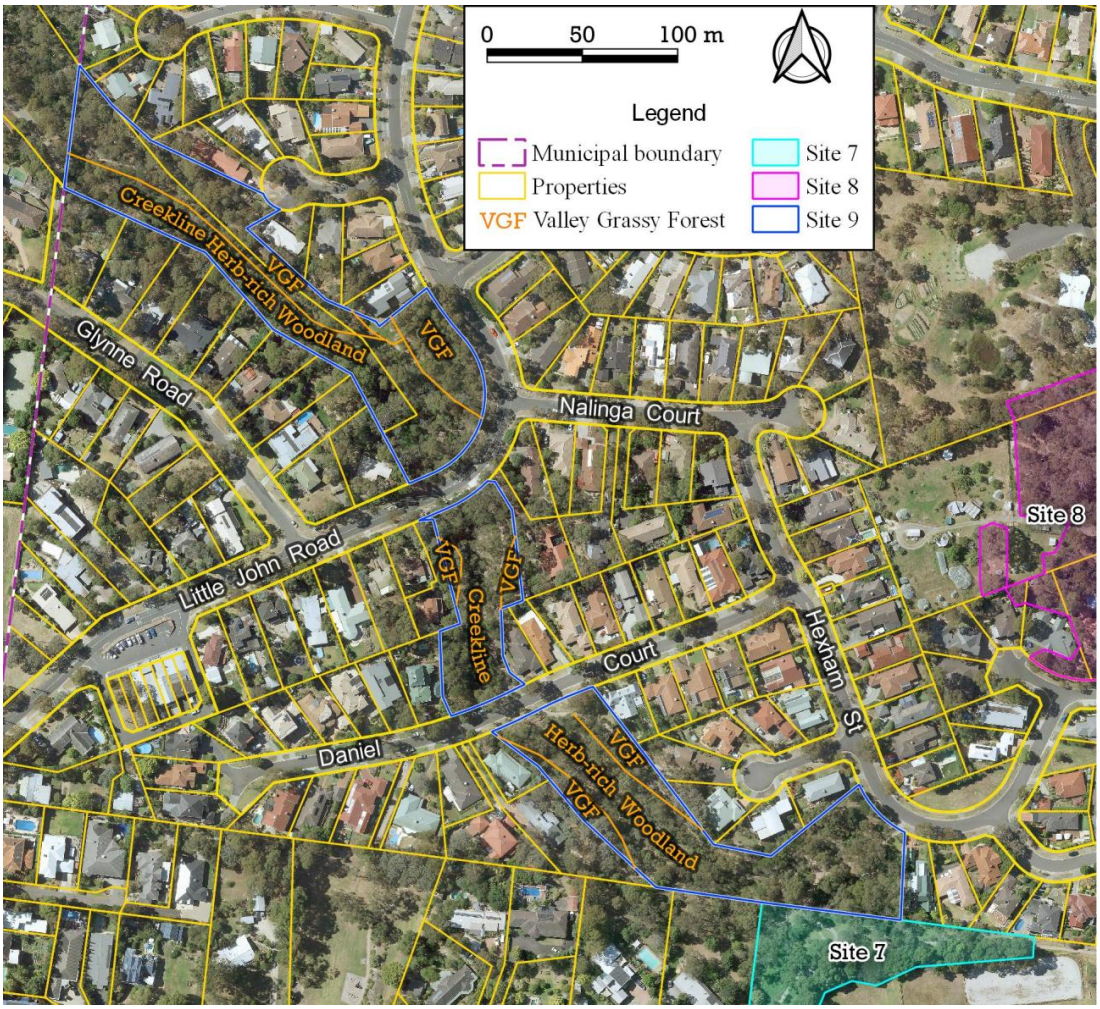
- A brief visit by the author on 20/12/18 to collect seeds of *Pultenaea pedunculata* and note associated plant species;
- A Birdlife Australia record of a solitary Bell Miner sitting on a nest on 28th August 2018 (but with no observer name provided);
- A list of plant species (largely planted or naturalised) for part of the school by botanist, David Cameron, on 7/3/05 (list no. T0367400 in the Victorian Biodiversity Atlas or no. 2404079.00 in the Atlas of Living Australia);
- Reports dated September 1997 by the author and by David Cameron, both to the Administrative Appeals Tribunal of Victoria regarding the (then) proposed Dromsally Rise development. The author's report was based, in part, on a three-hour flora survey he conducted in June–July 1997 and a 1½-hour follow-up survey on 8/9/98;

- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on a low-level fauna survey and a moderately detailed flora survey producing a list of indigenous plant species for each of three vegetation types;
- A report dated 1981 by David Cameron titled *'Vascular Flora of the Melbourne Rudolf Steiner School Grounds, Warranwood, Victoria – Systematic Arrangement of Species'*; and
- Aerial photographs taken in 1945, 2001, 2011 and 2017.

No other useful information could be found in the Victorian Biodiversity Atlas (VBA), the Atlas of Living Australia, eBird or iNaturalist. Note that the flora data in the abovementioned report by David Cameron in 1981 has been transcribed by third parties twice (inadvertently) to produce lists in the VBA (nos. T1562500 and T4054400). Those lists differ slightly from each other and neither is a completely accurate transcription of the original data.

Site 9. Andersons Creek East Branch, Warranwood

Biological Significance Level: *State* due to the presence of vulnerable vegetation types



Boundary, land use & tenure

The site is outlined in mid-blue above, overlaid on an aerial photograph taken in February 2019. The boundary corresponds precisely to the drainage reserve between Quambee Reserve (Site 7) and the municipal boundary with Manningham. The only change in boundary from the original version of Site 9 in the 1997 report, *'Sites of Biological Significance in Maroondah'*, is the deletion of 16 & 18 Daniel Court. Those two properties were newly-created vacant lots at the time and had not yet appeared on a cadastral map of the area.

In addition to the reserve's drainage function, there is a footpath to allow people to move about the neighbourhood and there has been a considerable effort to revegetate the land for environmental reasons.

General description

The east branch of Andersons Creek flows perennially through this 2.5-hectare site, toward the northwest. The creek channel and adjacent alluvial soil contain a small number of indigenous plant species – some of

them hardy and some of them able to germinate and mature quickly after soil is laid bare in a flood. Other indigenous species that were once present have been either displaced by vigorous introduced species or cannot tolerate the unnaturally variable flows in this urbanised environment. Despite the modification from a natural state, the creek probably still supports Shortfin Eels, yabbies, certain waterbirds and a range of invertebrates.

The banks of the creek rise as much as 8 m above water level along parts of the site boundary. The slopes support Valley Grassy Forest, tending toward Grassy Dry Forest at the highest elevations. The presence of houses immediately uphill from most of the reserve has significantly impaired the vegetation's ecological condition due to excavation, pipe-laying and migration of weed seeds, excessive nutrients, soil and rubbish. In addition, some neighbours have taken it upon themselves to use an adjacent part of the reserve as an extension of their garden and lawns.

However, there are no houses immediately uphill of the reserve boundary near Nalinga Court, because Little John Road intervenes. That part of the reserve has the highest number of indigenous plant species per unit area.

A total of sixty-two naturally-occurring, indigenous plant species were observed in Site 9 during this study.

While the influences of adjacent houses has been environmentally negative, there has been a very concerted and successful effort to augment the naturally-occurring indigenous plants by planting with indigenous species. Areas that supported only weedy grass in 1996 are now well vegetated. In addition, eucalypts that have died from urban pressures are now providing habitat for hollow-dwelling fauna such as Sugar Gliders.

The abundance of large tree hollows may be part of the reason for the abundance of Australian King Parrots that were observed during this study's site inspection. No concerted fauna survey was conducted but the habitat appears conducive for a wide range of forest birds, by Maroondah's standards.

When an ecological survey of Site 9 was done in 1996 there was a wetland opposite Wellington Park Drive. That wetland had been filled in by 2001.

Relationship to other land

Site 9 is part of habitat corridor from Yanggai Baring Reserve (Site 11) through the City of Manningham to Monterey Bush Park (Site 6) via Site 99. The Manningham part of the corridor is recognised as 'Biosite 27' in the Manningham Planning Scheme and by Foreman (2004). Manningham and Maroondah City Councils have cooperated to provide a corridor for recreation and wildlife from the '100 Acres' reserve in Park Orchards to Site 9, through revegetation and path construction.

These efforts have been slightly countered by the abovementioned impacts of neighbouring residences. Conversely, some of the wildlife (and particularly forest birds) that use the corridor also digress into adjoining residences and streets, enhancing the natural ambience of the neighbourhood.

The Shortfin Eels that are likely to be present in the creek are all born in the Coral Sea near New Caledonia and they must return there to breed. Nearly all other native fish species that may be in the site also need to move between there and the sea during their life cycles. However, the retarding basin immediately downstream of Site 9 may represent a barrier to fish other than the Shortfin Eel.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion) tending toward Grassy Dry Forest on the most elevated ground. Approximately 0.5 ha in total. 46 naturally-occurring, indigenous species were found on 8th March 2018.

Canopy trees: Mostly dominated by Yellow Box (*Eucalyptus melliodora*), followed by Candlebark (*E. rubida*). Red Box (*E. polyanthemos*) is dominant at the highest elevations where the vegetation tends toward Grassy Dry Forest. Bundy (*E. goniocalyx*) is notably extremely scarce. Red Stringybark (*E. macrorhyncha*) is represented by one dead tree but may have once been more abundant.

Lower trees: Black Wattle (*Acacia mearnsii*), Blackwood (*A. melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are moderately abundant.

Medium to large shrubs: Sweet Bursaria (*Bursaria spinosa*) is clearly dominant. Prickly Currant-bush (*Coprosma quadrifida*) and Yarra Burgan (*Kunzea leptospermoides*) are moderately abundant.

Small shrubs: Represented only by Hop Goodenia (*Goodenia ovata*), which is not abundant.

Ferns: Absent.

Climbers: Very scarce, represented by Small-leafed Clematis (*Clematis decipiens*), Downy Dodder-laurel (*Cassytha pubescens*) and Coarse Dodder-laurel (*Cassytha melantha*).

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is scarce.

Creepers: Bidgee-Widgee (*Acaena novae-zelandiae*) and Kidney-weed (*Dichondra repens*) are moderately abundant.

Other groundcover: Dominated by Thatch Saw-sedge (*Gahnia radula*) in some areas and Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) in others. Clustered Wallaby-grass (*Rytidosperma racemosum*) is abundant where other species are suppressed by mowing or trampling. The following additional species are moderately abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Pale Flax-lily (*Dianella longifolia*), Weeping Grass (*Microlaena stipoides*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Small Poranthera (*Poranthera microphylla*) and Rough Fireweed (*Senecio hispidulus*). Notably, there is also a patch of Tasmanian Wallaby-grass (*Rytidosperma semiannulare*).

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the bioregion). Approximately 2 ha in total. 37 naturally-occurring, indigenous species were found on 8th March 2018.

Canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*), with a few Yellow Box (*E. melliodora*) and Candlebark (*E. rubida*) as outliers from the adjacent Valley Grassy Forest.

Lower trees: Dominated by Swamp Paperbark (*Melaleuca ericifolia*) followed by Blackwood (*Acacia melanoxylon*). Black Wattle (*Acacia mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*) are moderately abundant.

Shrubs: Dense in patches, dominated by Sweet Bursaria (*Bursaria spinosa*) and Yarra Burgan (*Kunzea leptospermoides*). Prickly Currant-bush (*Coprosma quadrifida*), Common Cassinia (*Cassinia aculeata*) and Hop Goodenia (*Goodenia ovata*) are moderately abundant.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense in small areas. Other ferns are absent.

Climbers: Mountain Clematis (*Clematis aristata*) is moderately abundant. The only other vine is Coarse Dodder-laurel (*Cassytha melantha*), which is scarce.

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is moderately abundant.

Creepers: Bidgee-Widgee (*Acaena novae-zelandiae*) is moderately abundant.

Other groundcover: As for the Valley Grassy Forest except that Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) is a dominant species and there are more rushes (*Juncus* species).

Perennial stream channel (no EVC or conservation status have been assigned by the Victorian Government). 11 naturally-occurring, indigenous species were found on 8th March 2018, plus two that may or may not have been planted.

Trees and shrubs: Absent.

Ferns: Represented in 2019 only by two very young plants: a Common Maidenhair (*Adiantum aethiopicum*) and a Rough Tree-fern (*Cyathea australis*).

Amphibious species: Slender Knotweed (*Persicaria decipiens*) is abundant. Other species are fairly localised, mostly represented by Swamp Crassula (*Crassula helmsii*), Nodding Club-rush (*Isolepis cernua*), Green Rush (*Juncus gregiflorus*) and Angled Lobelia (*Lobelia anceps*). There are moderate numbers of Tall Sedge (*Carex appressa*) and a solitary Tassel Sedge (*Carex fascicularis*) but each of these may be present only due to planting.

Aquatics: Curly Pondweed (*Potamogeton crispus*) is moderately abundant. Water Plantain (*Alisma plantago-aquatica*) is very scarce.

Significant plants

The following naturally-occurring plant species recorded in Site 9 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Echinopogon ovatus* (Hedgehog Grass) – recorded in the 1996 survey and not in 2019;
- *Eucalyptus rubida* (Candlebark) – moderately abundant;
- *Gratiola pubescens* (Glandular Brooklime) – recorded in 1996 beside the creek between Quambee Reserve and Daniel Court. Neither the species nor suitable habitat could be found in 2019;
- *Pelargonium inodorum* (Kopata) – recorded in 1996 in the Creekline Herb-rich Woodland between Daniel Court and Little John Road; not found in 2019;
- *Pomaderris racemosa* (Cluster Pomaderris) – recorded in 1996 in the Creekline Herb-rich Woodland northwest of Little John Road; recorded again in 2019 but with doubts about whether the plants seen were planted rather than wild;
- *Potamogeton crispus* (Curly Pondweed) – moderately abundant in all sections of the creek;
- *Veronica derwentiana* (Derwent Speedwell) – recorded in 1996 in the Creekline Herb-rich Woodland between Quambee Reserve and Daniel Court; not found in 2019.

Significant fauna

In May 2018, midway between Daniel Court and Little John Road, six Sugar Gliders evacuated a eucalypt hollow that was being inspected by an arborist (Dayle Morgan). Sugar Gliders are quite uncommon in Maroondah.

Fauna habitat

- The creek supports Pacific Black Ducks and probably other waterbirds, Shortfin Eels, yabbies and a range of invertebrates;
- The creek provides a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat;
- The presence of all strata of native vegetation represents good habitat for a range of forest birds, bats, other arboreal mammals and invertebrates;
- There are many eucalypt hollows of a wide variety of sizes, including in dead trees. Large tree hollows are required by Australian King Parrots (which are abundant in Site 9). Sugar Gliders, insectivorous bats, owls, kookaburras and parrots are among the species that rely on tree hollows;
- The layer of large shrubs and small trees is believed to help avoid an overabundance of Noisy Miners;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The following figures relate to the A–D scale of ecological condition devised by Lorimer *et al.* (1997). In brief, 'A' represents excellent condition, 'B' represents good condition, 'C' represents fair condition and 'D' represents poor condition.

Valley Grassy Forest: Rating B: 0.05 ha near Nalinga Court; Rating C: 0.4 ha; Rating D: 0.10 ha.

Creekline Herb-rich Woodland: Rating C: 1.9 ha; Rating D: 0.17 ha.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

Each of the three segments of Site 9 contains native vegetation that clearly meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The present author estimates that more than 0.25 ha of that vegetation has a habitat score of 0.3 or above. Combining that assessment with the 'vulnerable' status of both the EVCs present, the vegetation would have a 'High' or 'Very High' conservation significance under the 'Native Vegetation Framework'. Standard criterion 3.2.3 then leads to a rating of **State** significance.

Locally threatened plant species

Referring to the plant species discussed in the section above headed 'Significant plants', Candlebark and Curly Pondweed are locally threatened and appear to have viable populations. Such populations meet standard criterion 3.1.5 for Local significance.

Ecological corridor

Site 9 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site. The specific 'remnant habitat blocks' in this case include Sites 6, 7, 8 and 99, as well as Manningham City Council's 'Biosite 27' (Foreman 2004).

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Grassy Forest and Creekline Herb-rich Woodland.

The continuation of Site 9 across the municipal boundary is Manningham Biosite 27, which Foreman (2004) rated as State significance for the same reason as above. Foreman also recognised Local significance for the ecological corridor.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and the immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site is expected to be beneficial to the health, wellbeing, childhood development and quality of life of people who come into contact with it. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the site.

The natural ambience may also encourage people to get exercise on the path through the site. The reserve also provides ready access to the sport facilities of Quambee Reserve (Site 7) for people in the neighbourhood, thereby encouraging physical activity.

The site's location along a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

A small, artificial wetland opposite Wellington Park Drive was filled in and replaced with weedy grass between 1996 and 2001.

Aerial photographs show that since 2001, the extent of native vegetation has expanded by approximately 0.16 ha through revegetation and the growth of tree crowns over previously open grass.

Change in the species present

Sixty-three naturally-occurring, indigenous plant species recorded in Site 9 in March 2019 (plus two species that may or may not be natural). The corresponding figure for the forerunner survey in February–March 1996 was 89. It is very likely the substantial difference between the figures is mostly due to species dying out. Some of those species probably died out due to the destruction of the small, artificial wetland that used to be opposite Wellington Park Drive. Most others are environmentally sensitive species that probably succumbed to modification of the site by the pressures of surrounding urban development.

Change in the ecological condition of habitat

Aerial photographs show a substantial increase in the average crown size of the site's eucalypts between 2001 and 2017. That represents an improvement in the suitability of the habitat for some forest birds and invertebrates. However, that improvement has been countered by deaths of eucalypts.

The abovementioned loss of plant species indicates a deterioration in the conditions for environmentally sensitive species, which may have been initiated prior to the 1996 flora survey.

Comparing the ecological condition ratings from 1996 (in *'Sites of Biological Significance in Maroondah'*) with the equivalent figures above indicates that:

- There has been a major shift in the Creekline Herb-rich Woodland from condition rating 'D' (poor) to 'C' (fair), which is attributable to revegetation and plant growth; and
- The most natural area of Valley Grassy Forest (near Nalinga Court) has deteriorated substantially, which may be due to the delayed effects of the earlier construction of Little John Road and associated drainage works.

Note that the figures from 1996 were estimated from hand-drawn lines on a paper map without the aid of GPS tracking. They were therefore quite imprecise. In particular, the total area of Valley Grassy Forest was overestimated.

Threats

The threats to Site 9's biodiversity identified in this study are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continuing eucalypt deaths, mainly during droughts, which are predicted to worsen with climate change;
- Further displacement of indigenous plants by introduced plants such as Wandering Trad;
- Exacerbation of the preceding problem by the introduction of weeds, soil, nutrients and planted plants from abutting residences;

- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and possibly further urbanisation of the catchment.

Strategic planning

The zoning of Site 9 is a mixture of General Residential Zone (GRZ1), Neighbourhood Residential Zone (NRZ4), Urban Floodway Zone and Public Use Zone - Service & Utility.

The whole site is affected by Schedule 4 of the Significant Landscape Overlay (SLO4) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. Most of it is also covered by the Vegetation Protection Overlay (VPO). The Bushfire Management Overlay applies downstream (northwest) for Daniel Court.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the original version of Site 9 and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in blue on the aerial photograph on p. 64.

Information sources

This assessment is based on the following sources of information about the site:

- Slightly more than three hours of flora survey specifically for this study on 8/3/19. This work produced separate, moderately comprehensive lists of naturally-occurring, indigenous flora for the site's three habitat types, including abundances. It also assessed vegetation condition and mapped the locations of EVC boundaries and significant species;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on a flora survey of similar intensity and nature to the 2019 one except that it included introduced species and excluded abundance information; and
- Aerial photographs taken in 1945, 2001, 2011 and 2017.

No useful information was found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Note that the state government's vegetation mapping is quite imprecise. The band of Creekline Herb-rich Woodland is mapped too wide and too far to the southwest, so it does not even contain the creek at one point. The mapping of 'native vegetation extent' is too coarse and pixelated to correctly reflect the true extent.

Site 10. Delatite Court, Warranwood (Discontinued)

Biological Significance Level: *Not Significant*

Site 10 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) had been recently subdivided. On its vacant blocks was 0.64 ha of Valley Grassy Forest, which is listed by the state government as a vulnerable Ecological Vegetation Class. Among the forty plant species was a large population of sun-orchids. Two ancient Candlebarks were listed under Maroondah's Heritage Overlay.

Aerial photographs show that by 2001, most blocks were built upon, the Candlebarks with heritage protection had gone and the understorey had mostly been destroyed. By 2011, all that remained was a few scattered trees. That remains the case in 2019.

As a result, Site 10 no longer meets any criteria for a site of biological significance.

Strategic planning

The whole of Site 10 is covered by the Vegetation Protection Overlay (VPO), Schedule 4 of the Significant Landscape Overlay (SLO4) and the Bushfire Management Overlay. Heritage Overlays (HO15 and HO16) apply where the two ancient Candlebarks once stood.

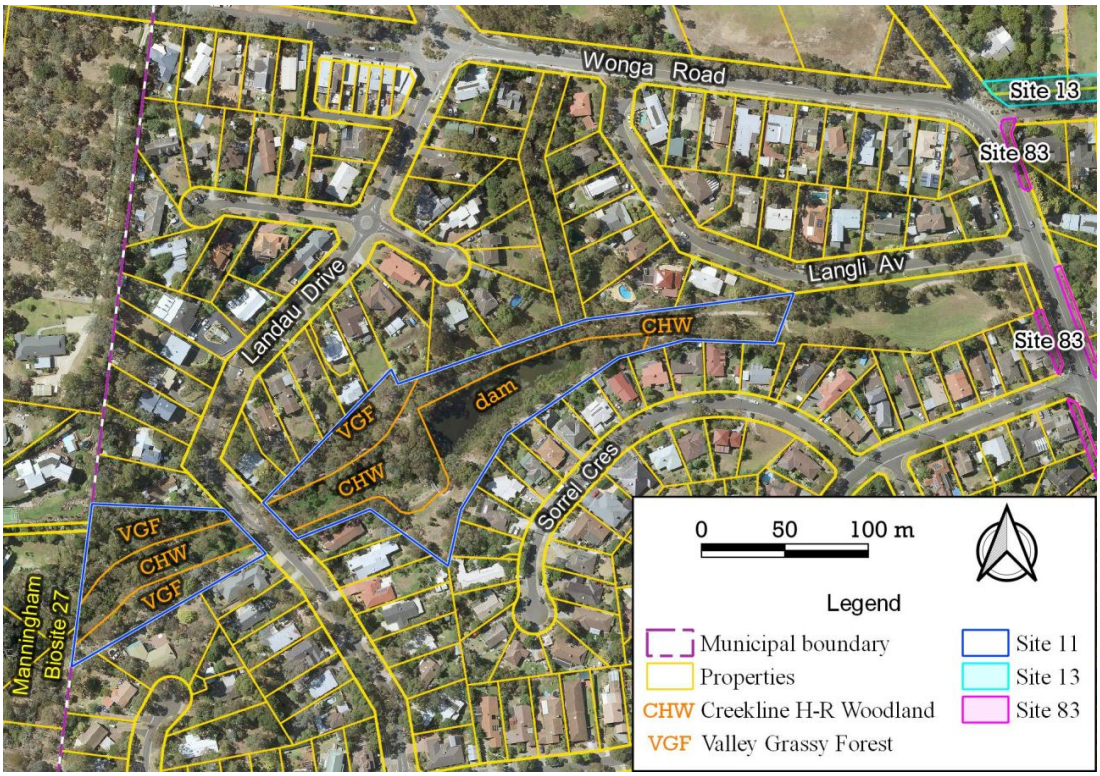
As the site no longer qualifies as a site of biological significance, it is recommended to remove the VPO. As the two heritage-protected Candlebarks within Site 10 no longer exist, their overlays (HO15 and HO16) should be removed.

The scattered indigenous trees that remain will continue to gain some protection under SLO4. Those on 81 Little John Road (which is within the site) will also continue to come under the state-wide clearing controls of clause 52.17 of the Victoria Planning Provisions.

The zoning of most of Site 10 comes under schedule 4 of the Neighbourhood Residential Zone. This differs from its surroundings, which are in the General Residential Zone. The difference is presumably because of the 1997 report and the VPO, which are now obsolete. It would therefore be appropriate to reconsider the zoning.

Site 11. Yanggai Barring Reserve, Warranwood

Biological Significance Level: *State* due to the presence of vulnerable vegetation types



Boundary, land use & tenure

The site is outlined in mid-blue above, overlaid on an aerial photograph taken in February 2017. Its 2.16 hectares occupy the majority of a council reserve managed for drainage, passive recreation and nature conservation. Footpaths through the reserve allow people to move about the neighbourhood. The area of Site 11 adopted here is smaller than the original version in the 1997 report, *'Sites of Biological Significance in Maroondah'* because this report aims to more precisely exclude areas without significant habitat.

General description

Yanggai Barring Reserve extends across the municipal boundary between Maroondah and Manningham. This report focuses on the Maroondah part but it should not be overlooked that it is part of a much larger area of habitat.

The reserve follows a creek valley, whose slopes have a typical gradient of 5-20º east of Landau Drive and 20–30º to the west. A dam was constructed across the creek, probably in the first half of the 20th Century when the area was grazing land. Much later, the creek was largely replaced by a pipe, leaving no trace of the creek upstream (east) of the dam. What remains of the creek no longer flows during dry weather but it flows strongly (if briefly) during rainfall events. The peak flows have eroded the channel up to 2 m deep into the floodplain.

Although there is no longer a creek channel east of the dam, some large, old Swamp Gums (*Eucalyptus ovata*) remain there from the time when the creek existed. There are other large, old Swamp Gums on the northern side of the dam. Otherwise, the vegetation surrounding the dam is mainly planted.

The dam itself was heavily vegetated with aquatic plants until 2018, when it was drained and dredged to remove silt and contamination. By the time the dam was inspected in March 2019 for this study, it had refilled, aquatic vegetation was beginning to recover naturally and common waterbirds were present.

Between the dam and Landau Drive, the naturally-occurring native vegetation comprises patches of bracken, patches of wetland plants on the floodplain and a modest cover of trees and shrubs. There are also areas of revegetation.

Downstream (west) of Landau Drive, there is a marked difference between the valley's northwest and southeast slopes. The northwest slope supports the most natural vegetation in the site, notwithstanding that the tree canopy has large gaps due to eucalypt deaths. Many more forest birds were found there than east of Landau Drive. The opposite slope supports a mixture of naturally-occurring and planted, non-indigenous eucalypts, with only weedy grass beneath. The grass is mown, at least during the fire danger period. There is also a gravel track beside the southeastern boundary, used as a rear access by abutting residents and also to access some drainage infrastructure.

A total of forty-seven naturally-occurring, indigenous plant species were observed in the reserve during this study.

Relationship to other land

Site 11 is effectively an arm of a larger area of habitat that is mostly located in the City of Manningham. The Manningham part of the area is recognised as 'Biosite 27' in the Manningham Planning Scheme and by Foreman (2004).

During the ecological survey for this study, the abundance of forest birds declined with distance from the Manningham boundary. It appears that, for forest birds, Site 11 is more of a terminus than a thoroughfare.

To the east of Site 11, the landscape has considerably lower habitat value for wildlife. The eastern end of Yanggai Barring Reserve has strips of revegetation that suit some common bird species. There is similar habitat along the verges of Wonga Road (Site 83 – see the aerial photograph on p. 72). Site 13 provides a further narrow habitat link to some broader areas of native tree cover with limited native understorey. The effectiveness of these strips of habitat for wildlife movement is impaired by their narrowness, fragmentation and proximity to traffic.

However, waterbirds are much more accepting of habitat fragmentation than most forest birds. Waterbirds that frequent the dam at Yanggai Barring Reserve are quite capable of crossing suburbia to get to and from other wetlands.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion). Approximately 0.5 ha in total. 26 naturally-occurring, indigenous species were found on 15th March 2019.

Canopy trees: There are substantial canopy gaps due to eucalypt deaths and the history of clearing. Overall, there are similar numbers of Messmate Stringybark (*Eucalyptus obliqua*), Red Box (*E. polyanthemos*) and Candlebark (*E. rubida*). There is also one Yellow Box (*E. melliodora*) and a dead Red Stringybark (*E. macrorhyncha*).

Lower trees: Blackwood (*Acacia melanoxylon*) is strongly dominant.

Medium to large shrubs: Mostly dense, dominated by Sweet Bursaria (*Bursaria spinosa*) and Prickly Currant-bush (*Coprosma quadrifida*).

Small shrubs: Absent.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over much of the more natural areas. Common Maidenhair (*Adiantum aethiopicum*) is very scarce.

Climbers: Mountain Clematis (*Clematis aristata*) is fairly abundant, west of Landau Drive.

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is scarce.

Creepers: Practically absent.

Other groundcover: Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) is scattered through the more natural areas. Weeping Grass (*Microlaena stipoides*) is abundant on the north-facing slope west of Landau Drive, where slashing appears to have eliminated nearly all other understorey.

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the bioregion). Approximately 1 ha in total. 24 naturally-occurring, indigenous species were found on 15th March 2019.

Canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*).

Lower trees: Patchy, mostly represented by Blackwood (*Acacia melanoxylon*).

Shrubs: There are small patches of Sweet Bursaria (*Bursaria spinosa*) or Prickly Currant-bush (*Coprosma quadrifida*).

Ferns: Austral Bracken (*Pteridium esculentum*) is dense in patches. Other ferns are absent.

Climbers: Mountain Clematis (*Clematis aristata*) is fairly abundant.

Creepers: Bidgee-Widgee (*Acaena novae-zelandiae*) and Rainforest Crane's-bill (*Geranium homeanum*) are fairly abundant.

Other groundcover: Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) is fairly abundant in the most natural section, west of Landau Drive.

Artificial wetland (no EVC or conservation status applicable). 0.3 ha. 14 naturally-occurring, indigenous species were found on 15th March 2019.

Trees: Absent.

Shrubs: Three Shrubby Fireweed (*Senecio minimus*) plants grow at the water's edge.

Creeper: Bidgee-Widgee (*Acaena novae-zelandiae*) is scattered at the water's edge.

Amphibious species: Slender Knotweed (*Persicaria decipiens*) and rushes (*Juncus* species, particularly *J. gregiflorus*) are abundant. Lesser Joyweed (*Alternanthera denticulata*), Hairy Willow-herb (*Epilobium hirtigerum*) and Lesser Loosestrife (*Lythrum hyssopifolia*) are moderately abundant. Waterwort (*Elatine gratioloides*) is very localised on the southern edge of the dam but fairly abundant in a small area.

Aquatics: Dominated by Tall Spike-rush (*Eleocharis sphacelata*). In 2019, there are large numbers of Common Duckweed (*Lemna disperma*) on the dam but with only small percentage cover. Water Plantain (*Alisma plantago-aquatica*) is moderately common.

Non-perennial stream channel (no EVC or conservation status applicable). 12 naturally-occurring, indigenous species were found on 15th March 2019.

Trees and shrubs: Absent.

Ferns: Represented in 2019 only by two Rough Tree-ferns (*Cyathea australis*).

Scrambler: One Small-leaf Bramble (*Rubus parvifolius*).

Creepers: Rainforest Crane's-bill (*Geranium homeanum*) is fairly abundant. Bidgee-Widgee (*Acaena novae-zelandiae*) is scattered along the brow of the channel.

Amphibious species: Nodding Club-rush (*Isolepis cernua*), Green Rush (*Juncus gregiflorus*), Slender Knotweed (*Persicaria decipiens*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are moderately abundant.

Aquatics: Water Plantain (*Alisma plantago-aquatica*) is scarce.

Significant plants

The following naturally-occurring plant species recorded in Site 11 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – recorded in the 1996 survey and not in 2019;

- *Eucalyptus rubida* (Candlebark) – five grow in the Valley Grassy Forest and one in the Creekline Herb-rich Woodland, all west-southwest of the dam;
- *Senecio minimus* (Shrubby Fireweed) – three grow at water's edge of the dam. This species is generally subject to large population fluctuations and may have been scarcer than usual during this study's March 2019 flora survey of the dam area due to drought conditions.

A small but dense colony of Waterwort (*Elatine gratioloides*) was found on the southern shore of the dam in March 2019. Although Waterwort cannot be so confidently presumed to fall into the 'critically endangered' category as the species above, it is at least a candidate for that category. This study could find only four other locations where Waterwort has been recorded in Maroondah's history: Sites 59, 62, 70 and 72. The record for Site 59 was from 2006 before the site was turned into 'The Range' residential development, so Waterwort may well have died out there.

Significant fauna

eBird contains the following significant records from local resident, Jackson Airey:
Hardhead (vulnerable in Victoria) – 2 seen in January 2019
Rufous Night-Heron (near-threatened in Victoria) – a temporary resident in 2014 and 2015
Collared Sparrowhawk, January 2014 – apparently only a brief visit, perhaps just flying overhead
Painted Button-quail, April 2016 – apparently only a brief visit
Southern Boobook – 1 bird in August 2016

The author heard a Mistletoebird during this study. That species has been very scarce in Maroondah since c. 2008 because the vast majority of mistletoes (on which Mistletoebirds rely for food) died from protracted drought. However, the 2018–2019 ecological survey of Yanggai Barring Reserve found no mistletoes, which are essential for the habitat needs of Mistletoebirds.

Fauna habitat

There are tree hollows in some of the eucalypts (mainly at the eastern end of the site). Sugar Gliders, insectivorous bats, owls, kookaburras and parrots are among the species that rely on tree hollows;

The dam:

- Supports waterbirds, frogs and aquatic invertebrates; and
- Provides a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat.

Where there is a reasonable cover of native vegetation with trees, shrubs and groundcover (which is mainly west of Landau Drive):

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, other arboreal mammals and invertebrates;
- Overabundance of Noisy Miners may be reduced by the presence of small trees and large shrubs;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Vegetation on the southeast-facing slope of the valley is in fair ecological condition – rating 'C' on the A–D scale of ecological condition devised by Lorimer *et al.* (1997). The same rating applies to revegetation on all other sides of the dam. The total area in condition 'C' is approximately 1.1 ha.

Excluding the dam and small areas of open grass, the ecological condition of the remaining 0.3 ha in the site is poor (rating 'D'). The dam's ecological condition cannot be rated currently because it is recovering from recent dredging.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The area that lies west of Landau Drive and northwest of the creek easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The present author estimates that at least 0.25 ha of that vegetation has a habitat score of 0.3 or above. Combining that assessment with the 'vulnerable' status of both the EVCs present, the vegetation would have a 'High' conservation significance under the 'Native Vegetation Framework'. Standard criterion 3.2.3 then leads to a rating of **State** significance. The continuation of Yanggai Barring Reserve across the municipal boundary is part of Manningham Biosite 27, which Foreman (2004) rated as State significance for the same reason.

The part of the site east of Landau Drive cannot be reliably assessed against standard criterion 3.2.3 because the vegetation there only qualifies as a 'patch' due to revegetation, which the criterion does not anticipate.

Locally threatened plant species

Referring to the plant species discussed in the section above headed 'Significant plants', Candlebark, Shrubby Fireweed and Waterwort are locally threatened and appear to have viable populations. Such populations meet standard criterion 3.1.5 for Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Grassy Forest and Creekline Herb-rich Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and the immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creek helps to stabilise the creek bed and bank. It also removes a small amount of water pollution, as do the plants in the dam.

The natural ambience of the site is expected to be beneficial to the enjoyment, health, wellbeing, childhood development and quality of life of park users. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the site.

The natural ambience may encourage people to get exercise in the reserve. It also contributes to the neighbourhood's 'green and leafy' character.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, the extent of native vegetation:

- Expanded over that period by approximately 0.12 ha through revegetation and the growth of tree crowns over previously open grass; and
- Approximately 0.04 ha of tree cover was lost, the probable cause being drainage works in the 1990s.

Change in the species present

Fifty-six naturally-occurring, indigenous plant species were detected in the site in 1996 but only forty-six were recorded in 2019. Many of the species lost are normally abundant in such vegetation (e.g. *Acacia verticillata* and *Themeda triandra*) and others are in decline throughout Maroondah (e.g. *Eucalyptus macrorhyncha* and *Ozothamnus ferrugineus*). Such a large change indicates a substantial shift in the ecological function and condition of the habitat. It could be largely explained by the drainage works that occurred in the 1990s, which changed the hydrology of the site and its catchment. Other losses of species could be due to fire protection work and the pressures of surrounding urban development. These problems are likely to have promoted the deaths of eucalypts and the consequent overgrowth of Austral Bracken (*Pteridium esculentum*), which suppresses the regeneration of other plants.

Change in the ecological condition of habitat

Aerial photographs show a substantial increase in the average crown size of the site's eucalypts and wattles between 2001 and 2017. That represents an improvement in the suitability of the habitat for some forest birds and invertebrates. However, that has been counterbalanced by many deaths of mature eucalypts.

The abovementioned loss of plant species suggests a deterioration in the conditions for environmentally sensitive species, or ongoing attrition from a deterioration that occurred prior to the 1996 flora survey.

Comparing the ecological condition ratings and plant lists from 1996 (in *'Sites of Biological Significance in Maroondah'*) with the equivalent figures above indicates the following changes:

- Some of the Creekline Herb-rich Woodland has improved from condition rating 'D' (poor) to 'C' (fair), which is attributable to revegetation, plant growth and partial recovery from drainage works in the 1990s; and
- The most natural area of Valley Grassy Forest (north of the creek, near the Manningham border) has deteriorated substantially from rating 'B' to rating 'D', which is associated with the loss of plant species discussed above.

Threats

The threats to Site 11's biodiversity identified in this study are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued premature deaths of eucalypts, particularly as a result of climate change;
- Suppression of regeneration of indigenous plants by overgrowth of Austral Bracken (*Pteridium esculentum*) west of Landau Drive;
- Further displacement of indigenous floodplain plants by introduced plants (mainly Water Couch, *Paspalum distichum*) just northeast of Landau Drive; and
- Creek erosion during flow pulses caused by urbanisation of the catchment and piping of the drainage system. Climate change is expected to worsen this problem.

Strategic planning

The zoning of Site 11 is Public Park and Recreation Zone. The whole site is affected by the Bushfire Management Overlay, Schedule 4 of the Significant Landscape Overlay (SLO4) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. It is also covered by the Vegetation Protection Overlay (VPO), which extends further east to Wonga Road.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the original version of Site 11 and apply the proposed schedule ESO1 of the Environmental Significance

Overlay to the area outlined in blue on the aerial photograph on p. 72. ESO1 could be extended to the whole of Yanggai Barring Reserve if Maroondah City Council wishes to undertake further revegetation.

Information sources

This assessment is based on the following sources of information about the site:

- An unexhaustive flora survey of the site on 17/3/18 and 14/3/19 specifically for this study. This work produced separate, moderately comprehensive lists of indigenous and introduced flora for the site's three habitat types, including abundances. It also assessed vegetation condition and mapped the locations of EVC boundaries and significant species;
- Fauna observations made incidentally during the abovementioned survey;
- Bird observations from local resident, Jackson Airey, lodged with eBird;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on a basic fauna survey and a flora survey of similar intensity and nature to the 2019 one except that it excluded abundance information;
- A bird list from 1990–1996 by Robert Nieuwenhuis and Pat Adair-Black; and
- Aerial photographs taken in 1945, 2001, 2011 and 2017.

No useful information was found in the Victorian Biodiversity Atlas or the Atlas of Living Australia.

Site 12. 342–356 Wonga Road, Warranwood

Biological Significance Level: *State* due to the presence of a vulnerable vegetation type



Boundary, land use & tenure

The site is outlined in mid-blue above, overlaid on an aerial photograph taken in February 2017. It occupies all of 344–356 Wonga Road (0.84 ha) and the parts of 342 Wonga Road that retain habitat for indigenous flora and fauna (2.08 ha).

Although the addresses of these two properties are on Wonga Road, the particular stretch of Wonga Road is generally known as Croydon Road.

The area of Site 12 adopted here is smaller than the original version in the 1997 report, *'Sites of Biological Significance in Maroondah'* because this report aims to more precisely exclude areas without significant habitat.

344–356 Wonga Road includes a securely fenced enclosure of 0.05 ha for a public utility installation. The rest of that property is undeveloped bushland. There is no fence between that property and 342 Wonga Road, on which a house is being constructed at the time of writing. The area occupied by the new house is excluded from Site 12. Power transmission lines run east-west through a 26 m-wide strip on the northern edge of 342 Wonga Road, with a pylon in the middle.

General description

344–356 Wonga Road slopes generally to the north, with a typical slope of 1:6. Excluding the dam and its embankment, the rest of the site has slopes facing between west and north, with a typical slope of 1:6. The soil is shallow and stony.

A 1945 state government aerial photograph shows this site to have been a lightly vegetated grazing property. At the time of the author's ecological survey of the site in 1996, it was grazed by horses and the tree cover had greatly increased compared with 1945. Since then, the land has been subdivided, kangaroos have replaced the horses and the trees have grown.

Grazing by kangaroos and rabbits is influencing the structure and composition of the vegetation, as native animals would have done prior to settlement.

Trees and large shrubs are periodically cut back hard beneath the electricity transmission lines in the site's north, for safety. The cutting can have negative environmental consequences but it is generally compatible with the existing vegetation, which has survived that treatment for scores of years. In fact, most of the site's most significant plant species occur beneath the transmission lines (though in very small numbers).

The habitat value of the land is increased by the presence of a dam, which measures 0.23 ha. The habitat for indigenous aquatic plants in the dam has been decreased by the planting of waterlilies but there is nevertheless considerable pondlife beneath the lily pads.

Altogether, seventy-three naturally-occurring, indigenous plant species were observed in Site 12 during this study.

Construction of a dam wall creates conditions favourable to establishment of introduced plants. As a result, there is a significant cover of Blackberry, Sweet Pittosporum and Spanish Heath on the crest and embankment of the dam wall.

Relationship to other land

From an ecological perspective, Site 12 is more closely allied to habitat in Manningham than Maroondah. It is a link between two sites of biological significance in the City of Manningham recognised by Foreman (2004) and the Manningham Planning Scheme. Those other sites are 'Biosite 26' to the north and 'Biosite 27' to the southwest, as marked on the aerial photograph above. If not for the municipal boundary, all three areas would be recognised as a single site of biological significance.

Most of the fauna species observed in the site during the ecological survey for this study cannot meet all their habitat needs solely within Site 12, so they must move between there and other areas of habitat. There is certain to be considerable traffic between Site 12 and the adjacent Manningham 'biosites' by kangaroos, forest birds (e.g. the Grey Fantail and Spotted Pardalote) and flying insects. Waterbirds are much more accepting of habitat fragmentation and can easily fly between Site 12 and other wetlands, even for long distances over suburbia.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Grassy Dry Forest (EVC 22, 'Least concern' in the bioregion)

Canopy trees: Dominated by Red Box (*Eucalyptus polyanthemos*), with fewer Red Stringybark (*E. macrorhyncha*) and Bundy (*E. goniocalyx*).

Lower trees: Black Wattle (*Acacia mearnsii*) and Golden Wattle (*Acacia pycnantha*) are also present.

Medium to large shrubs: There are thickets of Yarra Burgan (*Kunzea leptospermoides*). Sifton bush (*Cassinia sifton*) is also abundant. Shiny Cassinia (*C. longifolia*) and Hop Wattle (*Acacia stricta*) are moderately abundant. Other medium or large shrubs are scarce. Spreading Wattle (*Acacia genistifolia*) is represented by two individuals.

Small shrubs: Scarce, but notably represented beneath the transmission lines by two Heath Wattles (*Acacia brownii*) and three Slender Rice-flower (*Pimelea linifolia* subsp. *linifolia*).

Ferns: Absent.

Climbers: Represented only by Small-leafed Clematis (*Clematis decipiens*).

Creepers: Scarce, notably including three Cranberry Heath (*Astroloma humifusum*) and one Running Postman (*Kennedia prostrata*).

Grasses, rushes and sedges: Rich in species. Dominated in different areas by Thatch Saw-sedge (*Gahnia radula*), Red-anther Wallaby-grass (*Rytidosperma pallidum*), Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Purplish Wallaby-grass (*R. tenuius*) or Weeping Grass (*Microlaena stipoides*). Grey Tussock-grass (*Poa sieberiana*), Clustered Wallaby-grass (*R. racemosum*) and Bristly Wallaby-grass (*R. setaceum*) are also abundant but not dominant. The following species are fairly abundant: Variable Sword-sedge (*Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Kneed Wallaby-grass (*R. geniculatum*) and Kangaroo Grass (*Themeda triandra*).

Other groundcover: Almost absent when the site was visited on 17/3/18 but there may well be orchids, Chocolate Lily (*Arthropodium strictum*) and other seasonal species at other times of the year.

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion)

Canopy trees: Includes the same species as the Grassy Dry Forest as well as substantial numbers of Candlebark (*E. rubida*) and Swamp Gum (*E. ovata*). The rather unnatural regrowth on the dam embankment is dominated by Swamp Gum.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*) and thickets of Yarra Burgan (*Kunzea leptospermoides*).

Medium to large shrubs: Dense in patches, the densest species being Manuka (*Leptospermum scoparium*). Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) and Prickly Moses (*A. verticillata*) are fairly abundant in certain areas.

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*) and Common Heath (*Epacris impressa*) are fairly abundant.

Ferns: Common Maidenhair (*Adiantum aethiopicum*) was recorded in the 1996 flora survey but not in 2018, perhaps due to the time of year (March).

Climbers: Small-leafed Clematis (*Clematis decipiens*).

Creepers: Practically absent.

Grasses, rushes and sedges: Rich in species. Dominated in different areas by Thatch Saw-sedge (*Gahnia radula*) or Red-anther Wallaby-grass (*Rytidosperma pallidum*). Other species that are fairly abundant include Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Common Love-grass (*Eragrostis brownii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*), Grey Tussock-grass (*Poa sieberiana*), the wallaby-grass *Rytidosperma monticola/erianthum*, Smooth Wallaby-grass (*R. laeve*), Clustered Wallaby-grass (*R. racemosum*), Bristly Wallaby-grass (*R. setaceum*) , Purplish Wallaby-grass (*R. tenuius*) and Kangaroo Grass (*Themeda triandra*).

Other groundcover: Scarce, the main species being Common St John's Wort (*Hypericum gramineum*) and Yellow Rush-lily (*Tricoryne elatior*).

Artificial wetland (no EVC or conservation status applicable)

Trees and shrubs: Absent.

Amphibious species: Dominated by rushes – *Juncus amabilis, J. fockei, J. gregiflorus, J. pallidus, J. planifolius, J. procerus* and *J. sarophorus*. Swamp Club-rush (*Isolepis inundata*) is also abundant. Tall Sedge (*Carex appressa*), Swamp Crassula (*Crassula helmsii*) and Nodding Club-rush (*I. cernua*) are moderately abundant.

Aquatics: Australia's only two Cumbungi species, *Typha domingensis* and *T. orientalis*, form dense patches at the edge of the dam. In 1996, there was a substantial cover of the locally rare Small-fruit Pondweed (*Potamogeton cheesemanii*) on the water but it had been replaced by ornamental waterlilies in 2019.

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. Site 12 is one of many locations within the species' range to have an apparently viable population of the species.

The wallaby-grass, *Rytidosperma monticola*, is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. Site 13 is one of seven sites in Maroondah to support plants that are best regarded as an undocumented form of *R. monticola* with some characters tending toward the Hill Wallaby-grass (*R. erianthum*). This species is fairly abundant within a small part of 342 Wonga Road.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 12 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acacia brownii* (Heath Wattle) – two plants grow beneath the transmission lines;
- *Astroloma humifusum* (Cranberry Heath) – three plants grow beneath the transmission lines;
- *Centrolepis strigosa* (Hairy Centrolepis) – recorded in the 1996 survey but not in 2019 (which is understandable, considering the March timing);
- *Eucalyptus macrorhyncha* (Red Stringybark) – fairly common on the site;
- *Eucalyptus rubida* (Candlebark) – fairly common on the site;
- *Kennedia prostrata* (Running Postman) – one plant grows beneath the transmission lines;
- *Pentapogon quadrifidus* (Five-awned Spear-grass) – recorded in the 1996 survey but not in 2019 (which is understandable, considering the March timing and the extent of grazing by kangaroos);
- *Pimelea linifolia* subsp. *linifolia* (Slender Rice-flower) – three plants grow beneath the transmission lines. The only other known remaining occurrence in Maroondah is in Site 5; and
- *Potamogeton cheesemanii* (Small-fruit Pondweed) – present on the dam in 1996 but replaced by ornamental waterlilies by 2019.

Fauna habitat

The dam:

- Supports waterbirds, frogs and aquatic invertebrates; and
- Provides a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat.

In the rest of the site:

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, other arboreal mammals and invertebrates;
- Overabundance of Noisy Miners may be reduced by the presence of small trees and large shrubs;
- The grassy groundcover is providing fodder for Eastern Grey Kangaroos;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The site's native vegetation is in fair ecological condition – rating 'C' on the A–D scale of ecological condition devised by Lorimer *et al.* (1997). Parts of it approach rating 'B'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

Excluding the embankment of the dam wall, the Valley Grassy Forest easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The present author believes that most of it has a habitat score of 0.3 or above. Combining that assessment with the 'vulnerable' status of both the EVCs present, the vegetation would have a 'High' or 'Very High' conservation significance under the 'Native Vegetation Framework'. Standard criterion 3.2.3 then leads to a rating of **State** significance.

Under the same criterion, the Grassy Dry Forest only rates as Local significance because of its 'Least concern' conservation status.

Threatened plant species

Site 12 has an apparently viable population of Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

Site 12 also has an apparently viable population of the local form of *Rytidosperma monticola*. That species' range is not confined to Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Referring to the plant species discussed in the section above headed 'Significant plants', Candlebark and Red Stringybark are locally threatened and appear to have viable populations. Such populations meet standard criterion 3.1.5 for Local significance. Heath Wattle and Slender Rice-flower are so rare in Maroondah that even the small numbers of them at Site 12 might be regarded as 'important populations' within the municipality. If so, they meet standard criterion 3.1.5 for a site of Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Grassy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation will benefit the future residents of the two properties within Site 12.

The site supports the presence of birds, butterflies and other mobile fauna on the properties and in the neighbourhood generally. That is expected to benefit the health, wellbeing, childhood development and quality of life of future residents and the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there was an increase of 0.02 ha in the extent of habitat in the site's northeast corner through a combination of natural regeneration and growth of formerly immature trees.

Change in the species present

The loss of the Small-fruit Pondweed (also called Floating Pondweed), *Potamogeton cheesemanii*, may be due to displacement by waterlilies that have been planted in the dam and become quite extensive. The only other change in species around the dam is the arrival of dense patches of the Cumbungi species, *Typha domingensis* and *T. orientalis*.

Elsewhere within the site, the range of indigenous plant species increased between the flora surveys of 1996 and 2019, mainly attributable to the cessation of grazing by horses. The range of detected grass species increased markedly. Among the species detected in 2018 and not in 1996 are the locally threatened species, *Acacia brownii*, *Astroloma humifusum*, *Pimelea linifolia* and *Rytidosperma monticola/erianthum*. Conversely, the locally threatened *Centrolepis strigosa* and *Senecio minimus* were detected in 1996 and not in 2019, but those species are prone to disappear and reappear according to seasonal conditions.

Change in the ecological condition of habitat

Aerial photographs show a substantial increase in the average crown size of the site's eucalypts and wattles between 2001 and 2017. That represents an improvement in the suitability of the habitat for some forest birds and invertebrates. However, the improvement is somewhat countered by eucalypt deaths, most of which appear to have occurred during the Millennium Drought (between aerial photographs from 2001 and 2011).

The abovementioned increase in the numbers of indigenous plant species suggests an improvement in the conditions for environmentally sensitive species since 1996. However, the increase is not large enough to be reflected in the ecological condition ratings given above for 2018 and those of the 1996 flora survey.

Threats

The threats to Site 12's biodiversity identified in this study are:

- Possible further subdivision;
- Displacement of indigenous plants by introduced plants, particularly Sweet Pittosporum, Blackberry and Spanish Heath;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Recurrence of premature death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The zoning of Site 12 is Green Wedge A Zone. The whole site is affected by the Bushfire Management Overlay, Schedule 2 of the Significant Landscape Overlay and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. It is also covered by the Vegetation Protection Overlay (VPO), which extends further east to Wonga Road.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the original version of Site 12 and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in blue on the aerial photograph on p. 79.

Information sources

This assessment is based on the following sources of information about the site:

- A moderately thorough flora survey of the site on 17/3/18 specifically for this study. This work produced a list of indigenous and introduced flora for the dam and another such list for the rest of the site. It also assessed vegetation condition and mapped the locations of significant species;
- Fauna observations made incidentally during the abovementioned survey;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on a basic fauna survey and a flora survey of similar intensity and nature to the 2019 one except that it excluded abundance information and introduced species; and
- Aerial photographs taken in 1945, 2001, 2011 and 2017.

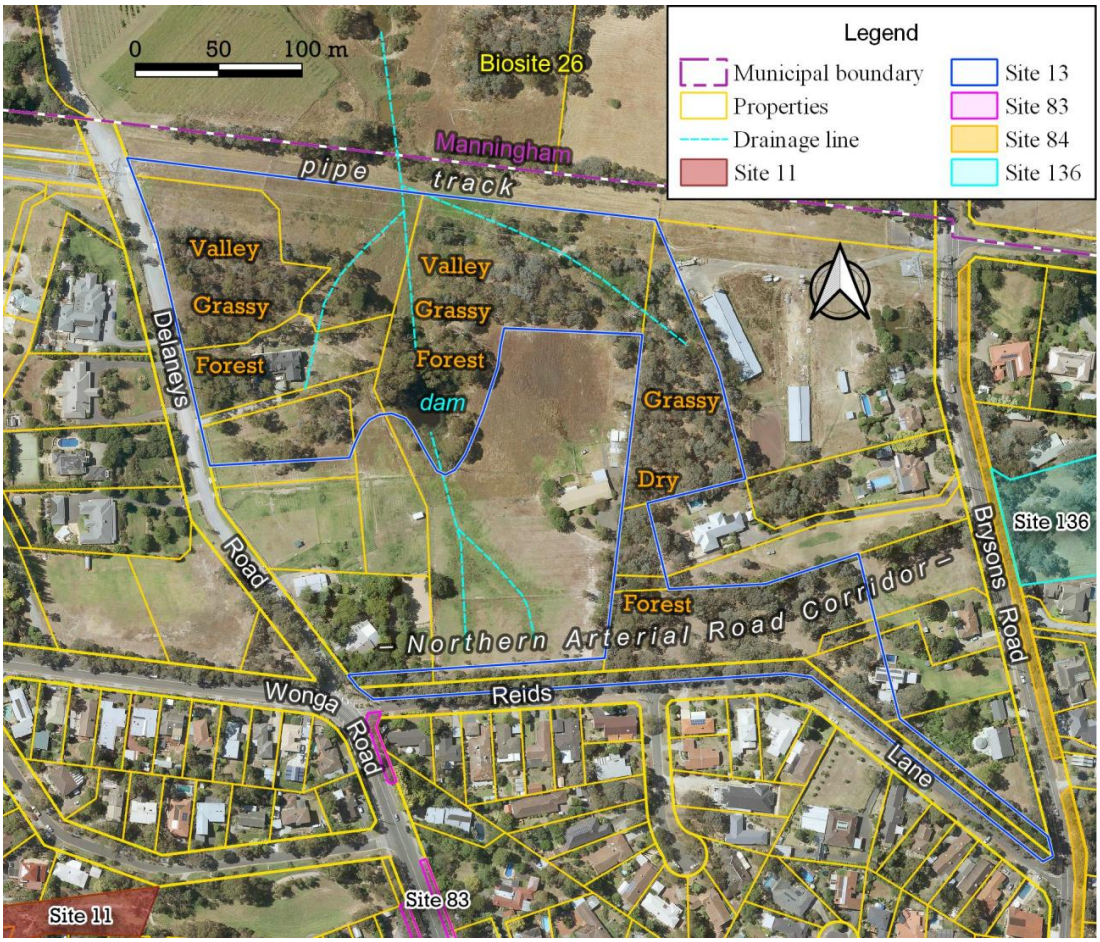
No useful information was found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Acknowledgement

Thanks to the Ross family for permitting the author to inspect 342 Wonga Road.

Site 13. Delaneys Rd – Reids Lane, Warranwood

Biological Significance Level: *Regional* due to the presence of a vulnerable vegetation type



Boundary, land use & tenure

The site is outlined in mid-blue above, overlaid on an aerial photograph taken in February 2017. It includes low-density residential land and the whole northern road verge of Reids Lane (a council road). The private land has a history of grazing but that is changing as it becomes subdivided for solely residential land use.

The proposed Northern Arterial Road would pass through the southern part of the site, as indicated on the aerial photograph.

The area of Site 13 adopted here is unchanged from the 1997 report, *'Sites of Biological Significance in Maroondah'*. However, the Vegetation Protection Overlay that arose from the 1997 report omits the Reids Lane verge, apparently due to a mapping error.

General description

Site 13 occupies 6.0 hectares. It is on undulating land dissected by the drainage lines marked on the aerial photograph above. The drainage lines have alluvial soil, with a strong tendency to become boggy where the drainage lines converge.

A farm dam of 0.14 ha, fringed with indigenous wetland plants, is located on the largest of the drainage lines. A highlight of the site is that around the dam is perhaps the best stand of Candlebark trees (*Eucalyptus rubida*) in Maroondah. There are roughly fifty, healthy individuals. That species probably falls into the 'critically endangered' category of risk of dying out in Maroondah. Candlebarks are also reliable indicators of the 'vulnerable'-listed vegetation type called Valley Grassy Forest, which covers most of the site's treed land.

Trees have been removed from along a substantial part of the drainage lines, leaving linear, seasonal wetlands with rushes and sedges. Where the drainage lines converge, there are Swamp Gums (*Eucalyptus ovata*), indicating a transition to another 'vulnerable'-listed vegetation type: Creekline Herb-rich Woodland.

Shrubs are severely depleted throughout the site but indigenous tree cover and/or grassy groundcover remain. The groundcover is sometimes not evident because of overgrazing, which affected an agistment property on the Northern Arterial Road alignment when it was inspected for this study (March 2019).

Perhaps the most natural part of the site is in the northeast, particularly on 22–24 Delaneys Road. All the Delaneys Road properties are the products of recent subdivision, so their habitat value is likely to decline.

Electricity transmission lines occupy a 21 m-wide band along the site's northern edge, with a Melbourne Water pipe track north of that. Drier parts of the strip beneath the transmission lines contain a range of indigenous grasses and some indigenous herbs.

Relationship to other land

Site 13 is part of a broader landscape that has highly fragmented habitat. Site 136 provides fragmented habitat used by kangaroos and presumably flying fauna to move between Site 13 and the Jumping Creek valley (Sites 14, 15 and 16). Species of flying fauna that are more tolerant of urban environments are likely to move between Site 13, Yanggai Barring Reserve (Site 11) and the revegetation along Wonga Road (Site 83).

Kangaroos, waterbirds and some other flying fauna are expected to move between Site 13 and Manningham City Council's 'Biosite 26' (Foreman 2004). Part of Biosite 26 due north of Site 13 is labelled on the aerial photograph on p. 86 and another part lies to the northwest, barely visible in the top-left corner of the aerial photograph.

Bioregion: Highlands - Southern Fall

Habitat types

The descriptions of vegetation below include only the more abundant or ecologically informative indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Grassy Dry Forest (EVC 22, 'Least concern' in the bioregion), all in poor ecological condition.

Canopy trees: Strongly dominated by Red Box (*Eucalyptus polyanthemos*). There are also small numbers of Red Stringybark (*E. macrorhyncha*) and Bundy (*E. goniocalyx*).

Lower trees: Sparse, represented by Cherry Ballart (*Exocarpos cupressiformis*) and Golden Wattle (*Acacia pycnantha*).

Medium to large shrubs: Very sparse, mainly represented by Sweet Bursaria (*Bursaria spinosa*).

Small shrubs: Almost absent, the only one detected being a Silky Daisy-bush (*Olearia myrsinoides*).

Ferns: None seen.

Climbers: None seen.

Creepers: Almost absent, the only species recorded being Purple Coral-pea (*Hardenbergia violacea*) and the wood-sorrel *Oxalis exilis/perennans*.

Grasses, rushes and sedges: The groundcover is dominated in some areas by Clustered Wallaby-grass (*Rytidosperma racemosum*) is dense where it has not been over-grazed or displaced by introduced pasture grass. Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Black-anther Flax-lily (*Dianella revoluta*) are fairly abundant.

Other groundcover: The moss, Common Hypnum (*Hypnum cupressiforme*) forms dense patches. Other groundcover species were almost absent when the site was visited on 20/3/18 due to drought and overgrazing but there may well be additional species under better conditions.

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion), in fair to poor ecological condition.

Canopy trees: Dominated by Candlebark (*Eucalyptus rubida*) or (along Reids Lane), Bundy (*E. goniocalyx*). Red Box (*Eucalyptus polyanthemos*) is fairly abundant but less so than the preceding species. Yellow Box (*E. melliodora*), Red Stringybark (*E. macrorhyncha*) and Narrow-leaved Peppermint (*E. radiata*) are scattered.

Lower trees: Sparse, mainly represented by Blackwood (*Acacia melanoxylon*).

Medium to large shrubs: Very sparse, mainly represented by Sweet Bursaria (*Bursaria spinosa*).

Small shrubs: None seen.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches but is quite localised.

Climbers: None seen.

Creepers: The following species are fairly abundant in the more natural areas: Bidgee-Widgee (*Acaena novae-zelandiae*), Kidney-weed (*Dichondra repens*), Crane's-bill (*Geranium* sp.) and the wood-sorrel *Oxalis exilis/perennans*. Purple Coral-pea (*Hardenbergia violacea*) is also present.

Grasses, rushes and sedges: Consistent with the history of grazing, Weeping Grass (*Microlaena stipoides*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) each dominate the groundcover in substantial areas. Other wallaby-grass species are also fairly abundant. Black-anther Flax-lily (*Dianella revoluta*) and Kangaroo Grass (*Themeda triandra*) are present in some areas. Common Bog-rush (*Schoenus apogon*) is abundant in wetter areas and probably widespread in wetter periods.

Other groundcover: Common Raspwort (*Gonocarpus tetragynus*) and Common St John's Wort (*Hypericum gramineum*) are fairly abundant. Spreading Crassula (*Crassula decumbens*) is abundant seasonally. Chocolate Lily (*Arthropodium strictum*) and Yellow Rush-lily (*Tricoryne elatior*) are scattered.

Artificial wetland (no EVC or conservation status applicable)

Trees and shrubs: Absent.

Amphibious species: Dominated by rushes (*Juncus* species). Swamp Club-rush (*Isolepis inundata*) was also abundant during a 1996 flora survey and it probably still is.

Aquatics: Dominated in different parts of the dam's fringe by Tall Spike-rush (*Eleocharis sphacelata*) and Cumbungi (*Typha* species).

Significant plants

Threatened throughout Victoria

The wallaby-grass, *Rytidosperma monticola*, is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. Site 13 is one of seven sites in Maroondah to support plants that are best regarded as an undocumented form of *R. monticola* with some characters tending toward the Hill Wallaby-grass (*R. erianthum*). This species was found by the author in each of his previous flora surveys of Site 13, in 1996, 2010 and 2015. It was not detected in March 2019 because of drought, the time of year and because one of the previous locations (near the bend in Reids Lane) was overgrazed.

Locally threatened

The following plant species recorded in Site 13 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – eleven were counted beside Reids Lane (in poor to fair health). Others may be present on private land, which was not accessible in 2019;

- *Eucalyptus rubida* (Candlebark) – approximately fifty grow around the dam and there are at least ten scattered elsewhere in the site, possibly the best stand in Maroondah;
- *Hypericum japonicum* (Matted St John's Wort) – a small patch was found in 1996, unable to be checked in this study;
- *Rumex brownii* (Slender Dock) – one plant was found in the 1996 flora survey, unable to be checked in this study; and
- *Stellaria flaccida* (Forest Starwort) - found in 1996, unable to be checked in this study.

Other

In addition, 22–24 Delaneys Road (next to the footpath) is one of only two locations in Maroondah where the author (or anyone else) has recorded the moss, *Didymodon torquatus*.

Fauna habitat

The dam:

- Supports waterbirds, frogs and aquatic invertebrates; and
- Provides a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat.

In the rest of the site:

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats and invertebrates;
- The grassy groundcover is providing fodder for Eastern Grey Kangaroos;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The site's native vegetation is in fair to poor ecological condition – ratings 'C' and 'D' on the A–D scale of ecological condition devised by Lorimer *et al.* (1997).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Regional (or possibly State)

Regionally threatened Ecological Vegetation Classes

The Valley Grassy Forest that lies to the west, northwest and near-north of the dam easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Much of the treeless vegetation under the transmission lines also qualifies. The present author calculated 'habitat scores' of 0.29 and 0.26 for those areas in 2010. Combining those scores with the 'vulnerable' status of Valley Grassy Forest, the vegetation would have a 'Medium' conservation significance under the 'Native Vegetation Framework'. Standard criterion 3.2.3 then leads to a rating of **Regional** significance.

It is possible that some of the Valley Grassy Forest that could not be seen well in this study has a habitat score of 0.3 or above (as suggested by the state government's map of modelled vegetation condition). In that case, the site's significance would rise to State under standard criterion 3.2.3.

Under the same criterion, the Grassy Dry Forest probably does not qualify as a 'patch' and therefore is not recognised as significant under standard criterion 3.2.3.

Threatened plant species

Referring to the plant species discussed in the section above headed 'Significant plants', Site 13 had an apparently viable population of the local form of *Rytidosperma monticola* until at least 2015. That species' range is not confined to Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **Regional** significance.

Candlebark and Red Stringybark are locally threatened and appear to have viable populations. Such populations meet standard criterion 3.1.5 for Local significance.

The site's overall 'Regional' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Grassy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the residents within and abutting Site 13.

The site supports the presence of kangaroos, birds, butterflies and other mobile fauna on the properties and in the neighbourhood generally. That is expected to benefit the health, wellbeing, childhood development and quality of life of future residents and the local community.

Changes

Change in the extent of habitat

0.1 ha was cleared for a house on 18 Delaneys Road in c. 2016. Otherwise, there has been no material change in the extent of habitat between 2019 and the 1996 study for *'Sites of Biological Significance in Maroondah'*.

Change in the species present

This study only inspected the site from public land, so only a very limited comparison can be made between present-day species and those recorded previously.

Several plant species that occurred on the Reids Lane verge are no longer present. They included several shrub species that have definitely died and several grass species that may well reappear when the current drought ends. Some of those species also grew on the adjacent horse agistment property (part of the Northern Arterial Road reservation) and may reappear if overgrazing ceases.

Change in the ecological condition of habitat

Aerial photographs show a substantial increase in the average crown size of the site's eucalypts between 2001 and 2017. That represents an improvement in the suitability of the habitat for some forest birds and invertebrates. Extensive blackberry control has also improved the habitat for some flora and fauna species.

However, the abovementioned decrease in the numbers of indigenous plant species along Reids Lane suggests a deterioration in the conditions for indigenous species since 1996.

Threats

The threats to Site 13's biodiversity identified in this study are:

- Construction of the Northern Arterial Road;
- Possible further residential subdivision;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Overgrazing, which is serious in part of the site at the time of writing;
- Continuing damage of indigenous plants by horses along the verge of Reids Lane, which appears to be used as a thoroughfare by horse riders;
- Displacement of indigenous plants by introduced plants, particularly Blackberry;
- Damage to soil, vegetation and consequently wildlife habitat by deer, which may well increase greatly in numbers from their present scarcity; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success.

Strategic planning

The zoning of Site 13 is Low Density Residential Zone. The whole site is affected by Schedule 4 of the Significant Landscape Overlay. The state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions apply except for the smallest property – 61 Brysons Road. The Vegetation Protection Overlay (VPO) applies except for the road verge of Reids Lane, which was apparently left out of the VPO due to a mapping error. The Bushfire Management Overlay affects 0.3 ha in the site's northwest corner.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the original version of Site 13 and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in blue on the aerial photograph on p. 86. The only change that would result in the area affected compared with the VPO is the correction of the abovementioned omission of the Reids Lane verge.

Information sources

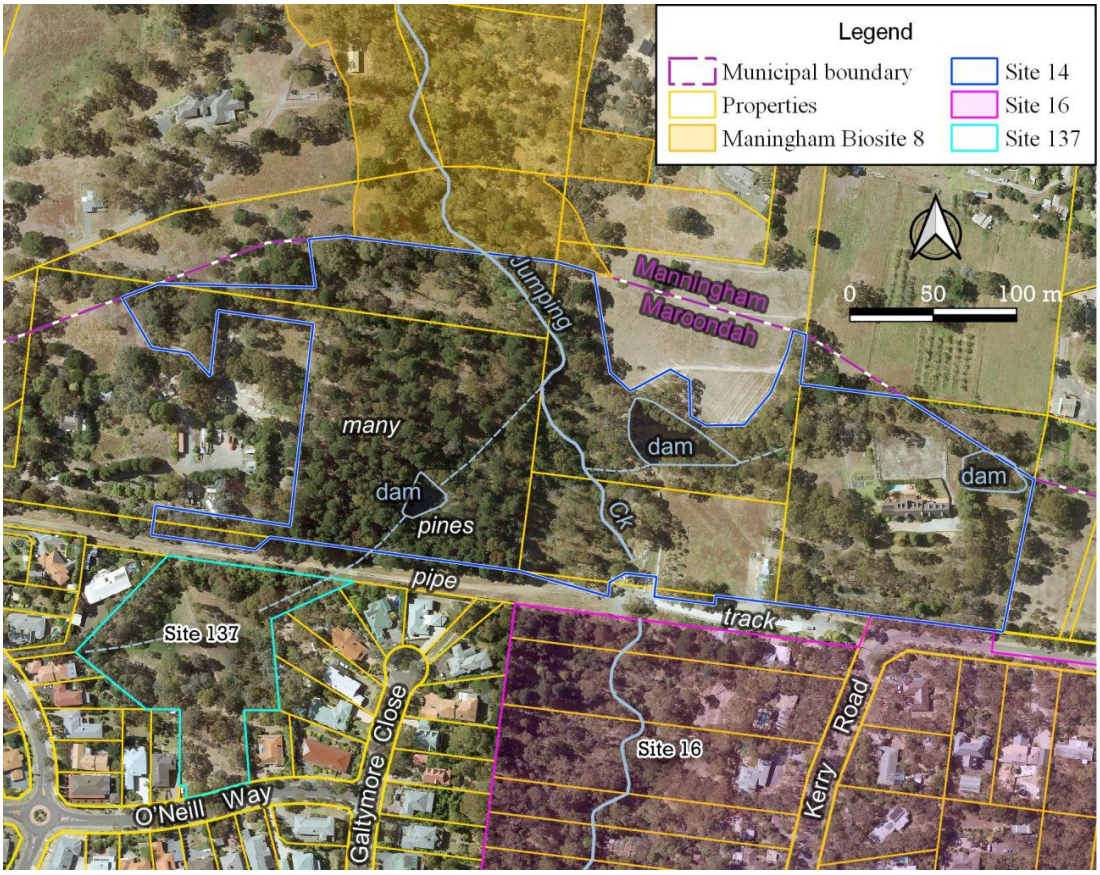
This assessment is based on the following sources of information about the site:

- Brief inspections of the site on 17/3/18 and 20/3/19, without entering the private land;
- A brief flora survey of the verge of Reids Lane by the author on 13/12/15, mainly in a (successful) attempt to find a rare type of wallaby-grass with characteristics that fall outside the range of any documented wallaby-grass species;
- Thorough vegetation surveys of 6–30 Delaneys Road in 2010 by the author and the firm, 'Tree Wishes', in regard to a planning permit application for the subdivision that created those lots;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on a flora survey of moderate intensity on 5/1/96 plus incidental bird observations; and
- Aerial photographs taken in 1945, 2001, 2011 and 2017.

No useful information was found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Site 14. Jumping Creek Valley, Warranwood / Croydon Hills

Biological Significance Level: *Local*



Boundary, land use & tenure

The site is outlined in mid-blue above, overlaid on an aerial photograph taken in February 2017. It includes land proposed for the Northern Arterial Road, whose centreline coincides with the municipal boundary. The site's southern edge mostly abuts a Melbourne Water pipe track and protrudes slightly into it. The majority of the site is semi-rural residential or grazing land.

The area of Site 14 adopted here differs from the 1997 report, *'Sites of Biological Significance in Maroondah'* due to destruction of native vegetation along the pipe track, development of vegetation along the arterial road alignment and an intention to better protect the Jumping Creek corridor (in harmony with Manningham City Council's adjacent 'Biosite 8').

General description

Site 14 occupies 6.9 hectares on moderately steep terrain. The aerial photograph above shows Jumping Creek flowing northward through the middle of the site and two non-perennial tributaries (dashed light blue lines) with dams on them. The eastern tributary has been filled in between the central and eastern dams. The channel of Jumping Creek provides habitat for aquatic invertebrates, fish, wetland plants and possibly Platypus and Rakali (or Water Rat). The dams provide habitat for waterbirds, frogs, pondlife and

wetland plants. The riparian (streamside) vegetation provides habitat for Black Wallaby and many forest birds.

The western property in the site (33 Gibson Road) contains Valley Grassy Forest that has become substantially modified by pines. When the author surveyed Site 14 in 1996, the pines were mostly immature. Now, they dominate the vegetation and have displaced much of the indigenous vegetation. The same was happening on the western half of the abutting property south of the central dam (63 Kerry Road) until the pines were cleared in c. 2017. Substantial natural regeneration has followed the pine removal. This indicates that the native vegetation has the capacity to recover on the western property, too. Such a recovery would be beneficial to the ecological function and value of the Jumping Creek habitat corridor.

The part of that corridor that lies in Manningham is recognised by Foreman (2004) as 'Biosite 8', which is covered by an Environmental Significance Overlay in the Manningham Planning Scheme. The original (1997) version of Site 14 did not extend as far north as what was to become Biosite 8 due to sparsity of native vegetation. The vegetation in the gap has grown substantially since 1997, so the new version of Site 14 extends to meet Biosite 8.

The property that includes the central dam (37 Gatters Road) has a good cover of the eucalypts of Valley Grassy Forest. The amount of native understorey could not be discerned in this study, which was limited to observation from the pipe track.

The eastern property, too (65 Kerry Road), has a good cover of the eucalypts of Valley Grassy Forest over most of the property. Among the eucalypts are substantial numbers of Candlebark (*Eucalyptus rubida*) and Red Stringybark (*E. macrorhyncha*), both of which fall into the 'critically endangered' category of risk of dying out in Maroondah.

Relationship to other land

Site 14 has ecological connections unsurpassed in Maroondah. There is a scarcely-broken eucalypt canopy extending south 1.4 km (via Warranwood Reserve and Narr-Maen Reserve) and north along Jumping Creek to the Yarra River and far beyond. Most sections of those routes have native understorey as well as tree cover. Black Wallabies can be observed moving up and down Jumping Creek. Fish are very likely to move along the creek, as almost all local native fish species must move between freshwater and the sea to complete their lifecycle. Platypus and Rakali (or Water Rat) may also move along the creek, at least in the case of dispersing young animals seeking a territory for themselves.

Many species of forest birds and flying insects are expected to move along such a stream corridor, taking into account the discussion in Section 7.9 of Volume 1. Peron's Tree Frog must have moved through this site in order to have expanded its range from the Yarra River corridor to Site 16. That raises the distinct possibility that other frog species may also move along the valley.

Kangaroos are also regularly present in Site 14, attributable to the abundance of good grazing country in the farmland to the northwest and northeast.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion), in fair to poor ecological condition.

- Canopy trees: Dominated by Bundy (*E. goniocalyx*), Yellow Box (*E. melliodora*), Candlebark (*Eucalyptus rubida*), Red Box (*Eucalyptus polyanthemos*) and Red Stringybark (*E. macrorhyncha*). Messmate Stringybark (*E. obliqua*) is scarce.
- Lower trees: Sparse: Black Wattle (*Acacia mearnsii*), Lightwood (*A. implexa*), Blackwood (*A. melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*).

Medium to large shrubs: Common Cassinia (*Cassinia aculeata*), Prickly Currant-bush (*Coprosma quadrifida*), Yarra Burgan (*Kunzea leptospermoides*), Tree Everlasting (*Ozothamnus ferrugineus*) and Austral Dusty Miller (*Spyridium parvifolium*).

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*), Common Heath (*Epacris impressa*), Hop Goodenia (*Goodenia ovata*) and Common Flat-pea (*Platylobium obtusangulum*).

Ferns: Austral Bracken (*Pteridium esculentum*) and Common Maidenhair (*Adiantum aethiopicum*).

Climbers: Mountain Clematis (*Clematis aristata*).

Scrambler: Small-leaf Bramble (*Rubus parvifolius*).

Creepers: Bidgee-Widgee (*Acaena novae-zelandiae*), Stinking Pennywort (*Hydrocotyle laxiflora*), Ivy-leafed Violet (*Viola hederacea*) and the wood-sorrel, *Oxalis exilis/perennans*.

Grasses, rushes and sedges: 15 Grasses, rushes and sedges were recorded in 1996, including Variable Sword-sedge (*Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis*), Spiny-headed Mat-rush (*L. longifolia*), Weeping Grass (*Microlaena stipoides*), Sword Tussock-grass (*Poa ensiformis*) , Slender Tussock-grass (*Poa tenera*), Red-anther Wallaby-grass (*Rytidosperma pallidum*), Slender Wallaby-grass (*R. pilosum*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (*Gonocarpus tetragynus*), Common Rice-flower (*Pimelea humilis*).

Riparian Forest (EVC 18, 'Least concern' in the bioregion) along the floodplain of Jumping Creek, in fair to poor condition.

Canopy trees: Dominated by Swamp Gum (*Eucalyptus ovata*) with fewer Yellow Box (*E. melliodora*) and Messmate Stringybark (*E. obliqua*). Manna Gum (*E. viminalis*) is scarce within the site but dominant immediately upstream (south) of the pipe track.

Lower trees: Black Wattle (*Acacia mearnsii*) and Blackwood (*Acacia melanoxylon*).

Medium to large shrubs: Prickly Moses (*Acacia verticillata*), Sweet Bursaria (*Bursaria spinosa*), Yarra Burgan (*Kunzea leptospermoides*) and Shrubby Fireweed (*Senecio minimus*).

Small shrubs: Hop Goodenia (*Goodenia ovata*).

Climbers: Mountain Clematis (*Clematis aristata*).

Grasses, rushes and sedges: Spiny-headed Mat-rush (*L. longifolia*), Weeping Grass (*Microlaena stipoides*), Sword Tussock-grass (*Poa ensiformis*), Slender Tussock-grass (*Poa tenera*) and Slender Wallaby-grass (*R. pilosum*).

Stream channel (no EVC or conservation status have been assigned by the Victorian Government)

Trees and shrubs: Absent.

Amphibious species: Slender Knotweed (*Persicaria decipiens*), Water Pepper (*P. hydropiper*), Angled Lobelia (*Lobelia anceps*), Green Rush (*Juncus gregiflorus*) and Broom Rush (*J. sarophorus*).

Artificial wetland (no EVC or conservation status applicable) – the dams

Trees and shrubs: Absent.

Amphibious species: Water Plantain (*Alisma plantago-aquatica*), Tall Sedge (*Carex appressa*), Austral Brooklime (*Gratiola peruviana*), Glandular Brooklime (*G. pubescens*), club-rushes (*Isolepis* species), rushes (*Juncus* species) Angled Lobelia (*Lobelia anceps*), Lesser Loosestrife (*Lythrum hyssopifolia*) and Slender Knotweed (*Persicaria decipiens*).

Aquatics: Cumbungi (*Typha orientalis*).

Significant plants

The following additional plant species recorded in Site 13 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – one plant was seen in 2019 just inside 65 Kerry Road;
- *Eucalyptus macrorhyncha* (Red Stringybark) – dozens were seen in 2019, in good or fair health. Others may well exist out of sight from public land;

- *Eucalyptus rubida* (Candlebark) – at least ten were seen in 2019, in good health. Others may well exist out of sight from public land;
- *Gratiola peruviana* (Austral Brooklime) and *Gratiola pubescens* (Glandular Brooklime) – growing together at the western dam (on 33 Gibson Road) in 1996, unable to be checked in this study;
- *Poa tenera* (Slender Tussock-grass) – recorded in 1996 as occurring in the Riparian Forest and the Valley Grassy Forest, unable to be checked in this study; and
- *Senecio minimus* (Shrubby Fireweed) - found within the Riparian Forest in 1996, unable to be checked in this study.

Significant Fauna

The Black Wallaby and Echidna have been recorded within the site.

A dog was bitten by a snake in March 2019. The snake is unidentified but all snake species are rare in Maroondah.

Koalas are rarely seen in Warranwood, the most recent sighting known by the author being 2009. When Koalas do visit, they almost certainly arrive via Site 14, as any other route would involve long distances without trees.

Fauna habitat

The water and stream channel of Jumping Creek provide habitat for fish, aquatic invertebrates, waterbirds and possibly Platypus or Rakali. The fertility of the valley favours high production of carbohydrates by plants and hence strengthens the base of the food chain that includes forest invertebrates, birds, bats and other arboreal animals (possibly including Koalas).

The dams:

- Support waterbirds, frogs and aquatic invertebrates, and the frogs provide food for snakes; and
- Provide a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat.

In the rest of the site:

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats and invertebrates;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1); and
- The pines may provide pine nuts for Yellow-tailed Black-Cockatoos but they are also making the habitat unsuitable for many other native fauna species that would otherwise be present.

Ecological condition

The site's native vegetation is in fair to poor ecological condition – ratings 'C' and 'D' on the A–D scale of ecological condition devised by Lorimer *et al.* (1997).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Regionally threatened Ecological Vegetation Classes

The Valley Grassy Forest visible from the pipe track and Kerry Road does not seem to meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. If that impression is correct, standard criterion 3.2.3 does not apply to that vegetation. It is unclear whether there is a 'patch' of Valley Grassy Forest that could not be seen for this study. If there is, its 'habitat score' would probably be less than 0.3. Standard criterion 3.2.3 would then give the site a rating of Regional significance (given the 'vulnerable' status of Valley Grassy Forest).

The Riparian Forest does appear to qualify as a 'patch', particularly in recognition that it extends into Manningham. The author estimates that the habitat score is below 0.6. Combining those assessments with the 'Least concern' rating of Riparian Forest leads to a **Local** rating for the site.

Locally threatened plant species

Referring to the plant species discussed in the section above headed 'Significant plants', Candlebark and Red Stringybark are locally threatened and appear to have quite viable populations. Such populations meet standard criterion 3.1.5 for **Local** significance. The other species in the 'Significant plants' section would also represent Local significance if viable or important populations were to be confirmed in a more detailed flora survey than was possible for this report.

Ecological corridor

Site 14 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords **Local** significance to such a site.

However, the effectiveness of the Jumping Creek habitat corridor is impaired in part of the site by dense pines and in other parts by incomplete forest regeneration following clearing. Those impairments can be overcome and there may be opportunities to do so, e.g. under conditions to planning permits that may be issued in future. This situation fits the following description from standard criterion 1.3.3: 'Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor… Site (or one of a group of such sites) to form a strategic corridor of local importance and scale'. That description applies to a site of **Local** significance.

The 'Local' rating is equivalent to the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997), allowing for differences in terminology.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the residents within and abutting Site 14. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside Jumping Creek and the non-perennial tributaries helps to reduce erosion and remove a small amount of water pollution.

The site supports the presence of wallabies, birds, butterflies and other mobile fauna on the properties and in the neighbourhood generally. That is expected to benefit the health, wellbeing, childhood development and quality of life of the local community.

The site's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and

riparian habitats. Consequently, almost all the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Aerial photographs from 2001 and 2017 indicate that approximately 0.1 ha of native vegetation has been lost within the total area covered by this version of Site 14 or its 1997 precursor. That amount comprised approximately 0.06 ha on the pipe track and 0.04 ha on 65 Kerry Road. That loss has been approximately balanced by the growth of eucalypt crowns that now spread into land that was previously introduced grass. In aggregate, there has been no significant change in the total extent of habitat.

Change in the species present

This study only inspected the site from public land, so only a very limited comparison can be made between present-day species and those recorded previously.

In 1996, the pipe track supported 26 indigenous plant species, from grasses and herbs to eucalypts. Only two of them could be found in March 2019, although a few of the grasses may reappear when the drought breaks. Six of the lost species were not recorded on parts of the site other than the pipe track, so it is quite possible that they have been lost to the site altogether.

Because pines have become so dominant on 33 Gibson Rd, it is very likely that plant species have disappeared there. Twelve species were not recorded elsewhere within the site in 1997 and most of those are sensitive to out-competition by mature pines.

In 2019, there is a dense patch of Water Pepper (*Persicaria hydropiper*) in the channel of Jumping Creek. It was not present in 1997 but, as an annual, its population and distribution is subject to fluctuations from year to year. It is uncertain whether Water Pepper is native to Victoria.

Change in the ecological condition of habitat

Aerial photographs show a substantial increase in the average crown size of the site's eucalypts between 2001 and 2017. That represents an improvement in the suitability of the habitat for some forest birds and invertebrates. However, that improvement is greatly outweighed by the deterioration that has occurred from the growth of pines in the western half of the site.

The 1997 *'Sites of Biological Significance in Maroondah'* report stated that 2 ha of 33 Gibsons Road was in good ecological condition (rating 'B'). Even without having access to that property, it seems unlikely that pines have left much of it (if any) in better than fair condition (rating 'C') in 2019. The whole of the Riparian Forest was rated 'B' in 1997 and it, too, seems unlikely to exceed 'C' in 2019.

Water testing of Jumping Creek at Brysons Road and Merrill Crescent by volunteers in the Waterwatch program has shown no trends in water quality between 2007 and 2017.

Without accessing the private land, it is not possible to provided more detailed information about changes in the condition of the site's habitat.

Threats

The threats to Site 14's biodiversity identified in this study are (in approximately decreasing order of seriousness):

- Further growth and proliferation of pines;
- Displacement of indigenous plants by other introduced plants such as Sweet Pittosporum and Blackberry;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;

- Loss of native vegetation of the floodplain due to creek erosion and the consequent lowering of the water table, which is in turn due to pulsed flows associated with runoff from the urbanised catchment;
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and possibly further urbanisation of the catchment;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success.
- Possible future subdivision;
- Damage to soil, vegetation and consequently wildlife habitat by deer, which may well increase greatly in numbers from their present scarcity;
- Construction of the Northern Arterial Road.

Strategic planning

The zoning of Site 14 is 'Green Wedge A Zone' except for the small protrusions into the pipe track land, which are zoned 'Public Use Zone – Service and Utility'. The whole site is affected by the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions as well as the Bushfire Management Overlay and Schedule 1 of the Significant Landscape Overlay. The Vegetation Protection Overlay (VPO) applies to most of the site and extends into some areas that have been excluded here.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the original version of Site 14 and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in blue on the aerial photograph on p. 92. Two parts of the site without any existing habitat are included so that any future development or subdivision will take into account: (a) indirect impacts on habitat (particularly watercourses); and (b) the benefits of compensating those impacts by improving the Jumping Creek habitat corridor.

Information sources

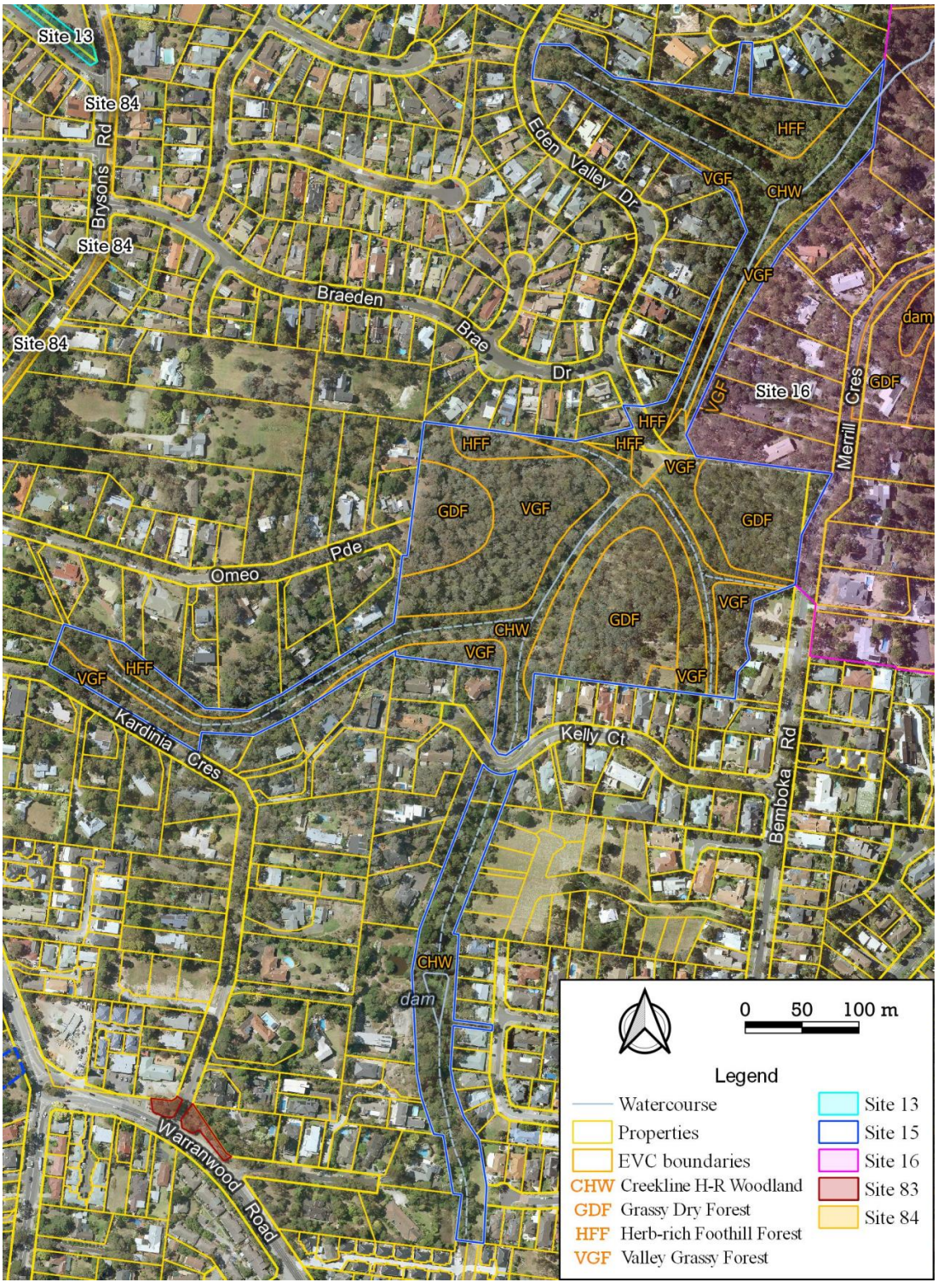
This assessment is based on the following sources of information about the site:

- Brief inspections of the site on 28/1/18 and 20/3/19, without entering the private land;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on an intensive flora survey (divided into five parts of the site) on 5/1/96 plus incidental fauna observations;
- A plant list by Zoe Jellie for an unstated area near where the pipe track crosses Jumping Creek. The list is stored in the Victorian Biodiversity Atlas (list T0818600);
- A 1988 bird list by Steve Rowe stated to be from 'Jumping Creek' but mapped in the Victorian Biodiversity Atlas in O'Neill Way Reserve (Site 137), so presumed to be from near where the pipe track crosses Jumping Creek;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- Melbourne Water Waterwatch data for the Jumping Creek subcatchment; and
- Aerial photographs taken in 1945, 2001, 2011 and 2017, and a satellite image from 2019.

No additional useful information was found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird. The state government's vegetation mapping is inaccurate in regard to both the location of native vegetation and the Ecological Vegetation Classes. Grassy Dry Forest is shown as occupying a substantial area in the southeast of the site but there are significant numbers of Candlebark and Yellow Box right through to the southeastern corner, indicating Valley Grassy Forest.

Site 15. Warranwood Reserve

Biological Significance Level: *State* due to threatened vegetation types and a rare wattle



Boundary

The image on the previous page shows an aerial photograph from February 2017 overlaid with relevant boundaries. The site boundary mostly follows property boundaries, the exceptions being the inclusion of small sections of road reserves and the omission beside Bemboka Road of a kindergarten, car park, playground, picnic shelter and adjacent lawn.

General description

Warranwood Reserve is a council reserve managed principally for nature conservation, nature appreciation and drainage purposes. Footpaths provide access for passive recreation and thoroughfare for pedestrians and (in some cases) horse riders. The abutting Kurboroo Kindergarten uses the reserve for 'bush play' and other activities. There is also a bridle trail, used by only two horses, infrequently.

The reserve has expanded over the decades by the addition of drainage reserves along creeks. Here, the reserve is taken to include the drainage reserve to the south of Kelly Court, which forms the southern 'arm' of the site. The total area is 12.4 ha.

Warranwood Reserve's terrain is hilly, dissected by 2 km of minor creeks. The soil on the hills is stony and the soil along the creeks is alluvium. The creeks originate in the surrounding residential land. They drain towards the reserve's northeast corner before joining Jumping Creek (or Narr-Maen Creek) approximately 100 m northeast of the reserve.

The creeks and their floodplains provide habitat for rare flora and fauna, whose numbers are decreasing over the years. The creeks also serve an important function in draining stormwater. All of them have been excavated for installation of pipes, and a retarding basin has been built at the end of Eden Valley Rd (where a farm dam had been). A farm dam remains in the middle of the reserve's southern 'arm'. Other farm dams were once located in the reserve's western and northwestern extremities before being converted to shallow wetlands. Most of the creeks are eroding and rockwork has been used to stabilise some of them. There has been extensive planting of indigenous (and sometimes non-indigenous) species along most of the creeks.

Even 100 years ago, the whole district had been largely cleared at least once. A 1945 aerial photograph shows a berry orchard in the southeast corner of what was to become the reserve's central rectangle – from the current-day kindergarten to the main north-flowing creek. Furrows from the orchard remain today, having regenerated with native grass and wildflowers. The rest of the land was sparsely treed in 1945, suggesting grazing. One exceptionally large Red Box (*Eucalyptus polyanthemos*) appears to have escaped clearing in the 20th Century, leading to its protection under the Heritage Overlay of the Maroondah Planning Scheme.

Altogether, 180 naturally-occurring, indigenous plant species were observed in Warranwood Reserve during this study.

The reserve's western arm was reserved for drainage in the 1950s (or thereabouts). The reserve's central rectangle (abutting Bemboka Road) was reserved in 1975. The rest was reserved in the late 1980s and 1990s. There has been a general increase in the effort to conserve and improve the reserve's natural assets, except along the creek south of Kelly Court.

There is an active Special Committee of Council (formerly the Committee of Management) which focuses mostly on maintaining and restoring the native vegetation. Maroondah City Council and some bushland contractors do the rest of the work to maintain the bushland. However, the arm south of Kelly Court has not been treated as part of Warranwood Reserve and has received much less management effort. It has become rather weedy, particularly due to dense Arum Lily (*Zantedeschia aethiopica*).

Relationship to other land

Most of the reserve's indigenous vertebrate fauna, and particularly the birds and fish, could not fulfil all their habitat needs entirely within Warranwood Reserve. They must therefore rely on connected areas of habitat.

The most important adjoining habitat is the 34 ha of Site 16 – the Warranwood Environmental Living Precinct. Site 16 is then connected to Sites 17–21 and also via the Jumping Creek habitat corridor in Wonga Park to the Yarra River and Warrandyte State Park. This continuity of habitat facilitates circulation of mobile fauna such as wallabies, echidnas, birds, bats and flying insects. The reserve's main north-flowing creek can be presumed to provide a wildlife corridor, based on the considerations of Section 7.9 of Volume 1 and this study's detection of Black Wallaby well south of Kelly Court. However, Warranwood Reserve is to some extent a terminus rather than a thoroughfare because there are only weak habitat links other than via Site 16.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) recommends that Warranwood Reserve's southern arm (south of Kelly Court) be given 'very high priority' for improving the ecological connections to Plymouth Road and the headwaters of Mullum Mullum Creek.

The movements of birds and insects through the landscape is important not only for the needs of the animals but also for the pollen and seeds that the animals may disperse as they go. Wallabies may also disperse seeds.

Wildlife attracted to the reserve also radiate (to varying degrees) into neighbouring residential land, at least for exploration of potential habitat. The presence of that wildlife in the neighbourhood greatly enhances the area's natural ambience, e.g. through birdsong. This no doubt benefits residents.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Grassy Dry Forest (EVC 22, 'Least concern' in the bioregion). 109 naturally-occurring, indigenous plant species were recorded in this study.

Canopy trees: Strongly dominated by Red Box (*Eucalyptus polyanthemos*). Bundy (*E. goniocalyx*) is moderately abundant. Red Stringybark (*E. macrorhyncha*) is scarce. Yellow Box (*E. melliodora*) is also scarce and may be regarded as an outlier from the adjacent Valley Grassy Forest.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Black Wattle (*Acacia mearnsii*) and Golden Wattle (*Acacia pycnantha*) are fairly abundant.

Medium to large shrubs: Patchy, sparse to dense, variously dominated by Hedge Wattle (*Acacia paradoxa*), Yarra Burgan (*Kunzea leptospermoides*) or Common Cassinia (*Cassinia aculeata*). The following species are fairly abundant: Dandenong Range Cinnamon Wattle (*Acacia stictophylla*), Sweet Bursaria (*Bursaria spinosa*), Shiny Cassinia (*Cassinia longifolia*) and Common Correa (*Correa reflexa*).

Small shrubs: Not dense, represented mostly by Grey Parrot-pea (*Dillwynia cinerascens*), Common Heath (*Epacris impressa*), Silky Daisy-bush (*Olearia myrsinoides*), Common Flat-pea (*Platylobium obtusangulum*) and Rough Fireweed (*Senecio hispidulus*). Stony Fireweed (*Senecio phelleus*) is notably present.

Ferns: Absent.

Climbers: Moderately abundant, represented mostly by Common Apple-berry (*Billardiera scandens*), Coarse Dodder-laurel (*Cassytha melantha*) Downy Dodder-laurel (*C. pubescens*), Mountain Clematis (*Clematis aristata*) and Small-leafed Clematis (*C. decipiens*). Love Creeper (*Comesperma volubile*) is scarce.

Creepers: Fairly abundant, the most abundant species being Thin-leaf Wattle (*Acacia aculeatissima*), Cranberry Heath (*Astroloma humifusum*), Kidney-weed (*Dichondra repens*), Purple Coral-pea (*Hardenbergia violacea*), Trailing Speedwell (*Veronica plebeia*), Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel *Oxalis exilis / perennans*.

Grasses, rushes and sedges: Abundant but with substantial inter-tussock spaces. Rich in species, the dominant ones being (variously) Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*) and Clustered Wallaby-grass (*Rytidosperma racemosum*). The next most

abundant group of species comprises Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Weeping Grass (*Microlaena stipoides*), Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*), Red-anther Wallaby-grass (*Rytidosperma pallidum*), Velvet Wallaby-grass (*R. pilosum*) and Kangaroo Grass (*Themeda triandra*).

Other groundcover: The mosses *Hypnum cupressiforme* and *Thuidiopsis furfurosa* dominate the groundcover. Chocolate Lily (*Arthropodium strictum*) and Small Poranthera (*Poranthera microphylla*) are abundant in season. Other conspicuous species include Sheep's Burr (*Acaena echinata*), Honeypots (*Acrotriche serrulata*), Blue Pincushion (*Brunonia australis*), Clustered Everlasting (*Chrysocephalum semipapposum*), Pale Flax-lily (*Dianella longifolia* var. *longifolia*), Black-anther Flax-lily (*D. revoluta*), Rosy Hyacinth-orchid (*Dipodium roseum*), Common Raspwort (*Gonocarpus tetragynus*), Common Hovea (*Hovea heterophylla*), Small StJohn's Wort (*Hypericum gramineum*), Common Rice-flower (*Pimelea humilis*) and Yellow Rush-lily (*Tricoryne elatior*).

Herb-rich Foothill Forest (EVC 23, 'Least concern' in the bioregion). 45 naturally-occurring, indigenous plant species were recorded in this study.

Canopy trees: The distinguishing feature of this EVC in the reserve is that it contains Messmate Stringybark (*Eucalyptus obliqua*), which forms a substantial component of the canopy (but reducing over the decades). The dominant eucalypt is Red Box (*E. polyanthemos*). Narrow-leaved Peppermint (*E. radiata*) is of comparable density to the Messmate Stringybark. Other eucalypts are scarce.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*), with Cherry Ballart (*Exocarpos cupressiformis*) less abundant and Black Wattle (*Acacia mearnsii*) is scarce.

Medium to large shrubs: Moderately dense, dominated by Sweet Bursaria (*Bursaria spinosa*) and Prickly Currant-bush (*Coprosma quadrifida*). The following species are fairly abundant: Prickly Moses (*Acacia verticillata*), Common Cassinia (*Cassinia aculeata*), Hop Goodenia (*Goodenia ovata*), Yarra Burgan (*Kunzea leptospermoides*), Snowy Daisy-bush (*Olearia lirata*) and Victorian Christmas-bush (*Prostanthera lasianthos*).

Small shrubs: Very sparse, restricted to scattered Rough Fireweed (*Senecio hispidulus*) and just two plants of Silky Daisy-bush (*Olearia myrsinoides*).

Ferns: Austral Bracken (*Pteridium esculentum*) is abundant and Common Maidenhair (*Adiantum aethiopicum*) is moderately abundant.

Climbers: Fairly abundant, particularly Mountain Clematis (*Clematis aristata*). The other species are Coarse Dodder-laurel (*Cassytha melantha*), Small-leafed Clematis (*C. decipiens*) and Twining Glycine (*Glycine clandestina*).

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is scarce.

Creepers: Kidney-weed (*Dichondra repens*) is abundant. Bidgee-widgee (*Acaena novae-zelandiae*), Trailing Speedwell (*Veronica plebeia*) and the wood-sorrel *Oxalis exilis / perennans* are common.

Grasses, rushes and sedges: Rather depauperate in species, attributable to mowing and the influences of abutting residences. Weeping Grass (*Microlaena stipoides*) dominates. The following species are fairly abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Variable Sword-sedge (*Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) Slender Wallaby-grass (*Rytidosperma penicillatum*) and Clustered Wallaby-grass (*R. racemosum*).

Other groundcover: Paper Moss (*Ptychomnion aciculare*) is abundant. Indigenous herbs are scarce, represented only by Pale Flax-lily (*Dianella longifolia* var. *longifolia*), Small Poranthera (*Poranthera microphylla*) and a few Sprawling Bluebell (*Wahlenbergia gracilis*).

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion). 104 naturally-occurring, indigenous plant species were recorded in this study.

Canopy trees: Dominated by Red Box (*Eucalyptus polyanthemos*). Bundy (*E. goniocalyx*), Red Stringybark (*E. macrorhyncha*), Yellow Box (*E. melliodora*), Narrow-leaved Peppermint (*E. radiata*) and Candlebark (*E. rubida*) are also present, along with some Swamp Gums (*E. ovata*) as outliers from the adjacent Creekline Herb-rich Woodland.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*), with smaller numbers of Blackwood (*Acacia melanoxylon*). Black Wattle (*Acacia mearnsii*) is scarce.

Medium to large shrubs: Moderately dense, variously dominated by Prickly Moses (*Acacia verticillata*), Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*) or Victorian Christmas-bush (*Prostanthera lasianthos*). The following species are fairly abundant: Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*) and Yarra Burgan (*Kunzea leptospermoides*).

Small shrubs: Sparse, the only abundant species being the fireweeds *Senecio glomeratus* and *S. hispidulus*.

Ferns: Austral Bracken (*Pteridium esculentum*) forms extensive, dense patches. Common Maidenhair (*Adiantum aethiopicum*) and Common Ground-fern (*Calochlaena dubia*) are also present, mostly over a south-facing slope.

Climbers: Fairly abundant, particularly Mountain Clematis (*Clematis aristata*). The other main species are Common Apple-berry (*Billardiera scandens*), Coarse Dodder-laurel (*Cassytha melantha*), Small-leafed Clematis (*C. decipiens*) and Twining Glycine (*Glycine clandestina*).

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is fairly abundant – a good indicator of the EVC.

Creepers: Kidney-weed (*Dichondra repens*) is abundant. Bidgee-widgee (*Acaena novae-zelandiae*), Trailing Speedwell (*Veronica plebeia*), Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel *Oxalis exilis / perennans* are common. Other creepers are scarce.

Grasses, rushes and sedges: Abundant and dense, dominated by Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or Weeping Grass (*Microlaena stipoides*). The next most abundant species are Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*) and Clustered Wallaby-grass (*Rytidosperma racemosum*). The following species are fairly abundant and good indicators of Valley Grassy Forest: Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Soft Tussock-grass (*Poa morrisii*) and Slender Wallaby-grass (*Rytidosperma penicillatum*).

Other groundcover: Moss is dense, particularly Paper Moss (*Ptychomnion aciculare*). Small Poranthera (*Poranthera microphylla*) is abundant in season. The lilies, Chocolate Lily (*Arthropodium strictum*), Bulbine Lily (*Bulbine bulbosa*), Pale Flax-lily (*Dianella longifolia* var. *longifolia*), Black-anther Flax-lily (*D. revoluta*) and Yellow Rush-lily (*Tricoryne elatior*) are fairly abundant, as are Honeypots (*Acrotriche serrulata*), Common Raspwort (*Gonocarpus tetragynus*), Common Hovea (*Hovea heterophylla*) and Native Flax (*Linum marginale*).

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the bioregion). 75 naturally-occurring, indigenous species were recorded in this study.

The creeks and drainage lines in the reserve have been so modified by pipelaying, dams, drainage works, stabilisation works and planting that it has become very hard to decide whether to classify the vegetation as Creekline Herb-rich Woodland or Swampy Riparian Complex. The former has been chosen here whereas the latter has been chosen in the state government's vegetation mapping. Swampy Riparian Complex is an ill-defined amalgam of vegetation types and intermediates (Oates and Taranto 2001). It is classified as Endangered in the bioregion.

The following description includes the creek channels.

Canopy trees: Swamp Gum (*Eucalyptus ovata*).

Lower trees: Blackwood (*Acacia melanoxylon*) and Black Wattle (*Acacia mearnsii*) dominate. Cherry Ballart (*Exocarpos cupressiformis*) and Swamp Paperbark (*Melaleuca ericifolia*) are also moderately abundant. Silver Wattle (*A. dealbata*) and Lightwood (*A. implexa*) are scarce.

Shrubs: Dominated by Prickly Currant-bush (*Coprosma quadrifida*) and Hop Goodenia (*Goodenia ovata*). Shrubby Fireweed (*Senecio minimus*) is abundant. The following species are moderately abundant: Prickly Moses (*Acacia verticillata*), Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*), Yarra Burgan (*Kunzea leptospermoides*), Victorian Christmas-bush (*Prostanthera lasianthos*) and Rough Fireweed (*Senecio hispidulus*). Although less abundant, Tree Everlasting (*Ozothamnus ferrugineus*) is a good environmental indicator.

Ferns: Rich in species (as is characteristic of Creekline Herb-rich Woodland), though less abundant than in decades past. Austral Bracken (*Pteridium esculentum*) forms extensive, dense patches. The following species are moderately abundant: Common Maidenhair (*Adiantum aethiopicum*), Common Ground-fern (*Calochlaena dubia*) and Rough Tree-fern (*Cyathea australis*). The

following species are scarce: Soft Water-fern (*Blechnum minus*), Ruddy Ground-fern (*Hypolepis rugosula*) and Mother Shield-fern (*Polystichum proliferum* – 2 natural and others planted).

Climbers: Mountain Clematis (*Clematis aristata*) is fairly abundant. The only other species is Coarse Dodder-laurel (*Cassytha melantha*), which is very scarce.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) and Kidney-weed (*Dichondra repens*) are abundant. Angled Lobelia (*Lobelia anceps*), a crane's-bill (*Geranium*? potentilloides) and the wood-sorrel *Oxalis exilis/perennans* are fairly abundant. Centella (*Centella cordifolia*) and Ivy-leaf Violet (*Viola hederacea*) are scarce.

Grasses, rushes and sedges: Rich in rushes and sedges. Dominated variously by Tall Sedge (*Carex appressa*), Weeping Grass (*Microlaena stipoides*) or Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*). The following species are also abundant but not dominant: Swamp Club-rush (*Isolepis inundata*), Green Rush (*Juncus gregiflorus*) and Clustered Wallaby-grass (*R. racemosum*). Hooker Fescue (*Hookerochloa hookeriana*) is much less abundant but a good environmental indicator.

Other groundcover: Lesser Joyweed (*Alternanthera denticulata*) is abundant. The following species are fairly abundant: Water Plantain (*Alisma plantago-aquatica*), Robust Willow-herb (*Epilobium billardiereanum* subsp. *intermedium*), Hairy Willow-herb (*E. hirtigerum*), Small Poranthera (*Poranthera microphylla*) and Slender Knotweed (*Persicaria decipiens*). Spotted Knotweed (*P. praetermissa*) and Hairy Knotweed (*P. subsessilis*) are also fairly abundant in the reserve's northwest but they may well be present only due to planting.

Artificial wetland (no EVC or conservation status applicable). 11 naturally-occurring, indigenous species were recorded in this study.

Trees and shrubs: Absent.

Amphibious species: Slender Knotweed (*Persicaria decipiens*) is the most abundant species, followed by Lesser Joyweed (*Alternanthera denticulata*). Tall Sedge (*Carex appressa*), Swamp Club-rush (*Isolepis inundata*) and Common Blown-grass (*Lachnagrostis filiformis*) are fairly abundant. Spotted Knotweed (*P. praetermissa*) and Hairy Knotweed (*P. subsessilis*) are also present but that may well be only due to planting. Other indigenous amphibious species are scarce.

Aquatic species: The cumbungi, *Typha orientalis*, dominates some areas. Another cumbungi species, *Typha domingensis*, is scarce. Water Plantain (*Alisma plantago-aquatica*) is moderately abundant. Common Duckweed (*Lemna disperma*) is fairly abundant in the dam south of Kelly Court and the wetland at the site's western extremity. The aggressive, non-indigenous River Club-rush (*Schoenoplectus tabernaemontani*) has been planted and has spread to become dominant in some areas.

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. Warranwood Reserve is one of many locations within the species' range to have a substantial and apparently quite viable population of the species.

The wallaby-grass, *Rytidosperma monticola*, is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. Warranwood Reserve is one of seven sites in Maroondah to support plants that are best regarded as an undocumented form of *R. monticola* with some characters tending toward the Hill Wallaby-grass (*R. erianthum*). One plant was found approximately 30 m southeast of the retarding basin on 31/12/17. Herbarium specimen *G.S.Lorimer 2720* was collected. Other plants must be present but would have been hard to detect as late in the season as 31st December. Other members of the species occur nearby in Site 16.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Warranwood Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – one plant was found in 2018 south of the Omeo Pde entrance, the first record from the reserve;
- *Asperula conferta* (Common Woodruff) – two plants were found in 2018 east of Omeo Pde, compared with 25 in 2001;
- *Astroloma humifusum* (Cranberry Heath) – moderately abundant in the Grassy Dry Forest – perhaps the largest population in Maroondah (and definitely among the top three);
- *Blechnum minus* (Soft Water-fern) – only one could be found in 2018, whereas 7 were found in 2001;
- *Caladenia praecox* (Early Caladenia) – one plant was photographed near Bemboka Road by Dayna Konheiser of Maroondah City Council on 13/9/19;
- *Calochlaena dubia* (Common Ground-fern) – locally dense beside creeks;
- *Chrysocephalum semipapposum* (Clustered Everlasting) – scattered around the upper slopes west of the kindergarten, possibly some of them planted;
- *Correa reflexa* var. *reflexa* (Common Correa) – moderately abundant in the Grassy Dry Forest, plus three plants in the Valley Grassy Forest;
- *Cynoglossum suaveolens* (Sweet Hound's-tongue) – Two plants grow in the Valley Grassy Forest, just east of the main, north-flowing creek;
- *Echinopogon ovatus* (Common Hedgehog-grass) – in 2018, two plants were found on the slope east of the Omeo Pde entrance to the reserve;
- *Eucalyptus macrorhyncha* (Red Stringybark) – once one of the dominant species in most of the reserve, now less abundant and often not in good health but still apparently a viable population;
- *Eucalyptus rubida* (Candlebark) – moderately common in the Valley Grassy Forest, plus one outlier in the gully west of the playground;
- *Glycine microphylla* (Small-leaf Glycine) – scattered over the slope generally east to southeast of the Omeo Pde entrance but numbers hard to determine due to similarity of some plants to *G. clandestina*;
- *Goodenia elongata* (Lanky Goodenia) – Helen Moss reported this species verbally to the author in 1994 without details, not seen again until it was planted in recent years;
- *Hookerochloa hookeriana* (Hooker Fescue) – ten were found in 2001 in the reserve's northwest but only two remained in 2018, the difference apparently due to creek erosion and the consequent fall in the water table;
- *Hypericum japonicum* (Matted St John's Wort) – one or two plants were found in 2018 in lawn on the northern embankment of the retarding basin, only the second record of the species in Maroondah since 1996;
- *Hypolepis rugosula* (Ruddy Ground-fern) – one plant was found in 2018 in the reserve's northeast corner, the first record from the reserve;
- *Juncus fockei* (Slender Joint-leaf Rush) – one plant was found in 2018 (perhaps planted);
- *Lachnagrostis aemula* (Purplish Blown Grass) – not recorded since the summer of 1994–5, abundance not recorded;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – last seen in 2001, when two individuals were found;
- *Pauridia vaginata* (Sheath Star) – one recorded in 2001and an unknown number in 1995; probably still present;
- *Poa tenera* (Slender Tussock-grass) – last recorded in 1994–5 but it may have escaped attention since then if there are only a few;
- *Polystichum proliferum* (Mother Shield-fern) – two plants were found in 2018, five in 2001;
- *Senecio minimus* (Shrubby Fireweed) – in this study, many were found along the creeks. The species is opportunistic and its population will fluctuate;

- *Veronica calycina* (Hairy Speedwell) – the author recorded two individuals in 2001, roughly halfway from the Omeo Pde entrance to the retarding basin. None could be found in 2018;
- *Veronica derwentiana* (Derwent Speedwell) – the author recorded three wild individuals in 2001. Significantly more individuals were present in 2018 but at least some (perhaps all) were planted.

Other

- *Olearia phlogopappa* (Dusty Daisy-bush) – a solitary plant grows 15 m up the northwest-facing slope next to the pond in the retarding basin. This species is very rare in Maroondah, occasionally establishing from seed blown in from elsewhere. It does not qualify as a locally threatened species because the sporadic plants probably represent a 'sink population' in the terms of the IUCN Red List Regional Guidelines, i.e. their continued occurrence probably does not depend on the plants living within Maroondah.

Significant fauna

Threatened in Victoria

The Powerful Owl is listed as Vulnerable in Victoria. It is periodically heard in the neighbourhood and its presence in the reserve was confirmed by a photograph in 2018 and a flight feather found in the reserve's northern triangle during breeding season (September) in 2017.

Threatened in Maroondah

Black Wallabies and Short-beaked Echidna are resident in the reserve. Koalas have not been seen in the reserve for many years.

Fauna habitat

The water and stream channel of the main, north-flowing creek provide habitat for Pacific Black Ducks, Wood Ducks, aquatic invertebrates, probably Shortfin Eel and possibly other fish.

The wetlands and dam:

- Support waterbirds, frogs and aquatic invertebrates; and
- Provide a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat.

In the rest of the site:

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals (including kookaburras, which were observed nesting) and roost sites for bats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The near-continuity of treed habitat that extends northward along the Jumping Creek valley greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the vegetation varies across all categories of the A–D scale of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The best condition (rating 'A') is in the Grassy Dry Forest and Valley Grassy Forest of the site's central rectangle.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The areas of Valley Grassy Forest easily meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The habitat score easily exceeds 0.3 almost throughout. Valley Grassy Forest is listed by the state government as 'vulnerable'. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

The Creekline Herb-rich Woodland in the reserve's northern triangle also qualifies as a 'patch'. That EVC is listed as 'vulnerable'. It seems likely (but not certain) that the habitat score there would be at least 0.3. If so, standard criterion 3.2.3 again yields a rating of **State** significance; otherwise, it defaults to Regional significance, which applies to other areas of Creekline Herb-rich Woodland in the reserve.

It is quite possible that a formal assessment of the habitat score of the Grassy Dry Forest would yield a score of at least 0.6. If so, the 'least concern' status of that EVC would lead to a significance rating of 'Regional' under standard criterion 3.2.3.

Rare or threatened species

The reserve has a substantial and apparently quite viable population of Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

The local form of *Rytidosperma monticola* occurs in the reserve, although only a single individual has been detected. That species' range is not confined to Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

At least eight of the other plant species listed in the section above headed 'Significant plants' have apparently viable populations in the reserve and they fall into the 'critically endangered' category of risk of dying out in Maroondah. Those species fit the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The same criterion applies to the Early Caladenia (*Caladenia praecox*) in Warranwood Reserve. One was photographed there in in 2019 and another about ten years prior. The only other site in Maroondah where the species has been recorded within the past eighty-five years is Hochkins Ridge Nature Conservation Reserve, in 1983. Clearly, the occurrences at Warranwood Reserve make the reserve an 'important site' for the species in Maroondah, leading to a Local significance rating.

The Powerful Owl is listed as 'Vulnerable' in the state government's 'Advisory List of Threatened Vertebrate Fauna in Victoria – 2013'. Its use of Warranwood Reserve for habitat was confirmed in 2017 and 2019. The species' distribution is not confined to Victoria. It follows that the site meets standard criterion 3.1.2 for a site of Regional significance.

Among the other fauna in the reserve, the resident populations of Black Wallaby and Echidna are stable or increasing despite those species being threatened in Maroondah more broadly. They fit the following description in standard criterion 3.1.5 for a site of Local significance: 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'.

Ecological corridor

Warranwood Reserve fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

To the extent that the habitat link is weak in the reserve's southern extremity (at Berrywood Walk), the following description from standard criterion 1.3.3 applies: "Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor… Site (or one of a group of such sites) to form a strategic corridor of local importance and scale". That description applies to a site of Local significance.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Grassy Forest, Creekline Herb-rich Woodland and the Dandenong Range Cinnamon Wattle.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and also immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creeks and waterbodies helps to stabilise the soil and remove a small amount of water pollution.

Warranwood Reserve's natural ambience is expected to be beneficial to the health, wellbeing and quality of life of visitors to the reserve. The ambience may also attract people to get exercise in the reserve.

Natural environments have also been shown to aid childhood development (Section 1.3 of Volume 1). Children at the Kurboroo Kindergarten are exposed to the birds, insects, sights, sounds and smells of the park's bushland, which can only be beneficial to the children's development. The park is also an educational resource for small excursions from the kindergarten, such as for 'bush play'.

The movement of birds, butterflies and other animals out of the reserve into neighbouring streets and gardens spreads nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

While the volunteers who work in the reserve provide ecological benefits to the bushland, the bushland reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The reserve's vegetation contributes substantially to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. A heritage overlay recognises the heritage value of the particularly large, old Red Box west of the kindergarten.

The streams flowing through the reserve give the reserve cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, most of the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Aerial photographs indicate that revegetation has increased the area of habitat in Warranwood Reserve during the period 2001–2018 by approximately 800 m² near the northwest corner and of 700 m² near the southern end of Eden Valley Road.

Change in the ecological condition of habitat

The 1997 report, *'Sites of Biological Significance in Maroondah'*, estimated that 1 ha of Creekline Herb-rich Woodland in the reserve's north was in good ecological condition (rating 'B' on the A–D scale used in that report). Today, the creeks have become deeply eroded, the water table has consequently dropped, floodplain plant species have died out from the drier conditions and rare plants have been washed away. The ecological condition of the Creekline Herb-rich Woodland has therefore declined significantly. Prevention and correction of the creek erosion are necessary to arrest the deterioration.

The 1997 estimated that the 0.1 ha of Herb-rich Foothill Forest was in excellent ecological condition (rating 'A'), 0.02 ha was in good condition ('B') and 0.05 ha was in poor condition ('D'). Today, the Herb-rich Foothill Forest is partly used as a firebreak and the rest has been afflicted by weeds, soil and nutrients emanating from abutting residences uphill. None of it is in better condition than 'fair' (rating 'C').

The 1997 report treated the Grassy Dry Forest and Valley Grassy Forest as a single vegetation type. To the precision that can be achieved with the A–D scale, no change can be discerned in the associated ecological condition since 1997.

Changes in the species present

Referring to the section above headed 'Significant plants', the 2018 flora survey failed to detect as many individuals of ten of those species as had been recorded in the reserve at some time since the 1980s –none at all, in some cases. Some of those species probably persist out of sight or have temporarily died back to underground storage. Others have certainly declined, particularly those whose habitat was the creek channels and floodplains. On the positive side, four of the 'significant plant' species found in 2018 had not been recorded in the reserve previously.

There is a similar situation with indigenous plant species other than those in the 'Significant plants' section.

To summarise: (a) a significant fraction of the plant species of the creeks and floodplains have died out or suffered definite, progressive declines between each consecutive pair of flora surveys since 1994–5, with very few new discoveries; and (b) in drier parts of the landscape, few plant species appear to have died out or significantly declined.

Among the indigenous fauna:

- Black Wallabies are probably more abundant now than in past ecological surveys;
- Echidnas remain scarce;
- Noisy Miners were observed in 2018 but not in previous ecological surveys;
- Perhaps because of the Noisy Miners, Bell Miners have not been seen for some years despite being abundant in the 1990s; and
- Far fewer butterflies were observed in the 2018 survey than in previous summer surveys.

The constraints of this study do not permit a more detailed analysis of changes in Warranwood Reserve's indigenous flora and fauna species.

Threats

This study has identified the following threats to the reserve's biodiversity (in approximately decreasing order):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of rare floodplain plant species and their habitat due to deep creek erosion and the consequent lowering of the water table, which is in turn due to pulsed flows associated with runoff from the urbanised catchment. This is most acute in the north of the reserve but could easily become more prevalent;
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and possibly further urbanisation of the catchment;
- Displacement of indigenous plants by introduced plants, mainly along the creek;
- Exacerbation of the preceding problem by the introduction of weeds, soil, nutrients and planted plants from abutting residences;
- Damage to soil, vegetation and consequently wildlife habitat by deer, which may well increase greatly in numbers from their present scarcity; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Northward from the southern end of Eden Valley Road, all land within approximately 35 m of the main, north-flowing creek comes under the Urban Floodway Zone. The Public Conservation and Resource Zone applies to the rest of the site other than the southern arm. The part of the southern arm that passes through the Kelly Court subdivision comes under Schedule 3 of the Neighbourhood Residential Zone. The rest of the southern arm is zoned General Residential Zone.

The whole site is affected by the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions as well as the Bushfire Management Overlay (BMO). The Significant Landscape Overlay applies throughout: Schedule 4 south of the Kelly Court subdivision and Schedule 3 everywhere else. One exceptionally large Red Box (*Eucalyptus polyanthemos*) is covered by the Heritage Overlay, as item HO76.

The Vegetation Protection Overlay (VPO) applies to the site except for:

- The southern arm;
- A small area of land abutting the western fence of the kindergarten; and
- A small triangle of land in the far northeast.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in mid-blue on the aerial photograph on p. 99. The changes in the area affected are the addition of the three areas just listed and the omission of an area around the picnic shelter and playground. However, the area around the picnic shelter and playground could be included if it is desired to control works there whose impacts may affect the native vegetation downhill.

Restoration opportunities

The serious creek erosion in the reserve's northern triangle is in urgent need of attention. It has lowered the water table and thereby caused several rare plant species to die out or decline in the reserve. Other rare plants have been washed away with the erosion. The environmental harm will continue to worsen and spread until action is taken. The creeks in the northern triangle are now so deeply incised into the floodplain that they represent a safety hazard, particularly for children.

It would be environmentally desirable to control the large and increasing numbers of Arum Lily in the site's southern arm. Blackberry and Sweet Pittosporum are also problems in that arm.

Information sources

The analysis above draws on the following sources of information about the site:

- 23½ hours of flora survey specifically for this study during the period from 31/12/17 to 27/3/19. This work produced seven lists of indigenous and introduced plant species (including mosses and liverworts) and their abundances, each list pertaining to a different part of the site; plus one list of indigenous species for the site's southern arm. Herbarium specimens were taken of three plant species;
- Incidental fauna observations during the work just described (41 species observed);
- Spotlighting for nocturnal fauna on 25/10/17 specifically for this study (7 species observed);
- A record (with photographic evidence) of a Powerful Owl feather in the reserve in September 2017, by workers with the firm, Forest to Foreshore;
- Wildlife observations (including further records of Powerful Owl) conveyed by Margaret Baber of the reserve's Special Committee of Council (formerly known as a Committee of Management);
- Maroondah City Council's records of planting in the reserve;
- The July 2006 report, *'Weed Mapping along Jumping Creek in Warranwood'*, and the underlying data;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- Herbarium specimens of three plant species during 2001–2006, including the first record of *Mercurialis annua* in Victoria since 1913;
- A 2003 list by David Cameron in the Victorian Biodiversity Atlas (VBA) of 15 plant species associated with *Mercurialis annua*;
- Information in the *'Warranwood Reserve Management Plan 2001'* (Lorimer 2001), which included a flora survey in the spring of 2001;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve included a flora survey, a brief bird survey, a 20-minute bird census, incidental fauna observations, a mammal hair survey, spotlighting and a frog call survey;
- The 1995 *'Warranwood Reserve Management Plan'* (Lorimer 1995), which involved a comprehensive flora survey during September 1994 to January 1995;
- Plant lists in *'Trees and Wildflowers of Croydon 1988'* and *'Trees and Wildflowers of Croydon 1995'*, the former compiled largely by David Cameron and the latter updated largely by the present author;
- Records in the Victorian Biodiversity Atlas (VBA) of two common frog species by Steve Rowe in 1988;
- A flora data sheet for a quadrat surveyed by Jane Ellis on 11th December 1986 (also transcribed into the VBA), with an unreliable record of *Senecio* ?*linearifolius*;
- A plant list for '½ acre' of the reserve by David Cameron and others in 1981; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

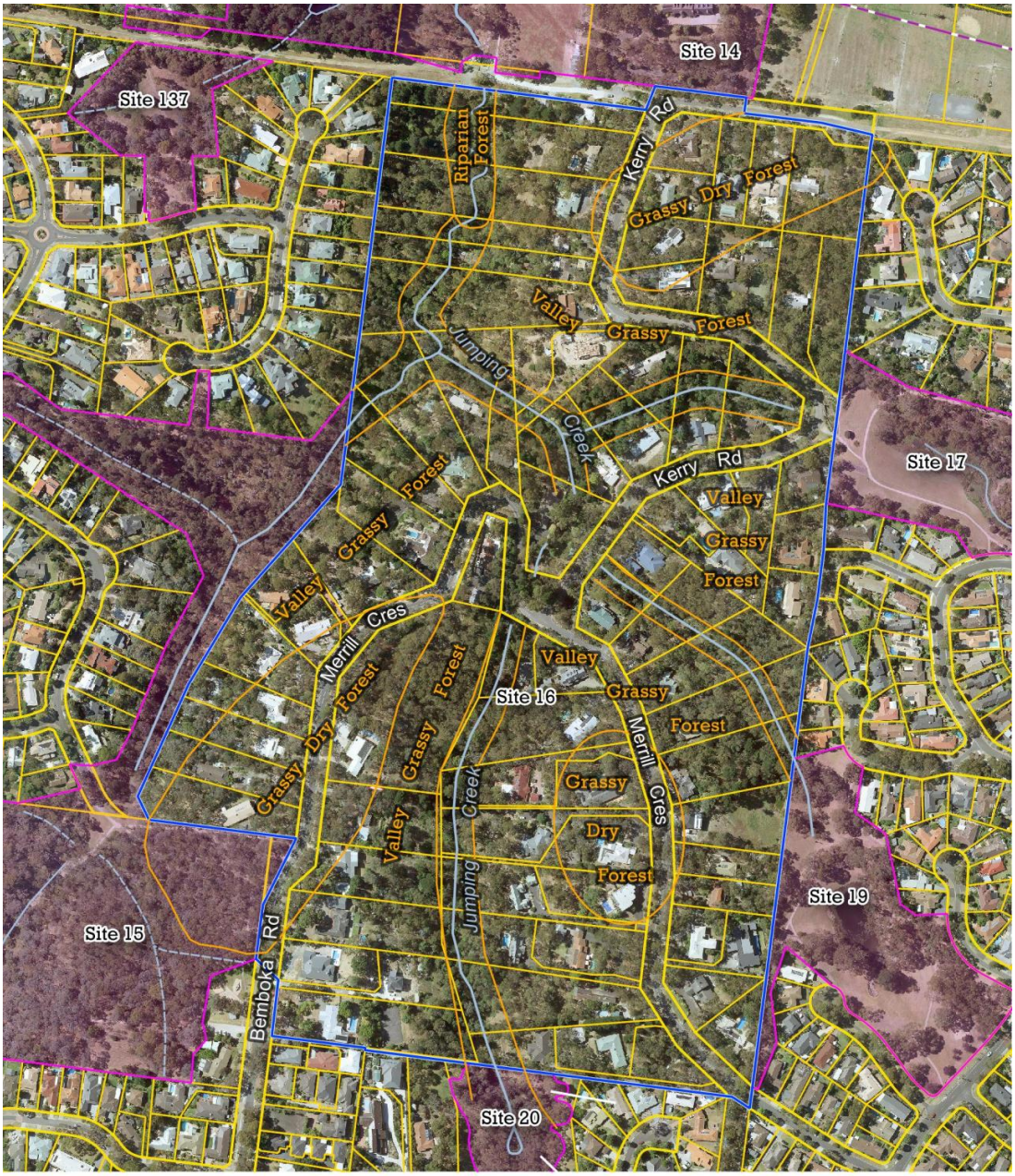
No other useful information could be found in the VBA, the Atlas of Living Australia or eBird. Note that the identification of EVCs in the state government's vegetation mapping is quite inaccurate in Warranwood Reserve. The most significant flaw is the depiction of Riparian Forest not along a stream but right up the slope that abuts the reserve's northern boundary.

Acknowledgements

Thanks to Margaret Baber of the Warranwood Reserve Special Committee of Council for passing on her knowledge of the site, its history and management, and for providing records of flora and fauna. Thanks also to Janette McNally for providing feedback on a draft of the site description above.

Site 16. Warranwood Environmental Living Precinct

Biological Significance Level: *State* due to a threatened plant species and vegetation type



Legend

Watercourse
Properties
EVC boundaries
Site 16
Other sites

N

Aerial photograph taken February 2017

1:5000

0 50 100 150 200 m

Boundary, land use and tenure

Site 16 is outlined in blue on the aerial photograph above. The boundary follows property boundaries except where it crosses roads. The roads are council roads. The rest of the site is private residential land. The total area is 34 ha and most lots measure 0.25 ha to 0.8 ha.

General description

Site 16 was previously an 'Environmental Living Zone', to conserve its natural assets by planning controls such as minimum lot sizes. That heritage has led to Site 16 being now the best-preserved natural habitat in any residential area in Maroondah.

The site is hilly and dissected by creeks, including Jumping Creek (or Narr-Maen Creek). Creeks in urban areas are typically in reserves because of their usage for drainage and sewers but this site is an exception, with a system of creeks running through private land. Drainage reserves are located further upstream along each creek, in Sites 15, 17, 19 and 20. There is also habitat downstream in Site 14 and from there to the Yarra River and beyond. The presence of the creeks and the habitat continuity with other sites add considerably to the area's environmental importance and habitat value. Black Wallabies, Echidnas and many bird species move daily from property to property along the creeks.

Nearly all the properties in the site have remnant eucalypts. Many of them also have natural understorey. Some of the native understorey is in very good ecological condition. There are substantial numbers of plant species that are rare or threatened locally or more widely, including Maroondah's only population of Gold-dust Wattle (*Acacia acinacea*).

The detailed information below concerning vegetation composition and rare plants has been compiled without the benefit of entering many of the properties during this study. Instead, one large property was examined in detail and the rest were viewed from roads and the pipe track along the northern edge. Despite the limited nature of that coverage, 136 naturally-occurring, indigenous plant species were detected. The author did conduct flora surveys of many of the properties in 1996.

Relationship to other land

Site 16 is effectively the private-land part of a much larger area of habitat that includes Sites 14–21 and Manningham City Council's 'Biosites 3–8', extending to Warrandyte State Park. The Jumping Creek valley is an important habitat corridor.

The movements of birds and insects through the site is important not only for the needs of the animals but also for the pollen and seeds that the animals may disperse as they go. Wallabies may also disperse seeds.

Bioregion: Highlands - Southern Fall

The state government's vegetation mapping shows Valley Heathy Forest in the south of Site 16 despite the presence of such contrary indicators as the presence of many Candlebark (*Eucalyptus rubida*) trees. As a result, the government has mapped the Gippsland Plain bioregion in that area to provide consistency with the presumed Valley Heathy Forest. The present study's fieldwork could find no evidence to support the presence of Valley Heathy Forest and hence no evidence of the Gippsland Plain bioregion.

Habitat types

The descriptions of vegetation below include only the more abundant or ecologically informative indigenous plant species that could be detected in the areas visited during this study. 'EVC' means 'Ecological Vegetation Class'.

Grassy Dry Forest (EVC 22, 'Least concern' in the bioregion) on three hilltops and their upper north- and west-facing slopes.

Canopy trees: Dominated by Red Box (*Eucalyptus polyanthemos*). Bundy (*E. goniocalyx*) and Red Stringybark (*E. macrorhyncha*) are fairly abundant. There are a few outliers of Yellow Box (*Eucalyptus melliodora*) from the adjacent Valley Grassy Forest.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Golden Wattle (*Acacia pycnantha*) is also abundant. Lightwood (*A. implexa*) and Black Wattle (*A. mearnsii*) are much less abundant.

Medium to large shrubs: The main species encountered in this study were Dandenong Range Cinnamon Wattle (*Acacia stictophylla*), Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*), Sifton Bush (*C. sifton*) and Narrow-leaf Bitter-pea (*Daviesia leptophylla*).

Small shrubs: Scarce. The main species encountered in this study were Grey Parrot-pea (*Dillwynia cinerascens*), Rough Fireweed (*Senecio hispidulus*) and Beaked Fireweed (*S. prenanthoides*).

Ferns: Absent.

Climbers: Represented mostly by Common Apple-berry (*Billardiera scandens*), Love Creeper (*Comesperma volubile*) and Purple Coral-pea (*Hardenbergia violacea*) in the areas accessible to the author.

Creepers: Fairly abundant, the most abundant species being Kidney-weed (*Dichondra repens*), Stinking Pennywort (*Hydrocotyle laxiflora*), Trailing Speedwell (*Veronica plebeia*) and the wood-sorrel *Oxalis exilis / perennans*. Characteristically for Grassy Dry Forest, Cranberry Heath (*Astroloma humifusum*) and Purple Coral-pea (*Hardenbergia violacea*) are present.

Grasses, rushes and sedges: Fairly abundant but with large inter-tussock spaces. Rich in species. The most abundant are Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*) and Red-anther Wallaby-grass (*Rytidosperma pallidum*). Weeping Grass (*Microlaena stipoides*), Clustered Wallaby-grass (*R. racemosum*) and Kangaroo Grass (*Themeda triandra*) are fairly abundant.

Other groundcover: Characteristically for Grassy Dry Forest, the moss *Hypnum cupressiforme* dominates the groundcover over substantial areas. The liverwort, Green Worms (*Chiloscyphus semiteres*) is also abundant. Other abundant groundcovers in the most natural areas include Scented Sundew (*Drosera aberrans*), Nodding Greenhood (*Pterostylis nutans*), Maroonhood (*P. pedunculata*) and, in season, Yellow Pennywort (*Hydrocotyle foveolata*). Characteristically for Grassy Dry Forest, Sieber Crassula (*Crassula sieberiana*) is fairly abundant in season, at least in some areas, and Cranberry Heath (*Astroloma humifusum*) is present (though scarce).

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion)

Canopy trees: Dominated by Yellow Box (*Eucalyptus melliodora*) and/or Candlebark (*E. rubida*). Bundy (*E. goniocalyx*), Red Stringybark (*E. macrorhyncha*), Red Box (*Eucalyptus polyanthemos*) and Narrow-leaved Peppermint (*E. radiata*) are widespread. Swamp Gum (*E. ovata*) is abundant in some locations as outliers from the adjacent creek vegetation and Messmate Stringybark (*E. obliqua*) is thinly scattered on the south-facing slope near Site 17, where the vegetation approaches Herb-rich Foothill Forest (but still has abundant Candlebarks).

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*), with smaller numbers of Black Wattle (*Acacia mearnsii*) and Blackwood (*Acacia melanoxylon*).

Medium to large shrubs: The main species encountered in this study were Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*) and Snowy Daisy-bush (*Olearia lirata*). Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*) and Yarra Burgan (*Kunzea leptospermoides*) are also conspicuous.

Small shrubs: none encountered.

Ferns: Austral Bracken (*Pteridium esculentum*) forms extensive, dense patches. Common Maidenhair (*Adiantum aethiopicum*) is also abundant in the more natural areas.

Climbers: Fairly abundant, particularly Mountain Clematis (*Clematis aristata*) and Love Creeper (*Comesperma volubile*). The other main species are Common Apple-berry (*Billardiera scandens*), Small-leafed Clematis (*C. decipiens*) and Twining Glycine (*Glycine clandestina*).

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is fairly abundant – a good indicator of the EVC.

Creepers: Abundant, the most common species encountered being Bidgee-widgee (*Acaena novae-zelandiae*), Kidney-weed (*Dichondra repens*), Trailing Speedwell (*Veronica plebeia*), Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel *Oxalis exilis / perennans*.

Grasses, rushes and sedges: Abundant and dense. The most abundant species seen in this study were Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*) and Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*). The next most abundant species are Variable Sword-sedge (*Lepidosperma laterale*) and Clustered Wallaby-grass (*Rytidosperma racemosum*).

Other groundcover: Golden Weft-moss (*Thuidiopsis furfurosa*) is one of the dominant groundcover species. The liverwort, Green Worms (*Chiloscyphus semiteres*) is also abundant, as are lilies and annuals.

Riparian Forest (EVC 18, 'Least concern' in the bioregion)

Canopy trees: Strongly dominated by Manna Gum (*E. viminalis*).

Lower trees: Black Wattle (*Acacia mearnsii*) and Blackwood (*Acacia melanoxylon*).

Medium to large shrubs: Prickly Moses (*Acacia verticillata*), Sweet Bursaria (*Bursaria spinosa*), Yarra Burgan (*Kunzea leptospermoides*) and Shrubby Fireweed (*Senecio minimus*).

Small shrubs: Hop Goodenia (*Goodenia ovata*).

Climbers: Mountain Clematis (*Clematis aristata*).

Grasses, rushes and sedges: Spiny-headed Mat-rush (*L. longifolia*), Weeping Grass (*Microlaena stipoides*), Sword Tussock-grass (*Poa ensiformis*).

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the bioregion) and
Swampy Riparian Complex (EVC 126, **Endangered** in the bioregion)

The creeks in Site 16 have been so modified by domestic activities, planting and historical grazing that it has become hard to detect the difference between Creekline Herb-rich Woodland and Swampy Riparian Complex, particularly without access to most of the private land. From Warranwood Reserve (Site 15) to the Riparian Forest, the author believes Creekline Herb-rich Woodland is a better classification. Elsewhere, it is probably safer to choose Swampy Riparian Complex, which is a broader EVC devised to represent such intermediate or indeterminate vegetation – particularly in the headwaters of creeks near the bioregional boundary (as in this case). The following description excludes aquatic or semi-aquatic species growing in the creeks or wetlands, which are covered below.

Canopy trees: Swamp Gum (*Eucalyptus ovata*) is strongly dominant. There are also outliers from the adjacent vegetation types.

Lower trees: Blackwood (*Acacia melanoxylon*) is dominant. Cherry Ballart (*Exocarpos cupressiformis*) and Silver Wattle (*A. dealbata*) are also present.

Shrubs: The most abundant species detected in this study were Prickly Moses (*A. verticillata*), Common Cassinia (*Cassinia aculeata*) Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*) and Snowy Daisy-bush (*Olearia lirata*).

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches. Common Maidenhair (*Adiantum aethiopicum*) and Rough Tree-fern (*Cyathea australis*) were also detected.

Climbers: Mountain Clematis (*Clematis aristata*).

Scramblers: Angled Lobelia (*Lobelia anceps*) and Small-leaf Bramble (*Rubus parvifolius*).

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*).

Grasses, rushes and sedges: Rich in rushes and sedges. The most conspicuous species seen in this study were Tall Sedge (*Carex appressa*), Green Rush (*Juncus gregiflorus*), Pale Rush (*Juncus pallidus*), Tall Sword-sedge (*Lepidosperma elatius*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Weeping Grass (*Microlaena stipoides*). Characteristically for Creekline Herb-rich Woodland and Swampy Riparian Complex, Slender Tussock-grass (*Poa tenera*) and Slender Wallaby-grass (*Rytidosperma penicillatum*) are present.

Other groundcover: Indigenous species are very scarce. They include Lesser Joyweed (*Alternanthera denticulata*), Tasman Flax-lily (*Dianella tasmanica*) and Hairy Willow-herb (*E. hirtigerum*) Slender Knotweed (*Persicaria decipiens*).

Stream channel (no EVC or conservation status have been assigned by the Victorian Government)

Trees and shrubs: Absent.

Amphibious species: Swamp Club-rush (*Isolepis inundata*), Slender Knotweed (*Persicaria decipiens*), Angled Lobelia (*Lobelia anceps*), Green Rush (*Juncus gregiflorus*), Broom Rush (*J. sarophorus*).

Artificial wetland (no EVC or conservation status applicable)

Trees and shrubs: Manuka (*Leptospermum scoparium*) grows at the water's edge, dying and regenerating as the water level rises and falls.

Amphibious and aquatic species: Tall Sedge (*Carex appressa*) and Swamp Club-rush (*Isolepis inundata*) are dominant except for a small area dominated by the locally rare Glandular Brooklime (*Gratiola pubescens*). The other species are Water Plantain (*Alisma plantago-aquatica*), Lesser Joyweed (*Alternanthera denticulata*), Hollow Rush (*Juncus amabilis*), Slender Joint-leaf Rush (*Juncus fockei*), Green Rush (*Juncus gregiflorus*), Common Blown Grass (*Lachnagrostis filiformis*), Slender Knotweed (*Persicaria decipiens*) and Common Bog-rush (*Schoenus apogon*),

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. Site 16 is one of many locations within the species' range to have an apparently quite viable population of the species.

The wallaby-grass, *Rytidosperma monticola*, is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. Site 16 is one of seven sites in Maroondah to support plants that are best regarded as an undocumented form of *R. monticola* with some characters tending toward the Hill Wallaby-grass (*R. erianthum*). Approximately five individuals were found beside the northernmost part of Kerry Road on 17/1/18, too late in the season to determine the full population size. Other plants have probably escaped detection on private land not visited by the author.

Both the Dandenong Range Cinnamon Wattle and *Rytidosperma monticola* also occur within 200 m of Site 16 in Warranwood Reserve (Site 15).

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 16 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Calochlaena dubia* (Common Ground-fern) – seen in 1995, no details recorded;
- *Acacia acinacea* (Gold-dust Wattle) – the only stand in Maroondah comprises over 250 stems on the northernmost section of Kerry Road;
- *Astroloma humifusum* (Cranberry Heath) – only a few seen in the limited survey in this study but others likely present, as they were in 1995;
- *Cassytha glabella* (Slender Dodder-laurel) – a small number were seen near the corner of Kerry Road and Merrill Crescent in 1995, which could not be searched in this study;
- *Correa reflexa* var. *reflexa* (Common Correa) – a few were seen in this study. Others may occur on land not inspected;
- *Crassula sieberiana/tetramera* (Sieber Crassula) – fairly abundant in the more natural areas of Grassy Dry Forest;
- *Echinopogon ovatus* (Common Hedgehog-grass) – seen in 1995, no details recorded;
- *Eucalyptus macrorhyncha* (Red Stringybark) – widespread and moderately abundant;
- *Eucalyptus rubida* (Candlebark) – a dominant species in the Valley Grassy Forest;
- *Glycine microphylla* (Small-leaf Glycine) – a few were found in the Valley Grassy Forest in this study and in 1995. Others probably remain undetected, in part due to similarity with *G. clandestina*;
- *Gompholobium huegelii* (Common Wedge-pea) – seen in 1995, no details recorded;

- *Gratiola pubescens* (Glandular Brooklime) – a dominant semi-aquatic groundcover at the spillway of a dam, and one of only two sites in Maroondah where the species appears to have survived;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – seen in 1995, no details recorded;
- *Pelargonium inodorum* (Kopata) – seen in 1995, no details recorded;
- *Poa tenera* (Slender Tussock-grass) – a few were found in this study and not in 1995. Others probably remain undetected;
- *Senecio minimus* (Shrubby Fireweed) – a few were found in this study and in 1995. Others almost certainly remain undetected. This species is generally subject to large population fluctuations and may have been scarcer than usual during this study due to drought conditions.

Other

There is a particularly large, old Red Box (*Eucalyptus polyanthemos*) in the front lawn of 35–37 Merrill Crescent. It is listed as a 'Notable tree' (Moss and Lorimer 1996) and protected under the Heritage Overlay (as HO43) under the Maroondah Planning Scheme.

Significant fauna

Threatened in Victoria

The Powerful Owl is listed as Vulnerable in Victoria. It is periodically heard in the neighbourhood.

Threatened in Maroondah

Black Wallabies, Short-beaked Echidnas and Lowland Copperhead snakes are resident in the site. The last record of a Koala that was uncovered in this study was in December 2008 by Adrian and Margaret Baber.

Fauna habitat

The water and channels of the site's creeks provide habitat for Pacific Black Ducks, Wood Ducks, aquatic invertebrates, Shortfin Eel and possibly other fish.

The dam:

- Supports waterbirds, frogs and aquatic invertebrates; and
- Provides a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat.

In the rest of the site:

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The near-continuity of treed habitat that extends northward along the Jumping Creek valley greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the vegetation varies across all categories of the A–D scale of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). Apportionment among the categories cannot be done without inspecting all the private properties, which was not possible in this study.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

Several areas of Valley Grassy Forest easily meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The habitat score easily exceeds 0.3 in some or all of those areas. Valley Grassy Forest is listed by the state government as 'vulnerable'. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Without inspecting much more of the private land, it is not possible to determine whether any of the other EVCs qualify as significant under standard criterion 3.2.3, or at what level.

Rare or threatened species

The site has an apparently viable population of Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

The local form of *Rytidosperma monticola* occurs in the site. That species' range is not confined to Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Among the site's plant species that fall into the 'critically endangered' category of risk of dying out in Maroondah, *Eucalyptus macrorhyncha*, *E. rubida*, *Gratiola pubescens* and *Senecio minimus* all have apparently viable populations. Those species fit the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating. It is likely that some other species in the section above headed 'Significant plants' also satisfy standard criterion 3.1.5 for Local significance.

Among the fauna in Site 16, the resident populations of Black Wallaby and Echidna are stable or increasing despite those species being threatened in Maroondah more broadly. They fit the description in the quote above and therefore meet standard criterion 3.1.5 for a site of Local significance. The site's Lowland Copperheads may also meet that criterion but the status of that species is insufficiently known.

Ecological corridor

Site 16 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Grassy Forest and the Dandenong Range Cinnamon Wattle.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit all the site's residents as well as adjacent homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creeks helps to stabilise the soil and remove a small amount of water pollution.

Site 16's natural ambience is expected to be beneficial to the health, wellbeing, childhood development and quality of life of the residents. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals attracted to Site 16.

The site's vegetation contributes substantially to Warranwood's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

The site's location along a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, most of the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Comparison of aerial photographs taken in 2001 and 2017 indicates that the only material loss of habitat during the period was approximately 0.13 ha at 86 Bemboka Road. That amount has been approximately balanced by tree crowns growing over other parts of the site that were bare in 2001. Overall, no net change in the extent of habitat can be discerned.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Residential subdivision;
- Other developments such as outbuilding construction;
- Displacement of indigenous plants by introduced plants, including weeds and expanded gardens;
- Exacerbation of the preceding problem by cultivation and fertilisers;
- Loss of rare floodplain plant species and their habitat due to deep creek erosion and the consequent lowering of the water table, which is in turn due to pulsed flows associated with runoff from the urbanised catchment;
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and possibly further urbanisation of the catchment;
- Damage to soil, vegetation and consequently wildlife habitat by deer, which may well increase greatly in numbers from their present scarcity;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Water pollution, particularly coming from Narr-Maen Reserve where the water smelled strongly of sewage when visited in April 2019.

Strategic planning

Eight properties abutting Warranwood Reserve are zoned 'Neighbourhood Residential Zone – Schedule 3'. The 'Urban Floodway Zone' extends various distances each side of the site's creeks, to a width that varies from 20 m to 60 m, depending on flood potential. The rest of the site is zoned 'Neighbourhood Residential Zone – Schedule 1'.

The whole site is affected by the Bushfire Management Overlay (BMO) and Schedule 3 of the Significant Landscape Overlay. The road reserves and all properties larger than 0.4 ha are subject to the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. The Vegetation Protection Overlay (VPO) applies throughout except for part of the road reserve of Bemboka Road.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the entire site, i.e. the area outlined in mid-blue on the aerial photograph on p. 112.

Information sources

The analysis above draws on the following sources of information about the site:

- 7.7 hours of flora survey (aided by Leigh Kett, so 15.4 person-hours total) on private land specifically for this study on 20/9/17. This work produced separate lists of indigenous and introduced plant species (including mosses and liverworts) and their abundances for Grassy Dry Forest, Valley Grassy Forest and Swampy Riparian Complex. All fauna species detected in the process were also recorded;
- 0.5 hours of follow-up of the above survey on 31/12/17 to detect grass species;
- Approximately 0.5 hours of flora survey along Kerry Road on 17/1/18;
- Vegetation mapping from the pipe track on 20/3/19 and from the roads on 3/4/19;
- 0.5 hours of follow-up on 12/4/19 to re-check if is there is any Valley Heathy Forest within the site;
- Wildlife observations conveyed by Margaret Baber;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site included a flora survey, a brief bird survey, a 20-minute bird census, incidental fauna observations and a mammal hair survey – all in 1995–1996;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- Melbourne Water Waterwatch data for the Jumping Creek subcatchment; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

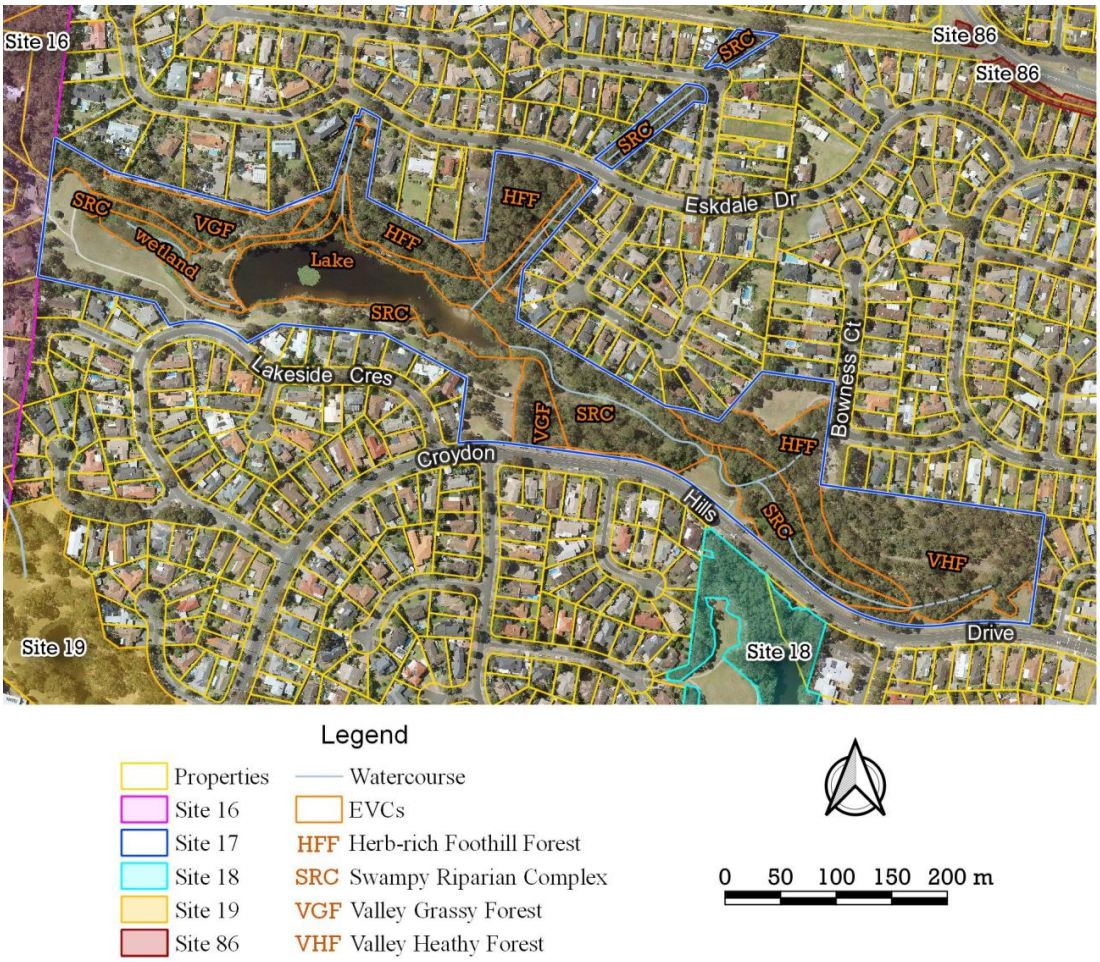
No other useful information could be found in the VBA, the Atlas of Living Australia or eBird. Note that the identification of EVCs in the state government's vegetation mapping has significant errors in this site.

Acknowledgements

Thanks to Margaret and Adrian Baber for records of flora and fauna on their property and for permission to survey it. Thanks also to Janette McNally for a 2016 record of a Lowland Copperhead snake.

Site 17. Candlebark Walk Reserve, Croydon Hills

Biological Significance Level: *State* due to the presence of threatened vegetation types



Boundary, land use and tenure

The image above shows an aerial photograph from February 2017 overlaid with relevant boundaries. The site boundary follows property boundaries except for the excision of a walkway from Greengable Court. Areas of lawn are included not because they are of any biological significance but for simplicity and because the lawns offer potential for habitat creation. The site is entirely council reserve, managed for drainage, nature conservation, recreation and pedestrian thoroughfare.

General description

The site comprises three segments, the largest of which (11.0 ha) is Candlebark Walk Reserve. The other two segments are drainage reserves north of Eskdale Drive, occupying a total of 0.3 ha.

A creek runs westward along Candlebark Walk Reserve's main axis, punctuated by a lake and a retarding basin downstream of the lake. The lake was well vegetated two decades ago, which helped remove pollutants from the water. The lake now has very little vegetation but it still provides amenity and wildlife habitat.

Three non-perennial tributaries enter the reserve from the north or northeast. The one that flows through the site's two minor segments in the northeast evidently suffers serious creek erosion during rainfall events. The creek channel has become a narrow, 2 m-deep canyon. All the site's watercourses and the lake are affected by erosion and pollution because of the urbanised catchment. The retarding basin is an engineering response to the pulsed flows that cause the erosion.

A 1945 aerial photograph shows cleared land south of the reserve's main axis and forest over most of the rest of the site. According to *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), introduced trees and blackberries ('environmental weeds') had become substantial components of the forest at that time. Fortunately, Maroondah City Council and the Friends of Candlebark Walk Reserve have since almost eradicated those weeds. Nevertheless, only a very small fraction of the site's vegetation approximates a natural state, due to activities many decades ago.

The site's most natural habitat is in two areas: south of Bowness Court and northeast of the lake.

Vegetation in the site's two minor segments, north of Eskdale Drive, contains extensive revegetation, a few trees that are apparently natural and a substantial number of introduced plants. The high level of revegetation reflects the 'very high conservation priority' given to that strip in the *'Maroondah Habitat Corridors Strategy'* (Context 2005). The intention is to maximise the ability of wildlife to move along the strip on the way to and from Hochkins Ridge (Site 51).

Relationship to other land

Site 17's main ecological connection is with Site 16 to the immediate west. Site 16 is part of a wildlife corridor along the Jumping Creek Valley, which extends northwards through the abutting Site 14 and then through Manningham City Council's 'Biosites 3–8' to Warrandyte State Park and the Yarra River corridor. That is the route that Shortfin Eels must have taken to travel from their birthplace in the Coral Sea to where they were caught in Yarrunga Reserve (Site 18) in 2011. Birds are also likely to take that route, as well as between Candlebark Walk Reserve and Warranwood Reserve (Site 15). Yarrunga Reserve would be expected to have significantly fewer forest birds if Candlebark Walk Reserve did not provide an ecological link to the west.

The movements of birds and insects to and from the site is important not only for the needs of the animals but also for the pollen and seeds that the animals may disperse as they go. Wallabies may also disperse seeds.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives a 'very high corridor conservation priority' to the creation of a habitat link from the northeastern arm of Candlebark Walk Reserve to Hochkins Ridge (Site 51). However, that objective would require extensive revegetation, including along a pipe track. Pipe tracks are normally kept clear of vegetation.

Bioregion: Highlands - Southern Fall and Gippsland Plain

The transition between Valley Heathy Forest and Herb-rich Foothill Forest within the site corresponds to a bioregional boundary. Valley Heathy Forest is in the Gippsland Plain region and Herb-rich Foothill Forest is in the Highlands - Southern Fall region.

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Herb-rich Foothill Forest (EVC 23, 'Least concern' in the bioregion)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*), followed by Narrow-leaved Peppermint (*E. radiata*). Bundy (*E. goniocalyx*) and Red Stringybark (*E. macrorhyncha*) are scattered. Swamp Gum (*E. ovata*) occurs as outliers from the Swampy Riparian Complex vegetation along the watercourses.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Blackwood (*Acacia melanoxylon*) is fairly abundant. Black Wattle (*Acacia mearnsii*) is scattered thinly.

Medium to large shrubs: Patchy, dominated in different locations by Sweet Bursaria (*Bursaria spinosa*), Burgan (*Kunzea* sp.) or Manuka (*Leptospermum scoparium*). Common Cassinia (*Cassinia aculeata*) and Prickly Currant-bush (*Coprosma quadrifida*) are scattered widely. The following species are scarce or very localised: Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) (planted and apparently natural), Prickly Moses (*Acacia verticillata*), Hop Goodenia (*Goodenia ovata*), Snowy Daisy-bush (*Olearia lirata*) (natural and planted), Elderberry Panax (*Polyscias sambucifolia*), Cluster Pomaderris (*Pomaderris racemosa*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: Very sparse, including thinly scattered Common Flat-pea (*Platylobium obtusangulum*) and Rough Fireweed (*Senecio hispidulus*).

Ferns: Austral Bracken (*Pteridium esculentum*) is abundant and Common Maidenhair (*Adiantum aethiopicum*) is moderately abundant. Common Ground-fern (*Calochlaena dubia*) was present in 1996 but was not encountered in this study's brief inspection, perhaps due to drought.

Climbers: Mountain Clematis (*Clematis aristata*) is abundant and Common Apple-berry (*Billardiera scandens*) is fairly abundant. Wonga Vine (*Pandorea pandorana*) is present but not indigenous to the area.

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is scarce.

Creepers: Kidney-weed (*Dichondra repens*) is fairly abundant. Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel *Oxalis exilis / perennans* are scarce.

Grasses, rushes and sedges: The most abundant species are Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Weeping Grass (*Microlaena stipoides*) and Red-anther Wallaby-grass (*Rytidosperma pallidum*). Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is also abundant on the lower slopes. Kangaroo Grass (*Themeda triandra*) is scattered throughout. Slender Wallaby-grass (*Rytidosperma penicillatum*) and Clustered Wallaby-grass (*R. racemosum*) are localised, or perhaps more abundant but obscured by rabbit grazing.

Other groundcover: The most abundant species are Pale Flax-lily (*Dianella longifolia* var. *longifolia*), Black-anther flax-lily (*D. revoluta*), Tasman Flax-lily (*D. tasmanica*) and Common Raspwort (*Gonocarpus tetragynus*). There is also at least one plant of Rosy Hyacinth Orchid (*Dipodium roseum*).

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion)

Canopy trees: Dominated in different areas by either Candlebark (*Eucalyptus rubida*) or Yellow Box (*E. melliodora*). Narrow-leaved Peppermint (*E. radiata*) is fairly abundant, along with Messmate Stringybark (*Eucalyptus obliqua*) close to the Herb-rich Foothill Forest. Red Stringybark (*E. macrorhyncha*) is scattered. Red Box (*E. polyanthemos*) and Bundy (*E. goniocalyx*) are scarce.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Black Wattle (*Acacia mearnsii*), Blackwood (*A. melanoxylon*) and Golden Wattle (*A. pycnantha*) are also fairly abundant.

Medium to large shrubs: There are patches of Sweet Bursaria (*Bursaria spinosa*), Burgan (*Kunzea* sp.) or Manuka (*Leptospermum scoparium*). Common Cassinia (*Cassinia aculeata*) and Prickly Currant-bush (*Coprosma quadrifida*) are scattered thinly.

Small shrubs: Very sparse, represented mainly by Rough Fireweed (*Senecio hispidulus*).

Ferns: There are localised patches of Austral Bracken (*Pteridium esculentum*) or Common Maidenhair (*Adiantum aethiopicum*).

Climbers: Mountain Clematis (*Clematis aristata*) is abundant and Common Apple-berry (*Billardiera scandens*) is fairly abundant. Wonga Vine (*Pandorea pandorana*) is present but not indigenous to the area.

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is fairly abundant, as is common in this EVC.

Creepers: Kidney-weed (*Dichondra repens*) is abundant. Bidgee-widgee (*Acaena novae-zelandiae*) and the wood-sorrel *Oxalis exilis / perennans* are scattered thinly.

Grasses, rushes and sedges: Abundant and dense, dominated in different areas by Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or Weeping Grass (*Microlaena stipoides*). The next most abundant species are Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*) and Veined

Spear-grass (*Austrostipa rudis* subsp. *rudis*). Kangaroo Grass (*Themeda triandra*) is scattered throughout. Red-anther Wallaby-grass (*Rytidosperma pallidum*) and Slender Wallaby-grass (*Rytidosperma penicillatum*) are scattered thinly. Thatch Saw-sedge (*Gahnia radula*) and Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) are very scarce.

Other groundcover: The most abundant species are Pale Flax-lily (*Dianella longifolia* var. *longifolia*), Black-anther flax-lily (*D. revoluta*) and Common Raspwort (*Gonocarpus tetragynus*). Chocolate Lily (*Arthropodium strictum*) is present and may be fairly abundant in season.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) and Bundy (*E. goniocalyx*).

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Blackwood (*A. melanoxylon*) is fairly abundant. Black Sheoak (*Allocasuarina littoralis*) is scarce.

Medium to large shrubs: Patchy in density, dominated by Sweet Bursaria (*Bursaria spinosa*) or Burgan (*Kunzea* sp.). Common Cassinia (*Cassinia aculeata*) is fairly abundant. Other species include Sifton Bush (*Cassinia sifton*), Common Correa (*Correa reflexa*), Hop Bitter-pea (*Daviesia latifolia*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Common Heath (*Epacris impressa*), Hop Goodenia (*Goodenia ovata*), Prickly Tea-tree (*Leptospermum continentale*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: The most abundant species is Common Flat-pea (*Platylobium obtusangulum*). Grey Parrot-pea (*Dillwynia cinerascens*) is also fairly abundant.

Ferns: Austral Bracken (*Pteridium esculentum*) is scattered in patches. Screw Fern (*Lindsaea linearis*) was recorded in 1996 but not seen in the brief inspection in 2019.

Climbers: Common Apple-berry (*Billardiera scandens*) and Mountain Clematis (*Clematis aristata*) are fairly abundant. Small-leafed Clematis (*Clematis decipiens*), Coarse Dodder-laurel (*Cassytha melantha*), Downy Dodder-laurel (*C. pubescens*) and Purple Coral-pea (*Hardenbergia violacea*) are scarce. Wonga Vine (*Pandorea pandorana*) is present but not indigenous to the area.

Creepers: Scarce. The only species detected in a brief inspection for this study was the wood-sorrel, *Oxalis exilis/perennans*.

Grasses, rushes and sedges: Abundant. Dominated by Red-anther Wallaby-grass (*Rytidosperma pallidum*) in the more natural areas or Weeping Grass (*Microlaena stipoides*) in the least natural areas. Other abundant species include Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Purplish Wallaby-grass (*Rytidosperma tenuius*). The next most abundant group of species includes Slender Sword-sedge (*Lepidosperma gunnii*), Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*), Bristly Wallaby-grass (*Rytidosperma setaceum*) and Kangaroo Grass (*Themeda triandra*). The scarcer species include Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Richer in species than the rest of the reserve. The most abundant species are the same as the Herb-rich Foothill Forest: Pale Flax-lily (*Dianella longifolia* var. *longifolia*), Black-anther flax-lily (*D. revoluta*), Tasman Flax-lily (*D. tasmanica*) and Common Raspwort (*Gonocarpus tetragynus*). Nodding Greenhood (*Pterostylis nutans*) is very localised. The following species are scarce: Honeypots (*Acrotriche serrulata*), Common Hovea (*Hovea heterophylla*) and Common Rice-flower (*Pimelea humilis*). Chocolate Lily (*Arthropodium strictum*) may be fairly abundant in season.

Swampy Riparian Complex (EVC 126, **Endangered** in the bioregion)

The creeks and drainage lines in the reserve have been modified by pipelaying, dams, drainage works, stabilisation works and planting. They also flow across the boundary between two bioregions, so the vegetation has mixed influences. Swampy Riparian Complex is the EVC applicable to such intermediate or indeterminate vegetation. The following description excludes aquatic or semi-aquatic species growing in the creeks or wetlands, which are covered below.

Canopy trees: Swamp Gum (*Eucalyptus ovata*) is strongly dominant. There are also outliers from the adjacent vegetation types, particularly Messmate Stringybark (*E. obliqua*).

Lower trees: Swamp Paperbark (*Melaleuca ericifolia*) forms dense thickets in some areas. Otherwise, Blackwood (*Acacia melanoxylon*) is dominant. Cherry Ballart (*Exocarpos cupressiformis*) is localised. Silver Wattle (*A. dealbata*) is very scarce.

Shrubs: Dominated by Manuka (*Leptospermum scoparium*) or Sweet Bursaria (*Bursaria spinosa*). Prickly Currant-bush (*Coprosma quadrifida*) and Hop Goodenia (*Goodenia ovata*) are scarce.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches. There are also at least three Rough Tree-ferns (*Cyathea australis*) (two of them dead) and a Soft Water-fern (*Blechnum minus*) at the edge of the lake. Mother Shield-fern (*Polystichum proliferum*) and Common Ground-fern (*Calochlaena dubia*) were present in 1996 but were not encountered in this study's brief inspection.

Climbers: Mountain Clematis (*Clematis aristata*) is scarce.

Scramblers: Angled Lobelia (*Lobelia anceps*) and Small-leaf Bramble (*Rubus parvifolius*) are very localised.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is scattered.

Grasses, rushes and sedges: The only conspicuous indigenous species are Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and rushes, particularly Pale Rush (*Juncus pallidus*) followed by Green Rush (*J. gregiflorus*) and Broom Rush (*J. sarophorus*). A tall form of Variable Sword-sedge (*Lepidosperma laterale*) is scarce.

Other groundcover: Indigenous species are very scarce. They include Tasman Flax-lily (*Dianella tasmanica*) and Hairy Willow-herb (*E. hirtigerum*).

Creeks and artificial wetlands (including the lake) – extensively planted with indigenous and non-indigenous species.

Trees and shrubs: Absent.

Amphibious species: the most abundant naturally-occurring, indigenous species are Tall Rush (*Carex appressa*), Broom Rush (*Juncus sarophorus*) and Slender Knotweed (*Persicaria decipiens*). The following species are fairly abundant: Lesser Joyweed (*Alternanthera denticulata*), Angled Lobelia (*Lobelia anceps*), Green Rush (*Juncus gregiflorus*) and Water Pepper (*Persicaria hydropiper*). Spotted Knotweed (*P. praetermissa*) is present but probably only due to planting. Other indigenous amphibious species are scarce. In 1996, the author found the terete-leafed form of Streaked Arrow-grass (*Triglochin striatum*), which is very rare in Maroondah. The aggressive, non-indigenous Salt Club-rush (*Bolboschoenus caldwellii*) has been planted and has spread to become dominant in one area.

Aquatic species: The two cumbungi species, *Typha domingensis* and *T. orientalis*, dominate substantial areas. Water Plantain (*Alisma plantago-aquatica*) is abundant. Loose-flower Rush (*Juncus pauciflorus*) grows sparingly in flowing water. The aggressive, non-indigenous River Club-rush (*Schoenoplectus tabernaemontani*) has been planted and has spread to become dominant in part of the retarding basin.

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. Perhaps all the members of this species in the reserve have been planted but three appear to be natural.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Candlebark Walk Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Blechnum minus* (Soft Water-fern) – one plant grows at water's edge on the lake's northern shore;
- *Calochlaena dubia* (Common Ground-fern) – recorded in 1996 in the Herb-rich Foothill Forest and the Swampy Riparian Complex but not seen in this study's brief inspection (perhaps due to dying back under the drought conditions of the preceding year);

- *Caladenia catenata* (White Caladenia) – one plant was reported by Craig Mauger of Maroondah City Council in October 2005, probably in the Valley Heathy Forest;
- *Correa reflexa* var. *reflexa* (Common Correa) – scarce in the Valley Heathy Forest;
- *Eucalyptus macrorhyncha* (Red Stringybark) – scattered widely but not dense and in many cases, not in good health;
- *Eucalyptus rubida* (Candlebark) – a dominant species in the Valley Grassy Forest and apparently a viable population, particularly in combination with Site 16 to the west;
- *Gratiola pubescens* (Glandular Brooklime) – reported in 1996 but with some doubt about the identification;
- *Polystichum proliferum* (Mother Shield-fern) – recorded in 1996 beside a creek without a precise location or population estimate; not detected in the brief 2019 inspection;
- *Ornduffia reniformis* (Running Marsh-flower) – one plant grows at water's edge near the southwest corner of the lake, in a crack between bluestone blocks. More were present in 2014. Bluestone blocks have destroyed most of the habitat for this species;
- *Pomaderris racemosa* (Cluster Pomaderris) – scattered in the Herb-rich Foothill Forest but it is hard to know how many of them are wild and how many planted;
- *Senecio minimus* (Shrubby Fireweed) – recorded in 1996 without a precise location or population estimate; not detected in the brief 2019 inspection. This species is generally subject to large population fluctuations and may have been absent during the April 2019 flora survey due to drought conditions.

Significant fauna

Threatened in Victoria

- Hardhead– one individual was reported to eBird on 12/7/14 by Emma B and not reported by anyone since;

Rare or threatened in Maroondah

- Great Cormorant – one individual was reported to eBird on 12/7/14 by Emma B and by Rohan Clarke on 17/8/19;
- Australasian Darter – one adult male was seen when the reserve was inspected for this study on 8/4/19. The previous record of the species in the reserve was in 2013, reported in eBird;
- Barn Owl – this record appears in a June 1999 list from Birds Australia without further information;
- Australian Hobby – one individual was reported to eBird on 24/3/11 by Alan Atkinson;
- Black Wallaby – scats were observed during this study.

In 1988, there were records of Azure Kingfisher and Growling Grass Frogs somewhere in the general area. Even if those records came from what subsequently became Candlebark Walk Reserve, they are not relevant to the site today other than for historical interest.

Fauna habitat

The waters of the lake and creeks provide habitat for a wide range of common waterbirds and rarely uncommon waterbirds. They also provide habitat for aquatic invertebrates, frogs and Shortfin Eel. The lake also provides a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat.

In the non-aquatic environment:

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;

- The near-continuity of treed habitat that extends westwards to the Jumping Creek valley greatly amplifies the habitat values above;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1); and
- The vegetation along the reserve's southern boundary, west of the Croydon Hills Drive frontage, comprises trees (mainly eucalypts) from other parts of Australia. Although they are not locally indigenous and they only have lawn beneath them, they still provide forage for some common native birds and insects. They also reduce the gaps in the tree canopy for fauna flying to or from Site 16.

Ecological condition

On the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the site's native vegetation comprises approximately:

- 1.5 ha in poor ecological condition (rating 'D');
- 5.2 ha in fair ecological condition (rating 'C');
- 0.5 ha in good condition (rating 'B'); and
- 0.05 ha of Valley Heathy Forest is borderline between ratings 'A' (excellent) and 'B'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The area of Valley Heathy Forest easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed by the state government as 'endangered' within the Gippsland Plain bioregion. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

The area of Swampy Riparian Complex that lies roughly south of Bowness Court also qualifies as a patch of an 'endangered' EVC, for the purposes of the standard condition 3.2.3. Some other areas of Swampy Riparian Complex probably also qualify. Any such area gives the site **State** significance under standard criterion 3.2.3. The two segments of the site north of Eskdale Drive do not qualify as patches because they are each smaller than 0.25 ha.

The two areas of Valley Grassy Forest qualify as patches of a 'vulnerable' EVC. Under standard criterion 3.2.3, they represent **State** significance if their habitat score is at least 0.3, which seems likely. Otherwise, they represent Regional significance.

The areas of Herb-rich Foothill Forest qualify as patches. Because of that EVC's 'least concern' status, standard criterion 3.2.3 only regards patches as being significant if the habitat score is at least 0.6. The author believes that this is unlikely at Candlebark Walk Reserve, although the patch abutting the southern side of Eskdale Drive may come close.

Rare or threatened plant species

The Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'* and it only occurs in Victoria. The species has been planted in the Candlebark Walk Reserve but three individuals look as though they may be natural. If they are, they meet standard criterion 3.1.2 for a site of State significance. The standard criteria make no distinction between planted plants, natural plants and descendants of planted plants but it seems reasonable to reserve the 'State' rating to natural populations.

The other plant species listed in the section above headed 'Significant plants' fall into the 'critically endangered' category of risk of dying out in Maroondah. The eucalypts and at least some of the other

species fit the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Candlebark Walk Reserve provides an ecological link between the habitat of the Jumping Creek Valley in Site 16 with Yarrunga Reserve (Site 18). For example, the Shortfin Eels that have been caught at Yarrunga Reserve must have passed through Candlebark Walk Reserve on their journeys from their birthplace in the Coral Sea.

The segments of Site 17 that lie north of Eskdale Drive may act as part of a fragmentary link for flying fauna travelling to and from Hochkins Ridge (Site 51) via Knee Lane Reserve (Site 102).

Site 17 therefore fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest, Valley Grassy Forest, Swampy Riparian Complex and the Dandenong Range Cinnamon Wattle.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and also immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creeks and wetlands helps to stabilise the soil and remove water pollution, including sediment.

Candlebark Walk Reserve's natural ambience is expected to be beneficial to the health, wellbeing, childhood development and quality of life of visitors to the reserve. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the reserve. The natural ambience also encourages people to get exercise by walking or running through the reserve.

While the members of the Friends of Candlebark Walk Reserve provide ecological benefits to the bushland, the bushland reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Aerial photographs of Candlebark Walk Reserve from 2001 and 2017 indicate that over that period:

- Revegetation increased the area of habitat with understorey by 0.2–0.3 ha;

- Planting of indigenous trees in lawns increased the area of indigenous eucalypt canopy by approximately 0.1 ha;
- Deaths of wild eucalypts caused the loss of roughly 0.02 m² of canopy;
- Growth of the crowns of eucalypts caused the edges of the natural tree canopy to spread outward, expanding the canopy area by roughly 0.1 ha; and
- Growth of the crowns of 'Australian native' specimen trees in lawns caused an increase in their canopy cover by roughly 0.1–0.2 ha.

Change in the ecological condition of habitat

The abovementioned aerial photographs indicate a significant deterioration of the ecological condition of the lake, which had extensive vegetation cover in 2001 and now has only a very narrow fringe of rushes. Part of the deterioration could be explained by the apparent installation since 2001 of rock edges along the southern shore. That would also explain the apparent loss of some rare wetland plants that grew on the shore. Another possible explanation for the deterioration would be if the lake has been dredged to remove an accumulation of silt.

The ecological condition of the creek that crosses Eskdale Drive has evidently deteriorated markedly. The section between Eskdale Drive and the lake is now a badly eroded canyon up to a least 2 m deep. None of the indigenous plant species that one would otherwise expect to be in such a creek remains; they have all been washed away in pulsed flows from the urbanised catchment. The resulting fallen water table imperils plants that live next to the creek. The soil that has been washed away would have been deposited into the lake, causing further ecological harm. None of these problems was mentioned in the 1997 report, *'Sites of Biological Significance in Maroondah'*, so they have presumably become apparent since then.

Similar stream erosion is not evident in the reserve's other creeks.

The 1997 report said the following about 'environmental weeds': '*Acacia elata* is becoming dominant is the eastern-most part of the reserve. *Pittosporum undulatum, Pinus radiata* and *Rubus discolor* are also common throughout the site. *Salix cinerea* is scattered along the drainage line.' It also said, 'Areas of the creek banks are also severely infested with blackberries'. Fortunately, all of these serious environmental weeds have been eradicated or reduced to small numbers. As a result, the ecological condition of the native vegetation is likely to be considerably better than it would have been.

The 1997 report also provided estimates of the amount of the reserve's native vegetation that fell into each category of ecological condition on an A–D scale. Within the precision that can be achieved by such a categorisation, no change in ecological condition can be determined with any confidence. There is an indication that the Swampy Riparian Complex has deteriorated but the 1997 report predated EVCs and so a direct comparison with the information gathered here is imperfect.

Changes in the species present

This study's 3½-hour assessment of the site was inadequate to compile complete lists of flora or fauna species. It is therefore not possible to make a meaningful assessment of changes in the species present.

Threats

This study has identified the following threats to the reserve's biodiversity (in approximately decreasing order):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continuing serious erosion of the creek that crosses Eskdale Drive, between Eskdale Drive and the lake, and the consequences of siltation of the lake and loss of indigenous flora from being washed away or dying from the water table dropping;

- Worsening of the extremes of low and high creek flows, causing erosion and siltation. Increased extreme flows is an expected a consequence of climate change. It may also arise from further urbanisation of the catchment;
- Proliferation of the reserve's infestation of the declared noxious weed, Spiny Rush (Juncus acutus), and consequent displacement of indigenous wetland flora and fauna;
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Most of the site's southeastern two-thirds is zoned 'Neighbourhood Residential Zone – Schedule 4'. The rest of the reserve is zoned 'Public Park and Recreation Zone'.

The Bushfire Management Overlay affects the reserve west of a line through the middle of the Lakewood Crescent frontage. The Vegetation Protection Overlay (VPO) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions affect all the site except the two segments north of Eskdale Drive. The VPO also affects a sparsely-vegetated walkway from Greengable Court.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole of Site 17, i.e. the area outlined in mid-blue on the aerial photograph on p. 121. However, if desired, the treeless lawn areas can be excised from the overlay.

Restoration opportunities

It is recommended to correct the serious erosion problem (and associated safety hazard) on the creek that crosses Eskdale Drive, and to control the infestation of the declared noxious weed, Spiny Rush (*Juncus acutus*).

Information sources

The analysis above draws on the following sources of information about the site:

- A 3½-hour site assessment specifically for this study on 8th April 2019;
- An incidental observation of Australasian Darter during the site assessment;
- Bird lists available from the eBird website, totalling 47 species as at 9th April 2019;
- A record in the Victorian Biodiversity Atlas (VBA) of three Shortfin Eels seen by Danielle Stokeld in 2011;
- Bird lists from Birds Australia: two 2-hectare searches in 1999, a list in 2015 and two in 2016;
- Maroondah City Council's records of planting in the reserve;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on a detailed flora survey throughout, a quadrat assessment in the Valley Heathy Forest, a brief bird survey, a 20-minute bird census, incidental fauna observations, a mammal hair survey, spotlighting and a frog call survey – all in 1996. A herbarium specimen was taken of the terete-leafed form of *Triglochin striatum*;
- Records by Steve Rowe in 1988 of fauna in the general area, stored in the VBA; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No other useful information could be found in the VBA or the Atlas of Living Australia. Note that the identification of EVCs in the state government's vegetation mapping is inaccurate in Candlebark Walk Reserve. The most significant flaws are substantial overestimation of the widths of the bands of Swampy Riparian Complex vegetation and the misidentification of abutting vegetation as Grassy Dry Forest.

Site 18. Yarrunga Reserve, Croydon Hills

Biological Significance Level: *State* due to the presence of threatened vegetation types



Boundary, land use and tenure

The image on the previous page shows an aerial photograph from February 2017 overlaid with relevant boundaries. Yarrunga Reserve contains such a large proportion of land with no biological significance that it has been deemed appropriate to restrict the site to the significant parts, which are outlined above in mid-blue. The site is entirely council reserve, managed for drainage, nature conservation, recreation and pedestrian thoroughfare.

General description

The parts of Yarrunga Reserve that form Site 18 occupy 3.7 hectares. They contain non-perennial creeks, three artificial ponds and forest. The forested areas vary from natural forest to pine forest with scattered indigenous understorey plants. A total of sixty-eight naturally-occurring, indigenous plant species were observed in the reserve during this study.

The southernmost (upstream) pond has a primary role of trapping sediment coming from the urbanised catchment. It is surrounded by large Monterey Pines (*Pinus radiata*), along with revegetation and scattered naturally-occurring, indigenous plants.

An engineered creek channel takes the overflow of the southern pond to the central pond (presumably a former farm dam) in a retarding basin. The levee of the retarding basin (marked on the aerial photograph on the previous page) divides the site in two. The vegetation to the west of the central pond, close to the frontage with Settlers Hill Crescent, has fewer pines in it than elsewhere in the southern two-thirds of the site. The area east and southeast of the central pond is heavily dominated by pines but even there, a gully and its banks support scattered indigenous plants. Among those plants are at least nine Purple-sheath Tussock-grass (*Poa ensiformis*) plants, of which none were found elsewhere in the reserve.

Water discharged from the retarding basin flows beneath the levee to a short section of creek and then into a pond that is very slender in the south and broadens toward the levee that holds the water back (northwest of the community centre). South of a bridge that crosses the pond, there is a surprising range of indigenous shrub and tree species competing with the dominant pines, mainly within approximately 5 m each side of the pond. Indigenous groundcover plants are sparse except for 0.1 ha at the northern end of the frontage to Settlers Hill Crescent, where there are many species not found elsewhere in the reserve. Maroondah City Council has planted many indigenous plants close to the eastern edge of the middle third of the site.

Overflow from the northern pond flows toward the reserve's northwest corner and then beneath Croydon Hills Drive to Candlebark Walk Reserve. The forest north of the northern pond contains no pines and it is consequently much better habitat for indigenous flora and fauna. Maroondah City Council has augmented the naturally-occurring plants with additional indigenous plants. In about 1998, Council also planted indigenous trees (but little understorey) along the reserve's western edge for a distance of 180 m from near the northwest corner – labelled 'Reveg' on the aerial photograph.

The northern and southern pond have been extensively planted with vigorous, non-indigenous wetland plants that are displacing the indigenous wetland flora.

Many people come to Yarrunga Reserve for its Community Centre, playground and picnic shelter. Those people may enjoy nature while they are there, even if that is not their primary reason for visiting.

While pines are enjoyed by some, they have steadily diminished the site's indigenous flora and fauna and are still causing steady deterioration. However, many indigenous plant species have the capacity to regenerate from seeds when the pines are removed, as they eventually must be. Forest birds will be the main fauna to benefit.

Relationship to other land

Croydon Hills Drive is the only thing separating Yarrunga Reserve from Candlebark Walk Reserve (Site 17), which abuts Site 16 to the immediate west. Site 16 is part of a wildlife corridor along the Jumping Creek Valley, which extends northwards through the abutting Site 14 and then through Manningham City Council's 'Biosites 3–8' to Warrandyte State Park and the Yarra River corridor. That is the route that

Shortfin Eels must have taken (in reverse) to travel from their birthplace in the Coral Sea to where they were caught in Yarrunga Reserve in 2011. They must return to the Coral Sea to breed. Birds are also likely to take that route. Birds are also likely to travel through Candlebark Walk Reserve *en route* between Yarrunga Reserve and Warranwood Reserve (Site 15). Yarrunga Reserve would be expected to have fewer forest birds if Candlebark Walk Reserve did not provide an ecological link to the west.

The movements of birds and insects through the site is important not only for the needs of the animals but also for the pollen and seeds that the animals may disperse as they go.

In most respects, Yarrunga Reserve is a terminus for wildlife movements rather than part of a corridor for travel between areas of habitat. However, waterbirds are much more prepared to traverse unsuitable habitat than most wildlife. Waterbirds that frequent Yarrunga Reserve are quite capable of crossing suburbia to get to and from other wetlands.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Messmate Stringybark (*E. obliqua*) and Red Stringybark (*E. macrorhyncha*). The other species are Mealy Stringybark (*E. cephalocarpa*), Bundy (*E. goniocalyx*) and Narrow-leaved Peppermint (*E. radiata*).

Lower trees: Strongly dominated by Blackwood (*Acacia melanoxylon*). There are also small numbers of Black Sheoak (*Allocasuarina littoralis*), Silver Wattle (*Acacia dealbata*), Black Wattle (*A. mearnsii*), Golden Wattle (*A. pycnantha*) and Cherry Ballart (*Exocarpos cupressiformis*).

Medium to large shrubs: Sweet Bursaria (*Bursaria spinosa*), Yarra Burgan (*Kunzea leptospermoides*) and Tree Everlasting (*Ozothamnus ferrugineus*) are fairly abundant. Australian Dusty Miller (*Spyridium parvifolium*) is scattered thinly.

Small shrubs: Very depleted. A few Common Flat-pea (*Platylobium obtusangulum*) grow in the small area that has fairly natural groundcover.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense and widespread.

Climbers: Mountain Clematis (*Clematis aristata*) is abundant. Common Apple-berry (*Billardiera mutabilis*) is scarce. Wonga Vine (*Pandorea pandorana*) is present but not indigenous to the area.

Creepers: Bidgee-widgee is fairly abundant.

Grasses, rushes and sedges: Abundant. Dominated in most of the EVC by Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) but Thatch Saw-sedge (*Gahnia radula*) is widespread and abundant. Leafy Wallaby-grass (*Rytidosperma fulvum*), Red-anther Wallaby-grass (*R. pallidum*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are fairly abundant. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*) are scattered thinly. Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*) are scarce.

Other groundcover: Seriously depleted. Black-anther flax-lily (*Dianella revoluta*) is fairly abundant. Honeypots (*Acrotriche serrulata*) is abundant in the small area that has fairly natural groundcover. Pale Flax-lily (*D. longifolia* var. *longifolia*) and Common Raspwort (*Gonocarpus tetragynus*) are scarce.

Swampy Riparian Complex (EVC 126, **Endangered** in the bioregion)

Canopy trees: Swamp Gum (*Eucalyptus ovata*) forms a pure stand in the northern third of the site. Further south, Messmate Stringybark (*E. obliqua*) dominates with fewer Swamp Gums. There are also a few Mealy Stringybark (*E. cephalocarpa*) and Narrow-leaved Peppermint (*E. radiata*) as outliers from the Valley Heathy Forest.

Lower trees: Swamp Paperbark (*Melaleuca ericifolia*) forms dense thickets in some areas. Otherwise, Blackwood (*Acacia melanoxylon*) is dominant. Black Wattle (*A. mearnsii*) is fairly abundant within a small area. There is a single Cherry Ballart (*Exocarpos cupressiformis*).

Shrubs: Rather abundant and rich in species in the more natural areas. The most abundant species are Common Cassinia (*Cassinia aculeata*), Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*) and Tree Everlasting (*Ozothamnus ferrugineus*). Sweet Bursaria (*Bursaria spinosa*), Yarra Burgan (*Kunzea leptospermoides*) and Australian Dusty Miller (*Spyridium parvifolium*) are scattered thinly. Prickly Moses (*Acacia verticillata*) is scarce and only a single individual was seen of Common Heath (*Epacris impressa*), Manuka (*Leptospermum scoparium*), Snowy Daisy-bush (*Olearia lirata*), Shrubby Fireweed (*Senecio minimus*) and Cotton Fireweed (*S. quadridentatus*).

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches over substantial areas. There are also three Rough Tree-ferns (*Cyathea australis*) and one Tender Brake (*Pteris tremula*), the latter being dubiously indigenous.

Climbers: Mountain Clematis (*Clematis aristata*) is fairly abundant.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is abundant and widespread. Seedlings of an unidentified crane's-bill (perhaps *Geranium homeanum*) were found in small numbers (perhaps abundant in season) and one patch of Kidney-weed (*Dichondra repens*) was found.

Grasses, rushes and sedges: Strongly dominated by Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*). Thatch Saw-sedge (*Gahnia radula*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are fairly abundant. Characteristically for Swampy Riparian Complex, Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) is present, represented by at least eight individuals in the southeast. Hollow Rush (*Juncus amabilis*) is scarce.

Other groundcover: Very depleted. There is a dense patch of Lesser Joyweed (*Alternanthera denticulata*). Common Cudweed (*Euchiton involucratus*) is scattered through a small area. Hairy Willow-herb (*E. hirtigerum*) and Tasman Flax-lily (*Dianella tasmanica*) are scarce.

Creeks, ponds and fringing mud.

Woody plants: Absent.

Shrubby herbs: There is a cluster of Pale Knotweed (*Persicaria lapathifolia*) in the retarding basin – the only record in Maroondah since 1989 – but that species is dubiously native to Victoria. Water-pepper (*P. hydropiper*) is localised in the site's south and is also dubiously native to Victoria.

Amphibious species: the following species are fairly abundant: Lesser Joyweed (*Alternanthera denticulata*), Tall Sedge (*Carex appressa*), Swamp Crassula (*Crassula helmsii*), Green Rush (*Juncus gregiflorus*), Broom Rush (*Juncus sarophorus*) and Slender Knotweed (*Persicaria decipiens*). There are a few patches of Tall Rush (*Juncus procerus*) around the northern pond and scattered plants of Swamp Club-rush (*Isolepis inundatus*) in creek channels.

Aquatic species: Water Plantain (*Alisma Plantago-aquatica*) is abundant and widespread in shallow water. Tall Spike-rush (*Eleocharis sphacelata*) dominates the pond in the retarding basin. The Cumbungi, *Typha domingensis*, is dense in another small area of water. Submerged aquatics could not be seen.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Warranwood Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – one of the dominant species in the Valley Heathy Forest;
- *Gratiola peruviana* (Austral Brooklime) – recorded in 1995, presumed destroyed by excavations in 1996 and unable to be found in 2019;
- *Poa tenera* (Slender Tussock-grass) – recorded in 1995 and perhaps still present but unable to be found in April 2019, perhaps due to the time of year;

- *Pomaderris racemosa* (Cluster Pomaderris) – seen in 1995–1996 in the south of the reserve but unable to be found in 2019;
- *Senecio minimus* (Shrubby Fireweed) – one plant was seen in 2019, just north of the southernmost pond. This species is generally subject to large population fluctuations and may have been scarcer than usual during this study's April 2019 flora survey due to drought conditions.

Other

- *Persicaria lapathifolia* (Pale Knotweed) – approximately twelve were seen immediately west of the outlet pit of the retarding basin. That is the only record of the species in Maroondah since 1989. The species is not regarded as critically endangered because: (a) there is uncertainty about whether it is native to Victoria; and (b) any plants found in Maroondah could be reasonably deemed to be a 'sink population' in the sense of the IUCN Red List international guidelines for assessing regionally threatened species.

Significant fauna

Rare or threatened in Maroondah

- Australasian Darter – one adult male was seen when the reserve was inspected for this study on 12/4/19. The previous record of the species in the reserve was in 2013, reported in eBird.

Fauna habitat

The ponds provide habitat for common waterbirds and rarely uncommon waterbirds. They also provide habitat for aquatic invertebrates, frogs, tortoises and Shortfin Eel.

In the non-aquatic environment:

- The structure and composition of the native vegetation represent supplementary habitat for common forest birds, bats and invertebrates, made less suitable by the pine trees;
- The native vegetation and its litter provide food and cover for invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The proximity to Candlebark Walk Reserve, with its ecological connection to other habitat, amplifies the habitat values above;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1); and
- While the pine trees have overwhelmingly negative consequences for wildlife, the pine nuts provide food for Yellow-tailed Black-Cockatoos.

Ecological condition

On the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the site's native vegetation comprises approximately:

- 0.1 ha in good condition (rating 'B');
- 1.8 ha in fair ecological condition (rating 'C'); and
- 1.0 ha in poor ecological condition (rating 'D') plus scattered indigenous plants beneath pines.

The ecological condition of the ponds is fair to poor (ratings 'C' to 'D').

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The area of Swampy Riparian Complex abutting Croydon Hills Drive easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Swampy Riparian Complex is listed by the state government as 'endangered' within the Gippsland Plain bioregion. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

The area of Swampy Riparian Complex and Valley Heathy Forest that lies between the retarding basin levee and the bridge west of the playground also qualifies as a patch, for the purposes of the standard condition 3.2.3. As both of those EVCs are listed as 'endangered', that patch gives the site additional **State** significance under standard criterion 3.2.3.

Rare or threatened plant species

Red Stringybark (*Eucalyptus macrorhyncha*) falls into the 'critically endangered' category of risk of dying out in Maroondah. As a dominant species in the Valley Heathy Forest of Yarrunga Reserve, the stand fits the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest and Swampy Riparian Complex.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and also immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creeks and wetlands helps to stabilise the soil and remove water pollution, including sediment.

Yarrunga Reserve's natural or semi-natural ambience is expected to be beneficial to the health, wellbeing, childhood development and quality of life of visitors to the reserve. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the reserve. The natural ambience also encourages people to get exercise by walking, running or cycling through the reserve.

Without Yarrunga Reserve and Candlebark Walk Reserve, the neighbourhood would have rather few trees and birds, and there would be quite limited opportunities for residents to enjoy nature.

Changes

Change in the extent of habitat

A combination of revegetation and growth of tree crowns has brought about an increase in the extent of habitat by 0.2 ha during the period 2001–2018, based on aerial photographs from those years.

Change in the ecological condition of habitat

The 1997 report, *'Sites of Biological Significance in Maroondah'*, provided estimates of the amount of the reserve's native vegetation that fell into each category of ecological condition on the same A–D scale as used above in the section headed 'Ecological condition'. Within the precision that can be achieved by such a categorisation, no change in ecological condition can be determined with any confidence. This study gave a 'B' rating to a small area (0.1 ha) next to 42 Settlers Hill Crescent whereas the highest rating in the 1997 report was 'C', but that difference could be due simply to the earlier report not focussing on such a small area. That possibility is supported by the fact that the flora survey for the 1997 report detected more indigenous plant species than 2019.

The 1997 report referred to extensive excavations and works around the ponds in 1996. It was presumed that those works had destroyed the populations of several rare wetland plant species seen in 1995 (see below). The works evidently resulted in steeper banks to some of the pond margins, which has significantly deteriorated the habitat for indigenous wetland plants. More recently, very vigorous, non-indigenous wetland plants have been planted, such as *Bolboschoenus medianus/fluviatilis*, *Lycopus australis* and *Schoenoplectus tabernaemontani*. Those plants are displacing the indigenous wetland flora.

Changes in the species present

This study's 2½-hour, unexhaustive assessment of Yarrunga Reserve found 66 naturally-occurring, indigenous plant species whereas the 1995 assessment detected 70. The former was done in April 2019, which would have caused about ten species to be overlooked for seasonal reasons, whereas the 1995 study was done in December, when fewer species are undetectable. Although the two surveys detected very similar numbers of species, there was a substantial difference in the particular species detected: The 2019 study detected 21 species not found in 1995 and the 1995 study detected 25 species not found in 2019.

The rarest plants detected in 1995 (*Gratiola peruviana*, *Patersonia occidentalis* and *Pomaderris racemosa*) could not be found in 2019 despite searching and they have probably died out. The 1997 report presumed that the first two of these species were destroyed by excavations in 1996. Conversely, *Senecio minimus* is in the 'critically endangered' category of risk of dying out in Maroondah and was found only in 2019, not 1995.

Threats

This study has identified the following threats to the reserve's biodiversity (in approximately decreasing order):

- Worsening decline and loss of indigenous flora as the pine trees grow, exacerbated by the increased incidence and severity of droughts predicted to result from climate change;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Progressive displacement of indigenous wetland plants by vigorous, non-indigenous species that have been planted around the ponds; and
- Worsening of the extremes of low and high creek flows, causing erosion and siltation. Increased extreme flows is an expected a consequence of climate change. It may also arise from further urbanisation of the catchment.

Strategic planning

The zoning of Site 18 (and Yarrunga Reserve more generally) is an enigmatic mixture of 'Neighbourhood Residential Zone – Schedule 4' and 'Public Park and Recreation Zone'.

The whole reserve is covered by:

- The state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions;
- Schedule 4 of the Significant Landscape Overlay; and
- The Vegetation Protection Overlay (VPO).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the whole reserve and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 18, i.e. the area outlined in mid-blue on the aerial photograph on p. 131. However, if desired, the area covered by ESO1 could be enlarged to provide a simpler boundary and/or to anticipate revegetation that Council has in mind to expand the habitat.

Restoration opportunities

While the continuing growth of pines is the greatest threat to the survival of much of the reserve's natural habitat, that threat is reversible if the pines are removed before the bank of indigenous plant seeds in the soil is exhausted. Pine removal projects in other parts of Maroondah have brought about remarkable regeneration of indigenous plants, e.g. at Dexters Bush (Site 76).

Removal of pines next to 42 Settlers Hill Crescent would not only stimulate regeneration of an endangered Ecological Vegetation Class but also remove the risk of the pines falling onto adjacent houses.

The pines close to houses will certainly need to be removed eventually for safety reasons. Each year of delay results in increased cost and increased risk of a pine falling down.

The 0.48 ha of lawn in the north of the reserves (excised from Site 18) offers an easy opportunity for revegetation, though some of it should be left clear of plants to provide passive surveillance for the security of walkers.

Information sources

The analysis above draws on the following sources of information about the site:

- A 2½-hour site assessment specifically for this study on 12th April 2019;
- An incidental observation of Australasian Darter during the site assessment;
- Three bird lists by Caroline MacDonald during 2011–2013, totalling 16 species, available from the eBird website;
- Records in the Victorian Biodiversity Atlas (VBA) of three Shortfin Eels and two Common Long-necked Tortoises seen by Danielle Stokeld in 2011;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on a detailed flora survey throughout, a 20-minute bird census, incidental fauna observations, a mammal hair survey and a frog call survey – all in December 1995; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No other useful information could be found in the VBA or the Atlas of Living Australia. Note that three records of Victorian Smooth Froglet in the Melbourne Water Frog Census have their coordinates given as being in Yarrunga Reserve but the associated data states that the observations were at Belgrave, Ivanhoe and Wantirna.

Site 19. Settlers Orchard Reserve, Croydon Hills

Biological Significance Level: *Not significant*



Boundary, land use and tenure

The image above shows an aerial photograph from February 2017 overlaid with relevant boundaries. The site corresponds exactly to the single property that forms Settlers Orchard Reserve, outlined above in mid-blue. The reserve is managed for drainage, recreation and pedestrian thoroughfare. The area is 2.7 ha.

General description

Site 19 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was recognised as being significant at the 'Local' level because: 'This site is biologically degraded, but it contains a representation of a rare habitat type and it augments highly significant habitat to the north and west'.

Settlers Orchard Reserve remains biologically degraded and a substantial fraction of the plant species observed in 1995–1996 have died out. To be precise, six of the thirteen non-aquatic plant species recorded in 1995–1996 have convincingly died out and another three may have died out. Altogether, thirteen naturally-occurring, indigenous plant species were observed in the reserve during this study.

The natural vegetation is limited to:

- A strip of mature to large Bundy trees (*Eucalyptus goniocalyx*) than runs beside Billabong Close and northeast of the pond. Some of the trees have hollows that would suit roosting or nesting by microbats and certain possums, birds and insects;

- Scattered native grasses beneath the strip of Bundy trees, regularly mown;
- Nine mature to large Swamp Gums (*Eucalyptus ovata*), some with hollows;
- Scattered wetland plants among weeds in the drain north-northwest of the pond; and
- Rushes and other common wetland plants fringing the pond.

Roughly half of the reserve's trees have been planted, particularly Manna Gums (*Eucalyptus viminalis* subsp. *viminalis*). The lawns that cover most of the reserve comprise introduced grass species.

When the reserve was inspected during this study (April 2019), only thirteen indigenous plant species were found. A few more would be expected in spring and once the pond recovers from recent dredging to remove silt. The only places where indigenous understorey species provided at least 10% cover were in some strips less than 1m wide around the edge of the site's pond. Those strips will broaden as time passes since the recent dredging, hopefully returning to the pre-dredging extent of 400–500 m² (estimated from a 2017 aerial photograph).

Biological significance ratings

The following is an assessment of the site's significance against the Victorian Government's *'Standard Criteria for Sites of Biological Significance in Victoria'* (Amos 2004), which are summarised on p. 2:

- The reserve falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the reserve is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The reserve is not believed to be part of a habitat corridor (as per standard criteria 1.2.6 and 1.3) but is at best a terminus or dead-end for fauna that need habitat continuity;
- Standard criterion 2 is not met because the reserve does not have an unusually high diversity of species or communities (quite the contrary) and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because no rare or threatened species are present and none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the reserve does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the reserve is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the reserve is not believed to be the type locality of any taxon.

The standard criteria direct that any site that fails to meet any of these criteria should be designated 'Not significant' under those criteria.

Other values

Just because a site does not have biological significance does not mean its vegetation is insignificant from other perspectives. As discussed in Section 1.3 of Volume 1, the criteria applied above do not consider ecosystem services, natural heritage values or the reserve's capacity to satisfy or foster people's attachment to nature. Those attributes are considered in the following three paragraphs.

The reserve's tree canopy reduces wind speed to a small degree. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate slightly warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and also immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creek and pond helps to stabilise the soil and remove water pollution, including sediment.

The reserve's trees, pond and rushes provide the local community with a low-level experience of the natural world. As explained in Section 1.3 of Volume 1, contact with nature has been shown to be beneficial to health, wellbeing, childhood development and quality of life. To a small degree, those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the reserve.

Changes

Change in the extent of habitat

Comparison of aerial photographs from 2001 and 2017 shows that the reserve's eucalypts – both planted and wild – have grown. The enlarged crowns have brought about a small increase in the extent of tree cover.

The aerial photographs show an increase in the extent of aquatic plants in the pond between 2001 and 2017. However, the extent reduced to less than 2001 levels in January 2019 due to dredging of the pond to remove silt.

Change in the ecological condition of habitat

The 1995–1996 flora survey of the reserve for the 1997 report, *'Sites of Biological Significance in Maroondah'*, assessed all of the native vegetation to be in poor ecological condition, falling into category 'D' of the A–D scale used in that report. The same remains true. There is insufficient information to determine any change within the 'D' category.

Changes in the species present

Twenty-two indigenous plant species were recorded in 1995–1996 (except that one of them – *Juncus* sp. – may have embraced multiple species). In April 2019, fifteen indigenous plant species were found but two of them were probably planted. While some of the difference might be due to the time of year and loss of vegetation when the pond was dredged in 2019, the following species have convincingly died out: *Adiantum aethiopicum, Cassinia aculeata, Dianella revoluta, Exocarpos cupressiformis, Lomandra longifolia* and *Pteridium esculentum*. These are all forest species. Aquatic and amphibious species have fared much better, despite the 2019 dredging.

Strategic planning

Settlers Orchard Reserve is zoned 'Public Park and Recreation Zone' except for the walkway to Merrill Crescent, which is 'Neighbourhood Residential Zone – Schedule 4'. The whole reserve is covered by:

- The state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions;
- The Vegetation Protection Overlay (VPO);
- Schedule 4 of the Significant Landscape Overlay (SLO4); and
- The Bushfire Management Overlay.

Because the reserve does not qualify as biologically significant and its native understorey is limited to grasses in lawn and some hardy wetland species, it would be inappropriate to apply the proposed schedule ESO1 described in Section 11.1.2 of Volume 1. The nature of the habitat is a good fit to the proposed schedule ESO2 but application of that schedule might be deemed unnecessary because:

- The reserve is presumably not vulnerable to subdivision; and
- Clause 52.17 and SLO4 provide a reasonable level of protection for the eucalypts and the wetland plants fringing the pond.

Taking into account the preceding information, the most appropriate options for planning controls to protect nature and its benefits to humans are:

- Keep the existing VPO; or

- Remove the VPO and leave clause 52.17 and SLO4 to protect the vegetation; or
- Remove the VPO and replace it with the proposed schedule ESO2.

Because the level of protection of the reserve's vegetation relates principally to matters other than biological significance, no recommendation is provided here for which of the three options above is the best fit for Maroondah City Council's policies, strategies and objectives.

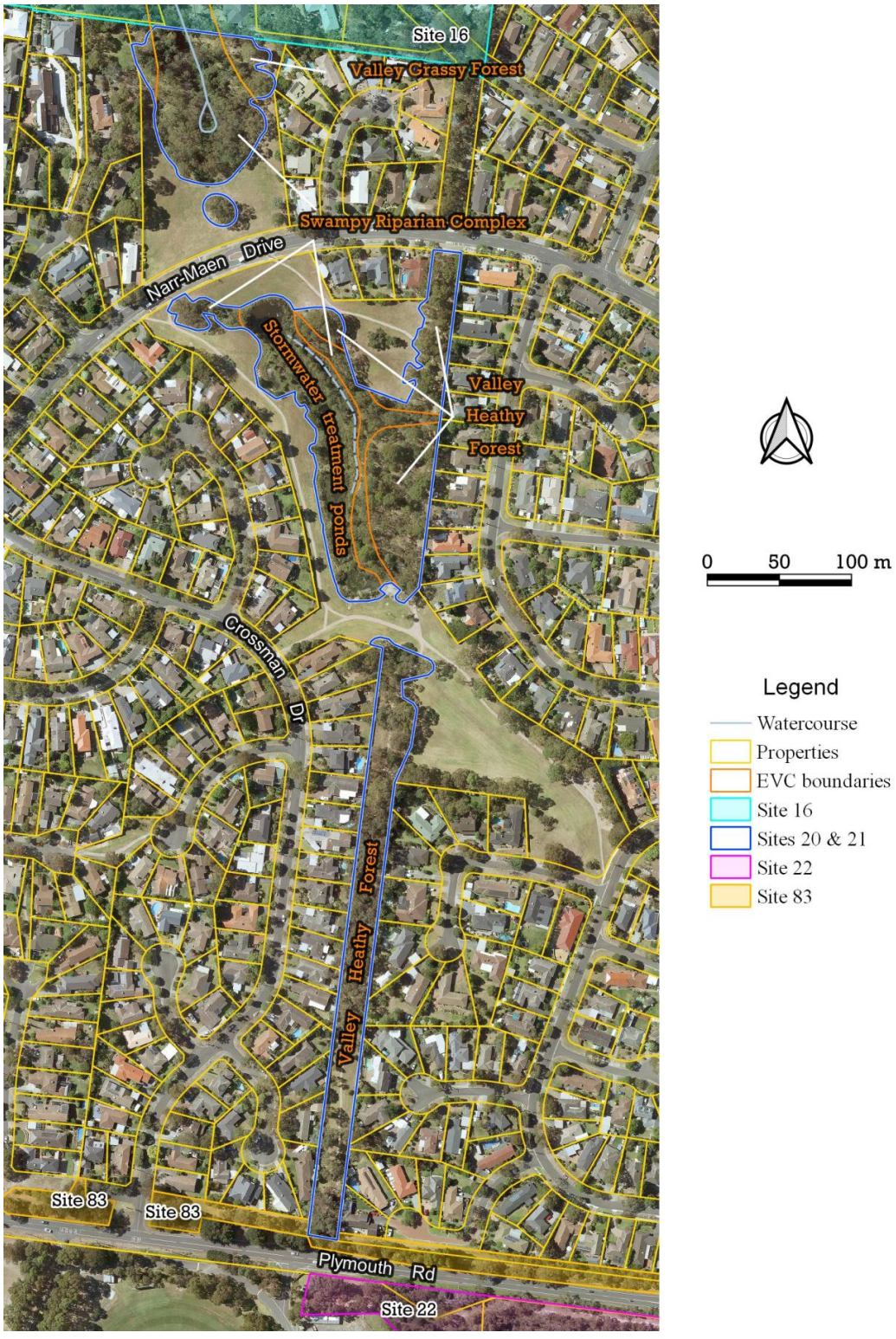
Information sources

The analysis above draws on the following sources of information about the site:

- A total of one hour of site assessment specifically for this study in April 2019;
- Six bird lists from 2011–2019 available from the eBird website, totalling 39 species as at 19th April 2019;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on a flora survey, incidental fauna observations, a frog call survey and spotlighting for nocturnal animals – all in 1995–1996;
- Aerial photographs from 1945, 2001, 2011 and 2017.

Sites 20 & 21. Narr-Maen Reserve

Biological Significance Level: *State* due to threatened vegetation types



Boundaries, land use and tenure

The image on the previous page shows an aerial photograph from February 2017 overlaid with relevant boundaries. The 1997 report, *'Sites of Biological Significance in Maroondah'*, designated the whole of the reserve north of Narr-Maen Drive as Site 20 and the whole of the rest of Narr-Maen Reserve as Site 21. The approach taken here is to combine the description of these sites and their attributes. Because the sites contain such a large proportion of land with no biological significance, it has been deemed appropriate to contract the site boundaries to the significant parts, which are outlined above in mid-blue. All the parts are council reserve, managed for drainage, stormwater treatment, nature conservation, recreation and pedestrian thoroughfare.

General description

Narr-Maen Reserve occupies 3.5 hectares at the headwaters of one arm of what is now known as Jumping Creek. 'Narr-Maen' appears to be a variant of Narr-meian, which was the name of Jumping Creek until at least the middle of the 20th Century.

Several decades ago, a retarding basin was created within what is now the reserve by constructing an earthen dam, whose base is 100 m wide. Narr-Maen Drive now follows the crest of the dam. The dam and road bisect the reserve and act as inhibitors of movement of fauna, pollen and seeds.

The dam at Narr-Maen Drive coincides with the approximate alignment of the boundary between two bioregions: the Gippsland Plain to the south and the Highlands - Southern Fall to the north. For example, Candlebark (*Eucalyptus rubida*) occurs to the north but not the south, and *vice versa* for Mealy Stringybark (*E. cephalocarpa*).

Around 2004, the creek and its fringing wetlands were excavated to create a system of stormwater treatment ponds. Some rare wetland plants appear to have been lost in the process. Since construction, a range of indigenous and non-indigenous wetland plants have been planted in and beside the ponds. Some of the non-indigenous species, such as River Club-rush (*Schoenoplectus tabernaemontani*) are extremely vigorous and are competing strongly against the surviving indigenous species. Nevertheless, the ponds still provide habitat for waterbirds and pondlife.

The aerial photograph on the previous page shows that to the east of the ponds, there are three areas of the endangered vegetation type, Valley Heathy Forest. Referring to the most southerly of those areas, the 1997 report, *'Sites of Biological Significance in Maroondah'*, remarked how regular mowing was restricting the indigenous groundcover. Maroondah City Council ceased the mowing in late 2014. The area was then fenced and has been given extensive restoration work, including the planting of many wildflowers. This area is dominated by an impressive stand of Yellow Box trees (*Eucalyptus melliodora*).

Immediately north of that area is a strip of vestigial Valley Heathy Forest that extends northward to Narr-Maen Drive. Merrill Crescent ran along this strip until at least the mid-1970s and it retains many indigenous trees (mainly Bundy, *Eucalyptus goniocalyx*) but hardly any indigenous understorey.

The aerial photograph on the previous page shows a substantial gap in the tree canopy immediately southeast of the string of stormwater treatment ponds. The gap has a broad expanse of lawn with a path heading east from Crossman Drive. Site 21 extends south of that gap in a narrow strip to Plymouth Road, along part of the original Merrill Crescent. The strip has a fragmented canopy of an almost pure stand of Mealy Stringybarks (*Eucalyptus cephalocarpa*). As with the northern section of the original Merrill Crescent, there is very little indigenous understorey.

Altogether, sixty-nine naturally-occurring, indigenous plant species were observed in the reserve during this study.

Relationship to other land

The part of Narr-Maen Reserve north of Narr-Maen Drive (i.e. Site 20) abuts Site 16. The only reason for treating the two sites as separate is because of the different land use, tenure and associated issues. Birds, wallabies, insects, pollen and seeds are certain to cross the boundary frequently. The suitability of Site 16

for indigenous flora and fauna is not significantly affected by the presence of Site 20 but the reverse is not true.

Narr-Maen Drive and the grassed earthen dam on which it is situated inhibit movements of the shyer or less mobile fauna such as wallabies and lizards. The more mobile fauna cross the road between Sites 20 and 21. Some may also travel along the narrow strip of trees along the former route of Merrill Crescent to Plymouth Road. However, many (perhaps most) fauna species that make use of a corridor as rudimentary as the former route of Merrill Crescent are also capable of moving through residential areas. Adding understorey to that strip would increase the range of fauna species likely to move along it. There would then be a better ecological connection between forest at the Yarra Valley Grammar School (Site 22) and Site 16. Each of those sites is, in turn, connected to larger areas of habitat along Mullum Mullum Creek and Jumping Creek, respectively.

For the reasons above, the *'Maroondah Habitat Corridors Strategy'* gives the whole site 'very high conservation priority'.

Bioregions: Highlands - Southern Fall north of Croydon Hills Drive; Gippsland Plain south

Habitat types

The descriptions of vegetation below include only the wild, indigenous plant species seen in 2019. So many indigenous plants have been planted that one or two of the species mentioned below may have been planted, even though the author took care to assess that possibility and check the available planting lists. 'EVC' means 'Ecological Vegetation Class'.

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion) – reduced to one Candlebark (*Eucalyptus rubida*), one Messmate Stringybark (*Eucalyptus obliqua*) and mown grass, in the northeast corner. This EVC is better developed on abutting private land to the north, where *E. melliodora* is conspicuous.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion) – Mealy Stringybark variant, in the narrow strip from Plymouth Road to the accessway from Crossman Drive, tending toward Swampy Woodland:

Canopy trees: An almost pure stand of Mealy Stringybark (*Eucalyptus cephalocarpa*).

Lower trees: Represented by a few Blackwood (*Acacia melanoxylon*) within one small area and a Silver Wattle (*A. dealbata*) that may have been planted.

Medium to large shrubs: Represented only by three Yarra Burgan (*Kunzea leptospermoides*), near Plymouth Road.

Small shrubs: None.

Ferns: None.

Climbers: None.

Creepers: None.

Grasses, rushes and sedges: There are a few small patches of Thatch Saw-sedge (*Gahnia radula*) near Plymouth Road.

Other groundcover: None.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion) – Yellow Box variant, north of the access from Crossman Drive:

Canopy trees: Dominated by Yellow Box (*Eucalyptus melliodora*), followed by Bundy (*E. goniocalyx*), Narrow-leaved Peppermint (*E. radiata*), Messmate Stringybark (*E. obliqua*) and Red Stringybark (*E. macrorhyncha*). There are also a few Swamp Gums (*E. ovata*) that can be regarded as outliers from the adjacent Swampy Riparian Complex.

Lower trees: Depleted. Blackwood (*Acacia melanoxylon*) is fairly sparse, there are three Black Wattles (*A. mearnsii*) and only one individual of Cherry Ballart (*Exocarpos cupressiformis*) was found.

Medium to large shrubs: Patchy. The more abundant species are Sweet Bursaria (*Bursaria spinosa*), Sifton Bush (*Cassinia sifton*) and Hop Goodenia (*Goodenia ovata*). Hedge Wattle (*Acacia paradoxa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*) and Rough Fireweed (*Senecio hispidulus*)

are scarce. A single Common Cassinia (*C. aculeata*) and a single Shiny Cassinia (*C. longifolia*) were found but they may have been planted.

Small shrubs: Scarce. Common Flat-pea (*Platylobium obtusangulum*) is the most abundant species. Silky Daisy-bush (*Olearia myrsinoides*) and Grey Parrot-pea (*Dillwynia cinerascens*) are scarce but the latter may be present solely due to planting.

Ferns: There are patches of Austral Bracken (*Pteridium esculentum*).

Climbers: Mountain Clematis (*Clematis aristata*) is fairly abundant. Common Apple-berry (*Billardiera mutabilis*) is scarce. Coarse Dodder-laurel (*Cassytha melantha*) and Purple Coral-pea (*Hardenbergia violacea*) are very scarce and the latter may have been planted.

Creepers: Rainforest Crane's-bill (*Geranium homeanum*) is scattered thinly.

Grasses, rushes and sedges: Dominated in different areas by Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) or Thatch Saw-sedge (*Gahnia radula*). Purplish Wallaby-grass (*Rytidosperma tenuius*) and the broad-leaf form of Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) are abundant. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Red-anther Wallaby-grass (*R. pallidum*), Bristly Wallaby-grass (*R. setaceum*) and Kangaroo Grass (*Themeda triandra*) are fairly abundant. Short-stem Sedge (*Carex breviculmis*), Finger Rush (*Juncus subsecundus*) and the fine-leafed form of Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*) are scarce.

Other groundcover: The species seen in the 2019 survey were Chocolate Lily (*Arthropodium strictum*), Black-anther flax-lily (*Dianella revoluta*), Tasman Flax-lily (*D. tasmanica*), Common Raspwort (*Gonocarpus tetragynus*), Wiry Buttons (*Leptorhynchos tenuifolius*), Small Poranthera (*Poranthera microphylla*) and Yellow Rush-lily (*Tricoryne elatior*).

Swampy Riparian Complex (EVC 126, **Endangered** in both bioregions)

Canopy trees: Swamp Gum (*Eucalyptus ovata*) is overwhelmingly dominant.

Lower trees: Swamp Paperbark (*Melaleuca ericifolia*) forms dense thickets. Blackwood (*Acacia melanoxylon*) is fairly abundant. Black Wattle (*A. mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*) are scarce.

Shrubs: The most abundant species are Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*), Hop Goodenia (*Goodenia ovata*) and Tree Everlasting (*Ozothamnus ferrugineus*). Characteristically of Swampy Riparian Complex, Prickly Moses (*Acacia verticillata*) and Shrubby Fireweed (*Senecio minimus*) are present (if very scarce in this instance).

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches over substantial areas.

Climbers: Mountain Clematis (*Clematis aristata*) is fairly abundant.

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is in the far north, where it is very scarce and arguably an outlier of the abutting Valley Grassy Forest.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is fairly abundant. Rainforest Crane's-bill (*Geranium homeanum*) is scattered (perhaps abundant in season). The wood-sorrel, *Oxalis exilis/perennans* is very scarce.

Grasses, rushes and sedges: Greatly depleted, but Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is fairly dense and widespread. Thatch Saw-sedge (*Gahnia radula*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are fairly abundant north of Narr-Maen Drive but absent or scarce to the south. South of Narr-Maen Drive, Common Love-grass (*Eragrostis brownii*) and Common Bog-rush are fairly abundant in a small area beside the most northerly pond. Purplish Wallaby-grass (*R. tenuius*) is scarce.

Other groundcover: None seen.

Creek, ponds and fringing mud (no EVC is recognised by the state government)

Woody plants: Absent except for some encroachment of Swamp Paperbark (*Melaleuca ericifolia*) from thickets in the Swampy Riparian Complex.

Amphibious species: the following species are fairly abundant: Lesser Joyweed (*Alternanthera denticulata*), Tall Sedge (*Carex appressa*), Hairy Willow-herb (*Epilobium hirtigerum*), Green Rush (*Juncus gregiflorus*), Angled Lobelia (*Lobelia anceps*), Lesser Loosestrife (*Lythrum hyssopifolia*) and Slender Knotweed (*Persicaria decipiens*).

Aquatic species: Water Plantain (*Alisma plantago-aquatica*) is widespread and fairly abundant in shallow water. The Cumbungi, *Typha domingensis*, forms dense patches in ponds. Submerged aquatics could not be seen.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Narr-Maen Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – there are four in the Valley Heathy Forest to the east of the stormwater treatment ponds, in fair to poor health (as is typical in Maroondah in 2019);
- *Eucalyptus rubida* (Candlebark) – as single tree in the Valley Grassy Forest;
- *Gratiola pubescens* (Glandular Brooklime) – recorded in 1996 in a wetland that was subsequently excavated to become part of the current-day stormwater treatment ponds. It could not be found in the April 2019 flora survey for this study but there is still a chance that it regenerated following the construction and periodic desilting of the stormwater treatment ponds;
- *Senecio minimus* (Shrubby Fireweed) – three plants were seen in the Swampy Riparian Complex north of Narr-Maen Drive in 2019. This species is generally subject to large population fluctuations and may have been scarcer than usual during this study's flora survey due to drought conditions.

Significant fauna

Rare or threatened in Maroondah

- Australasian Darter – recorded by Caroline MacDonald in 2013, reported in eBird – evidently only a rare visitor to the site;
- Southern Boobook – recorded by Caroline MacDonald in 2011, reported in eBird – evidently another rare visitor to the site, perhaps resident in Site 16;
- Golden-headed Cisticola – recorded by Caroline MacDonald in 2000, reported in eBird – evidently no longer resident in the area.

Fauna habitat

The creek and stormwater treatment ponds provide habitat for common waterbirds and rarely uncommon waterbirds. They also provide habitat for aquatic invertebrates, frogs and probably Shortfin Eel (though the eels may not reach south of Narr-Maen Drive).

In forested areas north of the accessway from Crossman Drive:

- The structure and composition of the Valley Heathy Forest and Swampy Riparian Woodland represents supplementary habitat for common forest birds, bats and invertebrates;
- Hollows in some of the eucalypts offer roost sites or nest sites for some animals, including microbats;
- The native vegetation and its litter provide food and cover for invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The location next to Site 16 amplifies the habitat values above (but to a lesser degree, south of Narr-Maen Drive); and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

In the narrow strip that extends northward from Plymouth Road, the eucalypt canopy provides basic habitat for common some birds and insects. It also represents a fragmented corridor for movement of flying fauna. However, most of those fauna would also be prepared to fly over the surrounding residential area.

Ecological condition

On the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), this study's assessment in 2019 is that:

- The Valley Grassy Forest is in poor condition (rating 'D');
- Roughly two-thirds of the Swampy Riparian Complex north of Narr-Maen Drive is in fair ecological condition (rating 'C') and the rest is in poor condition;
- All of the Swampy Riparian Complex south of Narr-Maen Drive is in poor condition;
- The Valley Heathy Forest north of the accessway from Crossman Drive is almost all in fair ecological condition;
- The Valley Heathy Forest in the narrow strip extending northward from Plymouth Road is all in poor ecological condition; and
- The ponds are in fair to poor condition but may improve as they recover from recent desilting work.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The area of Swampy Riparian Complex north of Narr-Maen Drive (in Site 20) easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Swampy Riparian Complex is listed by the state government as 'endangered' within both the Gippsland Plain bioregion and the Highlands - Southern Fall bioregion. It follows that Site 20 meets standard criterion 3.2.3 for a site of **State** significance.

The area of Valley Heathy Forest between Narr-Maen Drive and the accessway from Crossman Drive (in Site 21) easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that Site 21 meets standard criterion 3.2.3 for a site of **State** significance.

The area of Valley Heathy Forest in the narrow strip extending north from Plymouth Road has too little native understorey to qualify as a 'patch' for the purposes of standard criterion 3.2.3.

The Valley Grassy Forest in the northeast of Site 20 probably does not qualify as a patch unless one includes the mown lawn of native grass.

Rare or threatened plant species

Red Stringybark (*Eucalyptus macrorhyncha*) falls into the 'critically endangered' category of risk of dying out in Maroondah. The four individuals in the Valley Heathy Forest east of the stormwater treatment ponds are not very healthy but they may well have a viable future, taking into account the trees in nearby Site 16. The stand therefore fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The three plants of Shrubby Fireweed (*Senecio minimus*) seen in April 2019 north of Narr-Maen Drive are believed to be the tip of a larger population extending through Sites 14–18. The numbers of the species observed in this study are probably reduced by drought and are expected to increase. The population therefore fits the same quote from standard criterion 3.1.5 as Red Stringybark, meaning Local significance.

Ecological corridor

As discussed above, the *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives a 'very high corridor conservation priority' to the habitat link that Narr-Maen Reserve provides between the Mullum Mullum Creek corridor and the Jumping Creek corridor. That priority relates not so much to the reserve's current (limited) use as a wildlife corridor but to the potential for more fauna usage if improvements are made. Specifically, those improvements relate to the canopy continuity and indigenous understorey cover in the narrow strip extending between Plymouth Road and the stormwater treatment ponds.

Because the reserve is probably not functioning well as a corridor at present, standard criterion 1.2.6 is probably not applicable. Because it is given 'very high conservation priority' for its potential to be an effective corridor, it better fits the description in standard criterion 1.3.3, 'Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor… Site (or one of a group of such sites) to form a strategic corridor of local importance and scale'. That description applies to a site of Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest and Swampy Riparian Complex.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and also immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creek and ponds helps to stabilise the soil and remove water pollution, including sediment.

Narr-Maen Reserve's natural or semi-natural ambience is expected to be beneficial to the health, wellbeing, childhood development and quality of life of visitors to the reserve. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the reserve. The natural ambience also encourages people to get exercise by walking, running or cycling through the reserve.

The reserve's location along a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Changes in the extent of habitat has been investigated by comparing aerial photographs from 2001 and 2017. Over that period, the area of wetland habitat has increased due to the construction of the stormwater treatment ponds south of Narr-Maen Drive. The stormwater treatment ponds replaced all the pre-existing wetland area as well as some Swampy Riparian Complex but these changes involve replacement of habitat with artificial habitat rather than an unequivocal loss of habitat. Tree deaths caused a small decrease in the extent of tree canopy in the narrow strip extending northwards from Plymouth Road. Tree deaths also

caused the loss of approximately 300 m² of eucalypt canopy north of Narr-Maen Drive. No other changes could be discerned.

Change in the ecological condition of habitat

The 1997 report, *'Sites of Biological Significance in Maroondah'*, provided estimates of the amount of the reserve's native vegetation that fell into each category of ecological condition on the same A–D scale as used above in the section headed 'Ecological condition'.

Within the precision that can be achieved by such a categorisation, no change in ecological condition can be determined north of Narr-Maen Drive.

South of Narr-Maen Drive, the condition of the Swampy Riparian Complex has deteriorated significantly, probably as an outcome of the construction of the stormwater treatment ponds. The condition of the abutting Valley Heathy Forest has improved significantly, which can be attributed to cessation of mowing, the erection of protective fences and the application of ecological restoration work since late 2014.

The ecological condition of the vegetation in the narrow strip of trees extending northward from Plymouth Road was poor in 1996 and remains so in 2019.

Changes in the species present

A number of indigenous plant species found in the Valley Heathy Forest east of the stormwater treatment ponds in 2019 were not detected in 1996. That can be explained by the cessation of the mowing occurred there until late 2014.

Several wetland plant species found in 1996 could not be found in April 2019. They may have died out during the construction of the stormwater treatment ponds in the 2000s or they may have regenerated but escaped detection in the drought conditions leading up to the 2019 flora survey.

Other differences between the plant species detected in 1996 and 2019 might be explained by normal, reversible variability in vegetation and by differences between observers.

Threats

This study has identified the following threats to the reserve's biodiversity (in approximately decreasing order):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous forest plants by introduced plants such as Sweet Pittosporum and Cocksfoot, particularly north of Narr-Maen Drive;
- Progressive displacement of indigenous wetland plants by vigorous, non-indigenous species that have been planted around the stormwater treatment ponds;
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and possibly further urbanisation of the catchment; and
- Water pollution, if the strong smell of sewage encountered north of Narr-Maen Drive in April 2019 is other than a transient problem.

Strategic planning

The whole of Narr-Maen Reserve is covered by:

- The 'Public Conservation and Resource Zone';

- The state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions;
- Schedule 4 of the Significant Landscape Overlay; and
- The Vegetation Protection Overlay (VPO).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the whole reserve and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the areas outlined in mid-blue on the aerial photograph on p. 143. However, if desired, the area covered by ESO1 could be enlarged to provide a simpler boundary and/or to anticipate revegetation that Council has in mind to expand the habitat.

The inclusion within the overlay of the narrow strip extending northward from Plymouth Road takes into account that the *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives a 'very high corridor conservation priority' to the habitat link that Narr-Maen Reserve provides between the Mullum Mullum Creek corridor and the Jumping Creek corridor. If Maroondah City Council plans to act on the strategy and improve the habitat connectivity, it would be appropriate to extend ESO1 to link the narrow strip to the southern end of the stormwater treatment wetlands and the abutting Valley Heathy Forest.

Restoration opportunities

As discussed above, the value of Narr-Maen Reserve as a habitat corridor could be significantly improved by improving the canopy continuity and indigenous understorey cover from Plymouth Road to the southern end of the stormwater treatment wetlands and the abutting Valley Heathy Forest.

Information sources

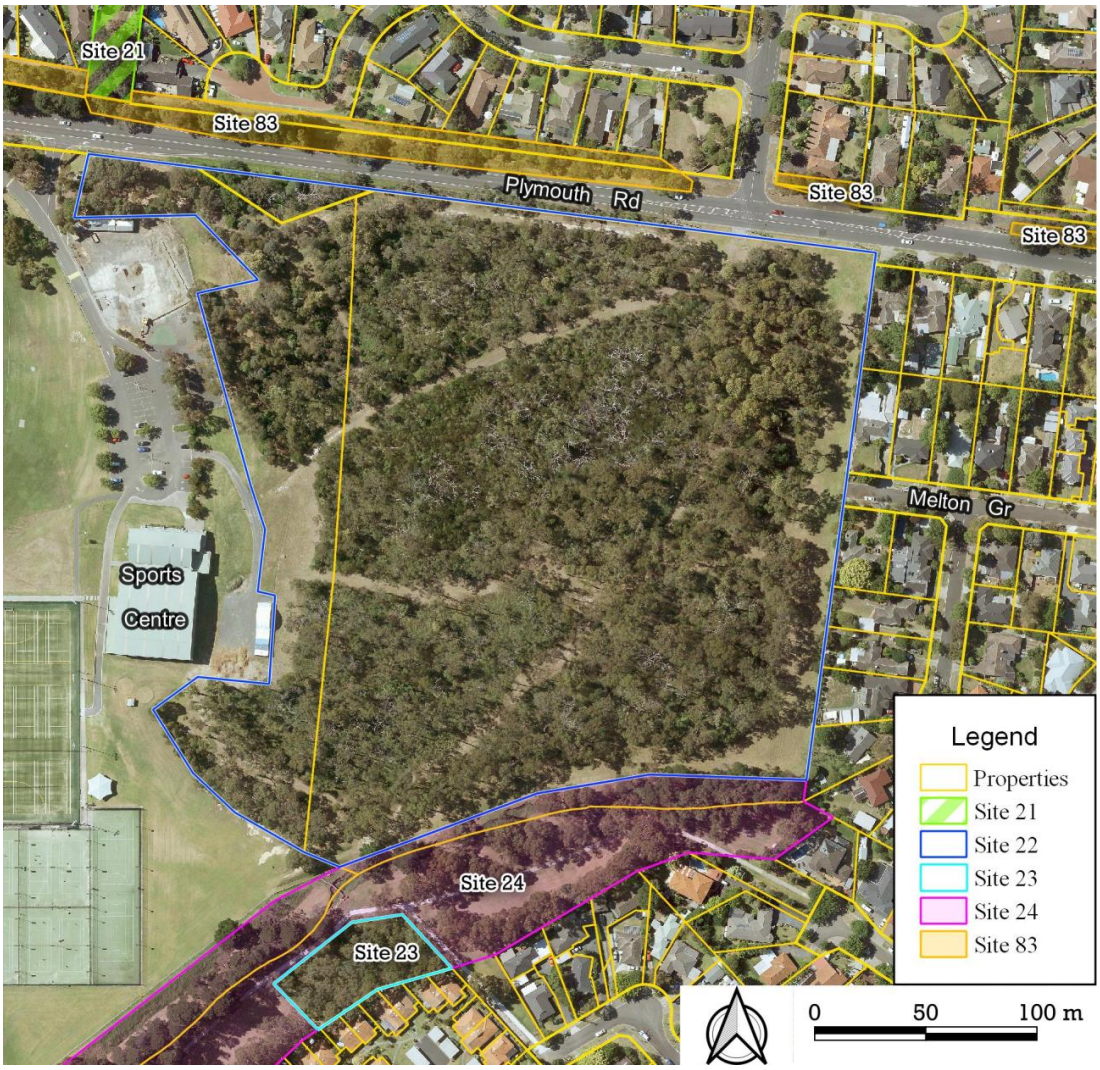
The analysis above draws on the following sources of information about the site:

- A three-hour site assessment specifically for this study in April 2019, including compilation of six lists of wild, indigenous plants, as well as incidental observations of fauna;
- 36 bird lists from 2000–2019 available from the eBird website, totalling 58 species as at 19th April 2019;
- Five bird lists for EAGA monitoring during 2015–2016 (containing only common species), curated by Birds Australia and available from the Atlas of Living Australia;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on a detailed flora survey in 1996 and concurrent incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas (VBA). Note that the VBA's mapped location of quadrat no. E1199400 within the stormwater treatment ponds is evidently erroneous and appears to be from a garden. Note also that the state government's vegetation mapping wrongly depicts Valley Heathy Forest as extending north of Narr-Maen Drive.

Site 22. Yarra Valley Grammar School, Ringwood

Biological Significance Level: *State* due to an endangered vegetation type



Boundaries, land use and tenure

The site is part of the Yarra Valley Grammar School's grounds. The image above shows an aerial photograph from February 2017 overlaid with relevant boundaries. Compared with the original version of Site 22 in the 1997 report, *'Sites of Biological Significance in Maroondah'*, the western boundary has been adjusted to account for clearing in the interim and to more precisely follow the edge of the native vegetation. The eastern boundary has been shifted to the property boundary because the edge of the habitat is very close to the property boundary. The southern boundary follows a tall, chain-mesh fence.

General description

This little-used patch of forest in the east of the schoolgrounds occupies 7.5 hectares. It abuts the bank of Mullum Mullum Creek to the south but the catchment is so narrow at this point that the northern two-thirds of the site form the source of Jumping Creek. There is only 7 m variation in elevation across the site, most

of which occurs in the northwest. Consequently, the site drains rather slowly. On the other hand, the site's position on a saddle means it receives very little runoff or sub-surface drainage from elsewhere, so the soil normally becomes quite dry in summer. These conditions have led to the development of the endangered vegetation community, Valley Heathy Forest. They have also favoured some locally rare plants.

As with nearly all native forest in Victoria, the vegetation in Site 22 is natural regrowth following past clearing. The exception is a small plantation of non-indigenous trees near the site's northeast corner.

The northern half of the forest was burned in 2010 and the southern half was burned in 2013. The burns caused the regeneration of some rare plants whose seed must have been stored in the soil for many years. Some of them appear to have already become undetectable again.

One hundred and twelve naturally-occurring, indigenous plant species were observed in the site during this study.

Relationship to other land

The site abuts the Mullum Mullum Creek habitat corridor (Site 24), which provides an ecological link to the southwest. That link probably increases the rate of visitation by fauna that are rather mobile, such as forest birds and Eastern Grey Kangaroos. (Kangaroo droppings were seen in Site 22 during this study).

The *'Maroondah Habitat Corridors Strategy'* gives 'very high conservation priority' to the currently badly fragmented corridor to the north through Narr-Maen Reserve (Site 21). If the fragmentation is reduced, more mobile fauna would be expected to visit Site 22. Increasing the continuity of vegetation on the opposite side of Plymouth Road (Site 83) will assist those visits.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Messmate Stringybark (*E. obliqua*). There are lesser numbers of Bundy (*E. goniocalyx*), Red Stringybark (*E. macrorhyncha*) and Narrow-leaved Peppermint (*E. radiata*). There are also two Swamp Gums (*E. ovata*) that can be regarded as outliers from the adjacent Mullum Mullum Creek floodplain.

Mistletoes: The 2017 inspection found one Drooping Mistletoe (*Amyema pendula*) and one Creeping Mistletoe (*Muellerina eucalyptoides*).

Lower trees: Fairly abundant. Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Blackwood (*Acacia melanoxylon*) and Black Wattle (*A. mearnsii*) are fairly abundant. There is one Lightwood (*A. implexa*) and a cluster of seven Black Sheoak (*Allocasuarina littoralis*).

Medium to large shrubs: Rather dense but with sparser patches. Dominated by Hedge Wattle (*Acacia paradoxa*), Sweet Bursaria (*Bursaria spinosa*) and Hop Goodenia (*Goodenia ovata*), followed by Common Cassinia (*C. aculeata*). The following species are fairly abundant: Myrtle Wattle (*A. myrtifolia*), Hop Wattle (*A. stricta*), Sifton Bush (*Cassinia sifton*), Common Correa (*Correa reflexa* var. *reflexa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Common Heath (*Epacris impressa*) (*Daviesia leptophylla*), Yarra Burgan (*Kunzea leptospermoides*), Prickly Tea-tree (*Leptospermum continentale*), Snowy Daisy-bush (*Olearia lirata*) and Tree Everlasting (*Ozothamnus ferrugineus*). The presence of two Bushy Needlewoods (*Hakea decurrens*) is ecologically informative and significant for nature conservation.

Small shrubs: Fairly abundant. Common Flat-pea (*Platylobium obtusangulum*) is the most abundant species. Grey Parrot-pea (*Dillwynia cinerascens*), Erect Guinea-flower (*Hibbertia riparia*) and Silky Daisy-bush (*Olearia myrsinoides*) are fairly abundant. The ecologically informative Common Beard-heath (*Leucopogon virgata*) was scarce in 1996 and not found in 2017. Fireweeds (*Senecio*

species) are fairly abundant, particularly Rough Fireweed (*S. hispidulus*) and Cotton Fireweed (*S. quadridentatus*).

Ferns: Austral Bracken (*Pteridium esculentum*) forms extensive, dense patches. Screw Fern (*Lindsaea linearis*) is scattered.

Climbers: Fairly abundant, mainly represented by Common Apple-berry (*Billardiera mutabilis*), Downy Dodder-laurel (*Cassytha pubescens*), Mountain Clematis (*Clematis aristata*) and Love Creeper (*Comesperma volubile*). Coarse Dodder-laurel (*Cassytha melantha*) and Purple Coral-pea (*Hardenbergia violacea*) are scarce.

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) was recorded in 1996 but not seen in 2017.

Creepers: Fairly abundant. The most abundant species are Bidgee-widgee (*Acaena novae-zelandiae*), Centella (*Centella cordifolia*), Wood-sorrel (*Oxalis exilis/perennans*) and Ivy-leaf Violet (*Viola hederacea*). Thin-leaf Wattle (*Acacia aculeatissima*) and Creeping Bossiaea (*Bossiaea prostrata*) are scarce. Trailing Goodenia (*Goodenia lanata*) was found in 1996 but not 2019.

Grasses, rushes and sedges: Abundant in density and rich in species. Dominated in different areas by Thatch Saw-sedge (*Gahnia radula*) or Red-anther Wallaby-grass (*Rytidosperma pallidum*). The broad-leaf subspecies of Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Common Bog-rush (*Schoenus apogon*) are also abundant. The next most abundant group of species includes Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Short-stem Sedge (*Carex breviculmis*), Reed Bent-grass (*Deyeuxia quadriseta*), Common Love-grass (*Eragrostis brownii*), the fine-leafed subspecies of Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Cluster-headed Mat-rush (*L. longifolia* subsp. *exilis*), Spiny-headed Mat-rush (*L. longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Soft Tussock-grass (*Poa morrisii*), Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*), Smooth Wallaby-grass (*Rytidosperma laeve*), Slender Wallaby-grass (*R. penicillatum*), Velvet Wallaby-grass (*R. pilosum*), Bristly Wallaby-grass (*R. setaceum*), Purplish Wallaby-grass (*R. tenuius*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Mosses are abundant, particularly Heath Star-moss (*Campylopus introflexus*) and Common Thread-moss (*Rosulabryum billarderi*). The liverwort, Green Worms (*Chiloscyphus semiteres*) is also abundant. 42 species of forbs (non-woody wildflowers) have been recorded, the most abundant being Chocolate Lily (*Arthropodium strictum*), Common Raspwort (*Gonocarpus tetragynus*) and Small Poranthera (*Poranthera microphylla*).

Significant plants

Rare (but not otherwise threatened) in Victoria

A subspecies of Veined Spear-grass (namely, *Austrostipa rudis* subsp. *australis*) is represented by a localised cluster of plants (number not estimated). The subspecies is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 22 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – a single individual was seen in the 2017 survey;
- *Calochilus paludosus* (Red Beard-orchid) – recorded in 1996 without a count; not seen in 2017;
- *Eucalyptus macrorhyncha* (Red Stringybark) – fairly abundant, in fair to poor health;
- *Gompholobium huegelii* (Common Wedge-pea) – recorded in 1996 without a count; not seen in 2017;
- *Hakea decurrens* (Bushy Needlewood) – two plants were discovered in 2017;
- *Hypoxis hygrometrica* var. *hygrometrica* (Golden Weatherglass) – recorded in 1996 without a count; not seen in 2017;
- *Muellerina eucalyptoides* (Creeping Mistletoe) – a single plant was seen in 2017, 30 m from the Plymouth Road fence and 210 m west of the site's northeast corner;
- *Pentapogon quadrifidus* (Five-awned Spear-grass) – a few were found in 2017, one of only two populations recorded in Maroondah since 2000;

- *Senecio minimus* (Shrubby Fireweed) – a single individual was seen in 2017. This species is generally subject to large population fluctuations and may be more abundant in other years;
- *Sphaerolobium minus* (Globe-pea) – a single individual was found at the edge of the mown area around the sports centre building.

Other

The moss *Campylopus pyriformis* was found in the middle of Site 22 in 2017 and a herbarium specimen was taken. The species appears to be rare in the Melbourne area. The closest records are: (a) a 1985 specimen from Williams Rd, Ringwood North; (b) a 1976 specimen from Montrose; and (c) a Box Hill specimen from c. 1892. The species may well be critically endangered with dying out in Maroondah but it cannot be placed in that category with confidence because mosses are so poorly studied.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including microbats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The location adjacent to the Mullum Mullum Creek habitat corridor (Site 24) greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

On the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), most of the site's forest in 2017 was assessed as varying between excellent (rating 'A') and fair (rating 'C'). The apportionment among these categories could not be determined in the time available for the fieldwork. The eastern and southern firebreaks and the northwest corner are in poor ecological condition (rating 'D').

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally endangered Ecological Vegetation Class

The forest easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed by the state government as 'endangered' within the Gippsland Plain bioregion. It follows that Site 22 meets standard criterion 3.2.3 for a site of **State** significance.

Rare or threatened plant species

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a small population in Site 22 that appears to be quite viable. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Red Stringybark (*Eucalyptus macrorhyncha*) falls into the 'critically endangered' category of risk of dying out in Maroondah. The population in this site is not very healthy but it is probably viable. The stand therefore fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a

viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

That same quotation and criterion apply to the site's two known plants of *Hakea decurrens* and one known plant of *Sphaerolobium minus*. That is because although the numbers are so low in Site 22, the species are extremely rare in Maroondah and any occurrence is 'an important site'. There may be additional seeds of both species in the soil, capable of regenerating in larger numbers.

The moss *Campylopus pyriformis* has been recorded so rarely in the Melbourne metropolitan area (particularly in the past quarter-century) that the population in Site 22 must be considered 'an important site' in that region. It therefore qualifies for Local significance under standard criterion 3.1.5.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people within and next to the forest. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to be beneficial to the health, wellbeing, childhood development and quality of life of the school community, particularly students. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies, kangaroos and other animals attracted to the site.

The site's location beside a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, most of the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Approximately 0.9 ha of forest was destroyed in c. 1999 for the construction of the sports centre building and clearing of an area to its north.

Change in the ecological condition of habitat

The white, filamentous structures visible in the aerial photograph on p. 152 are the branches of large numbers of dead eucalypts. They are also visible in a 2011 aerial photograph but not a 2001 aerial photograph. The deaths therefore occurred during the Millennium Drought, so soil dryness was probably a major factor.

Because of the limited time available for the fieldwork in Site 22, too little data could be gathered to make further assessments of changes in the ecological condition of the vegetation.

Changes in the species present

Of the 112 plant species detected in the November 2017 flora survey, 24 were not recorded in 1996. By comparison, the 1996 survey recorded 27 plant species that were not recorded in 2017. (These figures exclude mosses and liverworts, which were not recorded in 1996.) These differences can be largely explained by seasonal factors and the occurrence of fire in 2010 and 2013. A substantial decline in the number of species of rush (*Juncus*) can be attributed to drier conditions in 2017, which perhaps reflects climate change. The few remaining differences in plant species between 1996 and 2017 might be due to the shorter survey in 2017 and a small degree of randomness in the detection of very scarce species.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Displacement of indigenous plants by introduced plants, the most serious of which are Sweet Pittosporum, Cedar Wattle, Sallow Wattle and Japanese Honeysuckle. Encroachment of Kikuyu from the firebreaks and tracks is also a significant threat;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Further eucalypt deaths, which would most likely occur during droughts.

Strategic planning

The whole school is zoned 'General Residential Zone – Schedule 1' and covered by state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. The Vegetation Protect Overlay (VPO) covers an area that approximates the original (1997) version of Site 23. The VPO area differs from the current version of Site 23 due to:

- Past mapping inaccuracy;
- A decision that is taken here to extend the southern and eastern boundaries to fences; and
- Clearing that has occurred since 1997.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in mid-blue on the aerial photograph on p. 152.

The firebreaks along the southern and eastern boundaries do not contain significant habitat but they are recommended for ESO1 partly for the sake of well-defined boundaries and more importantly because works that may occur there in future could affect the significant habitat of Site 22 or the environmental values of Mullum Mullum Creek in Site 24. The northern firebreak is significant in its own right.

Restoration opportunities

The highest priority for maintaining and restoring the site's habitat is to control the introduced plant species ('environmental weeds') mentioned above in the section headed 'Threats'.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of 4¼ hours of inspection of the site for this study on 8–9 November 2017, including compilation of a list of indigenous and introduced plant species (including mosses and liverworts), as well as incidental observations of 23 bird species. A voucher specimen of *Campylopus pyriformis* (*G.S.Lorimer 2688*) was taken;

- A fauna list in the Victorian Biodiversity Atlas fauna by Katrina Sofo on 23/7/09, evidently gathered incidentally over a very brief period as it only includes a small fraction of the site's fauna (15 species). (Note that list T0248100 in the VBA, which apparently refers to somewhere in or near Site 22 and is attributed to Brett Lane and Associates on 3/2/09, includes planted species and some apparent misidentifications.);
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- A flora survey in July 1998 during preparation of an Environmental Management Plan for construction of the sports centre building now located immediately west of the site, as currently delineated;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the school was based on fieldwork in 1995–1996 that included a flora survey (including two quadrats), a 20-minute bird census, a mammal hair survey, spotlighting for nocturnal animals and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

Acknowledgement

Thanks to the Yarra Valley Grammar School for permitting the fieldwork for this assessment. Thanks also to the school's Grounds Supervisor, John Behrendt, for supervising the fieldwork and providing useful information.

Site 23. Cherry Tree Grove Reserve, Croydon

Biological Significance Level: *Local* as part of a habitat corridor and due to the presence of a locally threatened plant species

See page 152 for a 2017 aerial photograph that includes this site.

Boundaries, land use and tenure

The site is a council reserve managed for nature conservation. The boundary follows fences, and is marked on the aerial photograph on page 152. The fence discourages public entry.

General description

This 0.2-hectare fenced area has a very shallow gradient toward the west-northwest, draining into Mullum Mullum Creek only 10 m away. It is part of the Mullum Mullum Creek corridor, which forms Site 24. It was separated from Site 24 in the 1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) on the basis that it had a higher diversity of plants than the rest of the corridor. That is no longer the case, partly because of loss of wetland plant species but mainly because other parts of the corridor have improved in ecological condition to a similar level. Site 23 would not be recognised here as a separate site if not for its recognition in 1997.

The vegetation was young regrowth in 1993. It has matured with the assistance of fairly intensive weed control and supportive planting by Maroondah City Council.

Forty-one naturally-occurring, indigenous plant species were observed in the reserve during this study.

Relationship to other land

As explained below (beginning on p. 164), the Mullum Mullum Creek corridor is a patchwork of naturally-occurring, native vegetation linked by revegetation. Site 23 is one of the patches of naturally-occurring, native vegetation, acting like a small node or 'stepping-stone' in a habitat network. It is linked to other nodes by revegetation along the southeastern edge of the creek reserve and along the banks of the creek. On the opposite side of the creek is the Yarra Valley Grammar School's forest (Site 22).

Birds and insects can be observed moving between Sites 22, 23 and 24. Pollination that occurs from these movements improves the reproductive success and genetic diversity of plants in Site 23. Exchange of seeds between the sites by fauna movements and wind also improve the viability of the habitat in Site 23. Site 23 is so small that if it was isolated from Sites 22 and 24, most of its plant species would be unviable.

Unfortunately, Site 23's relationship with abutting residential land to the southeast is not beneficial. A neighbour is using the reserve to dump dog faeces and garden waste. The same problem was noted in a 1998 management plan (Lorimer 1998c).

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the indigenous plant species. So many indigenous plants have been planted that one or two of the species presumed to be present naturally may have been planted, even though the author took care to assess that possibility and check the available planting lists.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Overwhelmingly dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*). There are also about six Messmate Stringybark (*E. obliqua*) and three Bundy (*E. goniocalyx*). A few Narrow-

leaved Peppermint (*E. radiata*) have been planted (and natural ones were present in 1993). There is one Swamp Gum (*E. ovata*), which may also have been planted.

Lower trees: Blackwood (*Acacia melanoxylon*) is scattered but it was not recorded in 1993, 1996 or 1998 and is therefore presumed to have been planted. There are no other sub-canopy trees.

Medium to large shrubs: Patchy but mostly rather dense. Sweet Bursaria (*Bursaria spinosa*) is strongly dominant. Hedge Wattle (*Acacia paradoxa*) and Sifton Bush (*Cassinia sifton*) form dense patches over small areas. Prickly Tea-tree (*Leptospermum continentale*) is scattered. Other species are scarce except for Hop Goodenia (*Goodenia ovata*), which has been planted.

Small shrubs: Scarce, comprising only scattered plants of Common Flat-pea (*Platylobium obtusangulum*) and Grey Parrot-pea (*Dillwynia cinerascens*).

Ferns: Austral Bracken (*Pteridium esculentum*) is scattered.

Climbers: Very scarce, limited to a few Common Apple-berry (*Billardiera mutabilis*) and one Small-leafed Clematis (*Clematis decipiens*).

Creepers: Now represented only by scattered Bidgee-widgee (*Acaena novae-zelandiae*) and a few plants of the wood-sorrel, *Oxalis exilis/perennans*. However, in the 1990s there was also Creeping Bossiaea (*Bossiaea prostrata*), Centella (*Centella cordifolia*), Creeping Raspwort (*Gonocarpus micranthus*), Lanky Goodenia (*Goodenia elongata*), Trailing Goodenia (*Goodenia lanata*) and Ivy-leaf Violet (*Viola hederacea*).

Grasses, rushes and sedges: Dominated in different areas by Thatch Saw-sedge (*Gahnia radula*) or Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*). The latter comprises natural and planted plants. Rushes (*Juncus* species) dominated the western corner in the 1990s but have since dwindled to a handful of plants of a single species due to reduced soil moisture. The remaining species with more than a handful of individuals in 2019 are Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*) and Kangaroo Grass (*Themeda triandra*). The presence of small numbers of both Red-anther Wallaby-grass (*R. pallidum*) and Tasmanian Wallaby-grass (*R. semiannulare*) speak to the winter-wetness of part of the site and the summer-dryness of the other parts.

Other groundcover: Scarce except for Black-anther flax-lily (*Dianella revoluta*) and Common Raspwort (*Gonocarpus tetragynus*).

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Cherry Tree Grove Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Gonocarpus micranthus* (Creeping Raspwort) – recorded only once, in January 1993, and presumed to have died out due to loss of its required wetland habitat;
- *Goodenia elongata* (Lanky Goodenia) – one plant was seen in 1993, 1996 and 1998 but could not be found in April 2019 despite searching at that location, which was known to within 2 m;
- *Hypoxis hygrometrica* (Golden Weather-glass) – recorded only twice, in January 1993 and March 2020 – a single plant on each occasion. Other plants have probably gone undetected because this species is extremely hard to find except during its brief, sporadic flowering;
- *Wahlenbergia multicaulis* (Tadgell's Bluebell) – recorded only once, in January 1993, and presumed to have died out. This species is most commonly seen in young regrowth, as in this case.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds and invertebrates but the actual usage is limited by the small size of the site;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The location adjacent to the Mullum Mullum Creek habitat corridor (Site 24) greatly amplifies the habitat values above; and

- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

On the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), this study's assessment in 2019 is that approximately:

- 350 m² (17% of the site) is in good ecological condition (rating 'B'); and
- 1,400 m² (69% of the site) is in fair ecological condition (rating 'C'); and
- 300 m² (15% of the site) is in poor ecological condition (rating 'D') adjacent to the abutting retirement village.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Locally threatened plant species

Golden Weatherglass (*Hypoxis hygrometrica*) falls into the 'critically endangered' category of risk of dying out in Maroondah. This century, it has only been recorded at three other sites in Maroondah. The (presumably small) population at Cherry Tree Grove Reserve therefore fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Habitat corridor

As discussed above in the section headed 'Relationship to other land', Site 23 is a node or 'stepping-stone' on the Mullum Mullum Creek habitat corridor (Site 24). It fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The 'Local' significance rating here is the equivalent of the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people passing the site and also immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site contributes to the natural ambience of the Mullum Mullum Creek corridor. It is therefore expected to contribute in a small way to the health, wellbeing and quality of life of the people who use the corridor for recreation, exercise or as a thoroughfare. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the site. The natural ambience also helps encourage people to get exercise by walking, running or cycling along the abutting Mullum Mullum Trail.

The site's location beside a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Over the past twenty years, a 3 m-wide gravel path that previously ran along the axis of the site became covered with native vegetation. That represents a 200 m² increase in the extent of habitat within the site. There has been no other material change in the extent of habitat since at least 1993.

Change in the ecological condition of habitat

The 1997 report, *'Sites of Biological Significance in Maroondah'*, provided estimates of the amount of the reserve's native vegetation that fell into each category of ecological condition on the same A–D scale as used above in the section headed 'Ecological condition'. An area of 200 m² in the western corner was described as a seasonal wetland in good ecological condition (rating 'B'). That declined to borderline B–C in a 1998 management plan (Lorimer 1998c). Today, that area is no longer a wetland and its condition is fair (rating 'C').

The former 3 m-wide gravel path that has become colonised with native vegetation over the past twenty years is now in fair ecological condition (rating 'C').

The rest of the forest was rated as excellent (rating 'A') in the 1997 report. That assessment ignored 200 m² in a narrow band next to the retirement village, which was in rating 'D' (as the author recalls). As stated above, this study's assessment is that none of the site warrants rating 'A', 350 m² is in rating 'B', 1,400 m² is in rating 'C' and 300 m² is in rating 'D'.

The apparent decline in condition has not been due to displacement by introduced plants ('environmental weeds'). The site's 1998 management plan commented about the threat posed by existing plants of blackberry, Paspalum, Couch, Kikuyu and Montbretia. None of those species were detected in this study's survey (although the three grass species may have escaped detection because quarter of the site was cut with a brushcutter about three days before the survey). More generally, the site has a very low cover of introduced plants.

Part of the decline in ratings is due to 'extinction debt', in which plant species have died out because even in 1997, the conditions were already too poor for them to survive for long. That is evidenced by the following paragraph. Under the A–D scale used here, the loss of species leads to a reduction in rating even though the cause predated 1993.

Changes in the species present

The vegetation must have been young regrowth when it was first surveyed by Helen Moss in 1993. That can be inferred because the 1997 report, *'Sites of Biological Significance in Maroondah'*, described most of the plants (including its trees) as being only 'several years old' when inspected in March 1996.

At that time and when a management plan was prepared in 1998, the western (lowest) corner of the site was boggy and it contained wetland plants such as Swamp Club-rush (*Isolepis inundata*) and seven species of rush (*Juncus*). Broom Rush (*J. sarophorus*) was the dominant species in that area in 1998. With the subsequent drying of the climate and the growth of water-loving trees, only one wetland plant species remains (*Juncus amabilis*), represented by just a handful of individuals.

As usually happens with regrowth, the number of indigenous plant species fell fairly rapidly over the years due to extinction debt. Sixty-three were recorded in January 1993, 53 in March 1996 and 41 in April 2019. The decline was greatest among the wetland species, including two species in the 'critically endangered' category of risk of dying out in Maroondah (namely *Gonocarpus micranthus* and *Goodenia elongata*).

Although the number of indigenous plant species has declined from survey to survey, three species found in 2019 were not found in any previous flora survey. (That excludes mosses, which were not sought in prior surveys.) Those species are:

- Small-leafed Clematis (*Clematis decipiens*), which is rapidly expanding its range into new areas such as Croydon. Only one plant was found in the site;
- Manuka (*Leptospermum scoparium*), which may have been planted or overlooked previously due to the similarity to Prickly Tea-tree; and
- Small Grass-tree (*Xanthorrhoea minor*), whose sole plant has probably been overlooked in previous surveys.

Threats

As long as the present level of bushland maintenance continues, the only significant threats to this site identified in this study are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and
- The loss of plant species with low populations from attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The whole site is zoned 'General Residential Zone – Schedule 1' and covered by both the Vegetation Protect Overlay (VPO) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole site. As discussed below, the same recommendation applies to the abutting Site 24.

Information sources

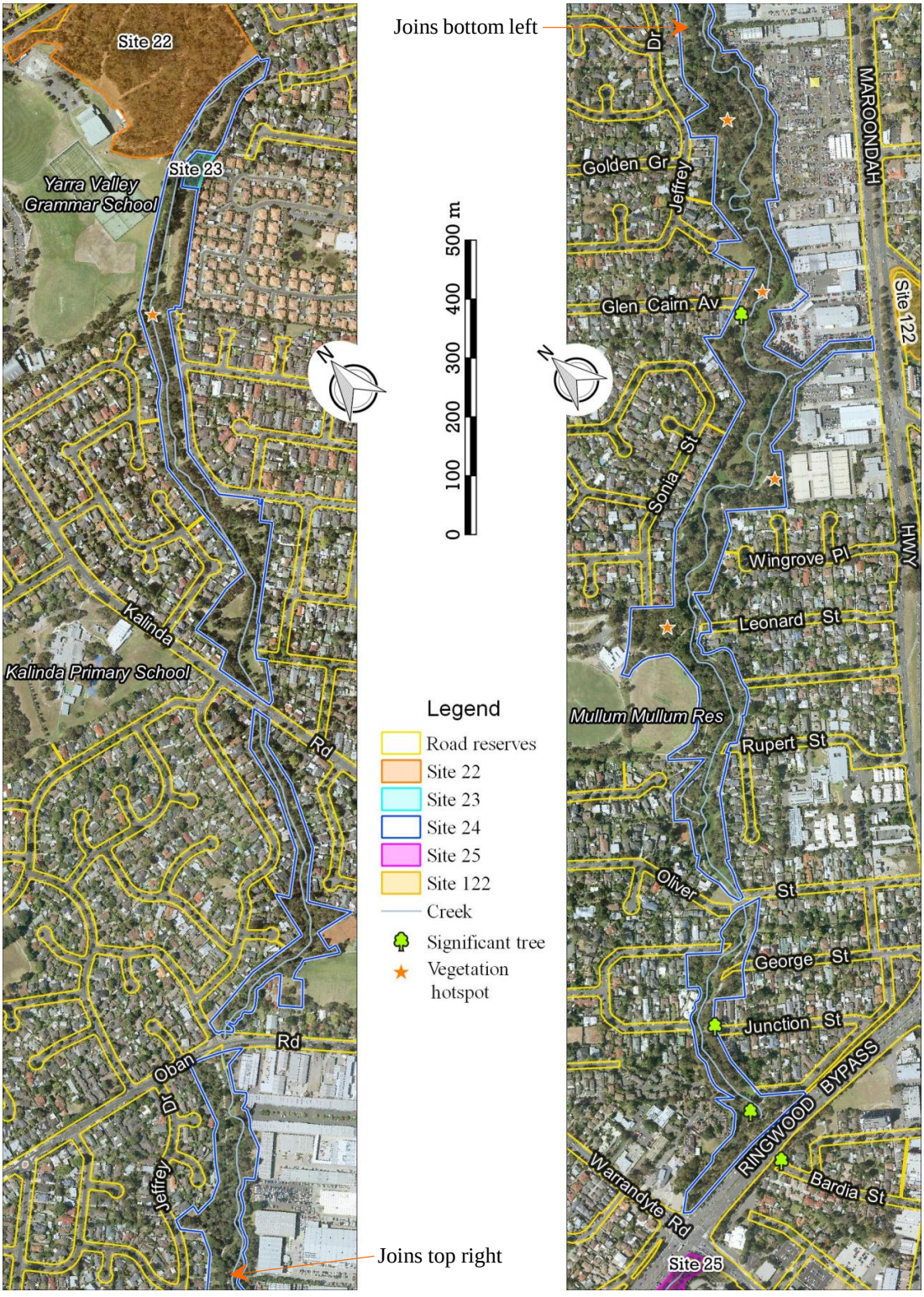
The analysis above draws on the following sources of information about the site:

- 70 minutes of flora survey of the site for this study on 21/4/19, including compilation of a list of indigenous plant species (including mosses and liverworts), as well as incidental observations of fauna. The survey of about quarter of the site was impaired by brushcutting that had occurred about three days prior;
- Advice from the CRISP Nursery about the plants they have planted in the site;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- Information in the *'Cherry Tree Reserve Management Plan 1998'* (Lorimer 1998c), which was based on fieldwork in May 1998 as well as the following item;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork on 24/3/96 that included a flora survey and incidental fauna observations;
- A plant list compiled by Helen Moss in January 1993; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas (VBA), Atlas of Living Australia or eBird. Note that the state government's vegetation mapping wrongly shows that there is no native vegetation present and that the original Ecological Vegetation Class was Swampy Riparian Complex. The latter is due to a more general problem of the government overestimating the width of riparian vegetation communities along watercourses.

Site 24. Mullum Mullum Valley, Section 1

Biological Significance Level: *State* due to endangered vegetation types



Boundaries

The aerial photographs on the previous page are from February 2017. The left-hand panel shows Site 24's northeastern half and the right-hand panel shows the rest. The boundary of Site 24 is shown in mid-blue. As with all sites in this report, the precise site boundary is available as a shapefile for geographic information systems.

The site comprises the Mullum Mullum Creek Linear Reserve between the Ringwood Bypass and the upstream limit of public land, next to the Yarra Valley Grammar School. The boundary follows the edge of public land except that:

- Roads and their nature strips and footpaths are excluded;
- A lawn north of the Oliver Street bridge has been omitted;
- At Mullum Mullum Reserve, only the areas of native vegetation near the creek are included;
- The boundary skirts around the playing field and tennis courts at Peter Vergers Reserve, just northeast of Oban Road;
- A playground and surrounding lawn on Chesney Drive have been excluded; and
- Walkways through to the dead-ends of Cherry Tree Grove and Highland Avenue are excluded due to paucity of habitat.

The original version of Site 24 in the 1997 report, *'Sites of Biological Significance in Maroondah'* did not extend further upstream (northeast) than Site 23. This revision does so because revegetation has extended the upstream limit of habitat since 1997.

The section of creek reserve along Mullum Mullum Creek downstream of the Ringwood Bypass is treated as a separate site (Site 25, p. 176) because of its different ownership, vegetation, issues and opportunities.

Land use and tenure

The land is council reserve, managed for drainage, sewerage, recreation, nature conservation and thoroughfare via footpaths and the Mullum Mullum Trail.

General description

This site extends 4.1 km from end to end as the crow flies and occupies a total of 28.2 ha. It is one of the most complex sites in this report in regard to the patchiness and variability of its vegetation as well as the issues involved in managing vegetation, water quality, drainage and pressures from neighbours and park users. It is part of the most ecologically important habitat corridor in Melbourne's outer eastern suburbs.

The site's northeastern end is close to the source of Mullum Mullum Creek, which is in the residential area near the corner of Maroondah Highway and Yarra Road. An aerial photograph from 1945 shows that the creek corridor was almost fully forested between Junction Street and Oban Road. The strip abutting the current-day Cherry Tree Grove retirement village was also fully forested. The rest of Site 24 was cleared or sparsely vegetated.

In the second half of the 20th Century, residential development resulted in Site 24 being dug up to lay sewers and stormwater pipes. Urbanisation of the catchment caused the creek's flow rate to vary increasingly between pulses of high flow and long lulls of low flow. Engineering works slightly altered the creek's course and fortified its banks with rocks. However, Mullum Mullum Creek escaped the usual engineering approach of constructing retarding basins and replacing the creek with a straightened drain over a pipe that takes the base flow. The creek still meanders and one can still observe the processes that govern a natural stream environment. Since the opening of the Dight's Falls fishway in Abbotsford in 2012, there is only one significant barrier to fish and Platypus moving between Port Phillip Bay and the upstream end of Site 24. That barrier is the large pipe structure beneath the intersection of Warrandyte Road and the Ringwood Bypass, immediately southwest of Site 24. At least one Platypus appears to have negotiated the pipe, Shortfin Eels are quite capable of doing so and it is likely that other fish do so.

Many Monterey Pines (*Pinus radiata*) and a few ornamental species such as willows were planted along Mullum Mullum Creek in the 20th Century. The pines are now large and reproducing. By the end of the 1980s, planting of pines ceased and revegetation with indigenous species of trees and understorey began. A substantial fraction of the vegetation in Site 24 today is revegetation of various ages. Most of it has been planted in areas that were previously mown grass, the rest within patches of naturally-occurring eucalypts. The revegetation has greatly decreased the fragmentation of the tree canopy and increased the occurrence of indigenous understorey.

Fortunately, some areas retain naturally-occurring understorey as well as trees. The largest or most significant areas are highlighted on the aerial photographs on p. 164 with orange stars. There is also a small number of large eucalypts that are probably over a century old, three of which are marked on the right-hand aerial photograph. A total of 113 naturally-occurring, indigenous plant species were observed in the site during this study.

The most upstream star (near Yarra Valley Grammar School) marks the location of Maroondah's only known plant (or clump of plants) of Downy Ground-fern (*Hypolepis glandulifera*), amid a patch of creek vegetation. The star near Jeffrey Drive marks an area of approximately 0.5 ha that retains a good representation of naturally-occurring, indigenous plant species in all strata of vegetation – even one of the only two known colonies in Maroondah of Dainty Bird-orchid (*Chiloglottis trapeziformis*). The star near the end of Glen Cairn Avenue marks a smaller, less diverse area of naturally-occurring, indigenous vegetation with all strata present. The star just upstream of Wingrove Place is at the centre of a 0.4-hectare patch of an endangered vegetation type called Swampy Riparian Woodland with all strata present. The star at Mullum Mullum Reserve marks a patch of approximately 0.6 ha of the endangered vegetation type, Valley Heathy Forest, again with all strata present.

The spatial variability of the vegetation is quite complex downstream of Oban Road. Because the creek has meandered from side to side across the floodplain through geological time, parts of its current course are right on the edge of the floodplain. At those locations, the non-riparian vegetation type, Herb-rich Foothill Forest, extends right next to the creek bank. The narrowest sections of the valley occur at two locations downstream from Wingrove Place. They support the vegetation type known as Riparian Forest. Elsewhere, the floodplain supports Swampy Riparian Woodland.

A map of sufficient resolution to show the complex pattern of native vegetation and its various types over the site's 4.1 km length would add too many pages to this volume.

Relationship to other land

The Mullum Mullum Creek and its fringing vegetation form the foremost habitat corridor in Melbourne's outer-eastern suburbs. Eels, Galaxias and possibly other native fish species migrate along the creek from the sea to Site 24 and back. (All but one local native fish species must reach the sea to complete their lifecycles.) Platypus evidently move along the corridor, as evidenced by the discovery of a mauled Platypus at the upstream end of Site 24 in 2015. These movements would not be possible if Site 24 were somehow disconnected from the habitat downstream in Site 25 to the Yarra River and beyond.

Forest birds can be seen moving along Mullum Mullum Creek daily. Kangaroos can also sometimes be seen moving along it. These animals cannot live solely within Site 24; they use the site as supplementary habitat and to travel between other sites, e.g. between the Yarra Valley Grammar School's forest (Site 22) at the upstream end, Ringwood Lake Park (Site 26) near the downstream end and Yarran Dheran just downstream of Maroondah.

Flying insects may also use the corridor in similar ways.

Pollination that occurs from these movements of birds and insects improves the reproductive success and genetic diversity of plants in all the visited sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

The ecological functions of Site 24 are critically dependent on the creek's catchment. Increased subdivision and impermeable surfaces are causing increasing problems of pulsed flows in the creek. Water pollution –

particularly from the automotive commercial and industrial area on the creek's left bank – significantly affects what can live in the creek and on its banks.

Site 24 is also adversely affected by the spread of introduced plants ('environmental weeds') from abutting properties, and sometimes by deliberate planting or by dumping of garden waste.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'. So many indigenous plants have been planted that one or two of the species presumed to be present naturally may have been planted, even though the author took care to assess that possibility and check the available planting lists.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion) at Mullum Mullum Reserve, 381A Maroondah Highway and near Turnbull Court

Canopy trees: Mealy Stringybark (*Eucalyptus cephalocarpa*) is the only canopy species on the left bank at 381 Maroondah Highway. That species is scarce at Mullum Mullum Reserve, where Bundy (*E. goniocalyx*) is dominant and there are a few Yellow Box (*E. melliodora*).

Lower trees: Blackwood (*Acacia melanoxylon*) is dominant, followed by Silver Wattle (*A. dealbata*), Cherry Ballart (*Exocarpos cupressiformis*) and outliers of Swamp Paperbark (*Melaleuca ericifolia*).

Medium to large shrubs: Patchily dense. Dominated by Burgan (*Kunzea* sp.), followed by Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*), Sifton Bush (*C. sifton*), Hop Goodenia (*Goodenia ovata*), Snowy Daisy-bush (*Olearia lirata*) and Victorian Christmas-bush (*Prostanthera lasianthos*). form dense patches over small areas. Prickly Tea-tree (*Leptospermum continentale*) is scattered. Other species are scarce except for which has been planted.

Shrubby herb: Rough Fireweed (*Senecio hispidulus*) is fairly abundant.

Small shrubs: Absent.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over substantial areas.

Climbers: A single Purple Coral-pea (*Hardenbergia violacea*) is the only climber seen.

Creepers: Represented only by scattered Bidgee-widgee (*Acaena novae-zelandiae*) and a few Ivy-leaf Violet (*Viola hederacea*).

Grasses, rushes and sedges: Fairly abundant and rich in species. Thatch Saw-sedge (*Gahnia radula*) dominates. The following species are scattered or fairly abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Pale Rush (*Juncus pallidus*), Finger Rush (*J. subsecundus*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Weeping Grass (*Microlaena stipoides*), Red-anther Wallaby-grass (*Rytidosperma pallidum*), Clustered Wallaby-grass (*R. racemosum*), Purplish Wallaby-grass (*R. tenuius*), Common Bog-rush (*Schoenus apogon*) and Kangaroo Grass (*Themeda triandra*).

Other groundcover: Mosses are fairly abundant, particularly Heath Star-moss (*Campylopus introflexus*). Forbs (i.e. non-grassy, non-woody species) are very depleted, the only species present in significant numbers being Tasman Flax-lily (*Dianella tasmanica*) and Solenogyne (*Solenogyne gunnii*).

Herb-rich Foothill Forest (EVC 23, Vulnerable in the bioregion) – Manna Gum variant – from immediately upstream of Mullum Mullum Reserve to near Kinton Court

Physical environment: lower south- or southeast-facing slopes abutting the floodplain, not on alluvium.

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) and Manna Gum (*E. viminalis* subsp. *viminalis*), as well as Bundy (*E. goniocalyx*) in some places. Narrow-leaved Peppermint (*E. radiata*) is fairly abundant. Mealy Stringybark (*E. cephalocarpa*) and Swamp Gum (*E. ovata*) occurs as scarce outliers from adjacent vegetation types.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*), followed by Silver Wattle (*A. dealbata*) and Cherry Ballart (*Exocarpos cupressiformis*). Close to the Riparian Forest or Swampy Riparian Woodland, there are occasional outliers of Swamp Paperbark (*Melaleuca ericifolia*).

Medium to large shrubs: Rather depleted. The most abundant species are Sweet Bursaria (*Bursaria spinosa*) and Burgan (*Kunzea* sp.). There are also small numbers of Manuka (*Leptospermum scoparium*), Snowy Daisy-bush (*Olearia lirata*), Victorian Christmas-bush (*Prostanthera lasianthos*) and Shrubby Fireweed (*Senecio minimus*).

Small shrubs: Absent.

Ferns: Austral Bracken (*Pteridium esculentum*) is abundant.

Climbers: Mountain Clematis (*Clematis aristata*) is scarce.

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is scarce.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is fairly abundant but it is unclear how much of it may have been planted.

Grasses, rushes and sedges: Dominated by Thatch Saw-sedge (*Gahnia radula*). The following species are moderately abundant: Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Slender Wallaby-grass (*Rytidosperma penicillatum*) and Forest Wire-grass (*Tetrarrhena juncea*). In areas that have been mowed, Clustered Wallaby-grass (*R. racemosum*) can be abundant.

Other groundcover: Mosses are abundant and fairly diverse, the most abundant being Heath Star Moss (*Campylopus introflexus*). The liverwort, Green Worms (*Chiloscyphus semiteres*) is also abundant. Only four species of forbs (i.e. non-grassy, non-woody species) were found in this study, but one of them (Tasman Flax-lily or *Dianella tasmanica*) is abundant. The other three are scarce: Black-anther flax-lily (*D. revoluta*), Yellow Rush-lily (*Tricoryne elatior*) and – surprisingly – one of only two colonies of the Dainty Bird-orchid (*Chiloglottis trapeziformis*) in Maroondah.

Riparian Forest (EVC 18, Vulnerable in the bioregion) from the Ringwood Bypass to Wingrove Place

Canopy trees: Strongly dominated by Manna Gum (*Eucalyptus viminalis*), followed by Messmate Stringybark (*E. obliqua*). There are occasional outliers of Swamp Gum (*E. ovata*), Narrow-leaved Peppermint (*Eucalyptus radiata*) and Mealy Stringybark (*E. cephalocarpa*) from adjacent vegetation types.

Lower trees: Dominated by Silver Wattle (*Acacia dealbata*), with moderate numbers of Blackwood (*Acacia melanoxylon*), Cherry Ballart (*Exocarpos cupressiformis*) and Swamp Paperbark (*Melaleuca ericifolia*).

Medium to large shrubs: Quite depleted, all of the small number of species being scarce. They include Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*), Yarra Burgan (*Kunzea leptospermoides*) and Manuka (*Leptospermum scoparium*). In 1996, Tree Everlasting (*Ozothamnus ferrugineus*) and Elderberry Panax (*Polyscias sambucifolia*) were also present.

Small shrubs: Absent.

Ferns: Austral Bracken (*Pteridium esculentum*) is abundant. Common Maidenhair (*Adiantum aethiopicum*) was recorded in 1996 and may have been overlooked in this study due to the time of year.

Climbers: Mountain Clematis (*Clematis aristata*) was found in 1996 but not Small-leafed Clematis (*C. decipiens*). The reverse was true in 2018.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) and Kidney-weed (*Dichondra repens*) were found in 1996 but not in 2018.

Grasses, rushes and sedges: Thatch Saw-sedge (*Gahnia radula*) and Weeping Grass (*Microlaena stipoides*) is the only indigenous grassy species present in substantial numbers.

Other groundcover: Very depleted. Tasman Flax-lily (*Dianella tasmanica*) is fairly abundant. The only other species is Common Raspwort (*Gonocarpus tetragynus*), which is scarce.

Swampy Riparian Woodland (EVC 83, **Endangered** in the bioregion) from the upstream end of the site to Georges Road but interspersed with Riparian Forest downstream from Wingrove Place

Dominant canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*), followed by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Messmate Stringybark (*Eucalyptus obliqua*). There are also a few Bundy (*Eucalyptus goniocalyx*) and one Red Stringybark (*Eucalyptus macrorhyncha*).

Lower trees: Dominated in different areas by Silver Wattle (*A. dealbata*), Swamp Paperbark (*Melaleuca ericifolia*) or Cherry Ballart (*Exocarpos cupressiformis*). Blackwood (*Acacia melanoxylon*) and Black Wattle (*Acacia mearnsii*) are also fairly abundant.

Medium to large shrubs: Patchy. The most natural areas have abundant Victorian Christmas-bush (*Prostanthera lasianthos*), followed by Yarra Burgan (*Kunzea leptospermoides*) and Hop Goodenia (*Goodenia ovata*). Other species are scarce.

Small shrub: Common Flat-pea (*Platylobium obtusangulum*) is scattered through the most natural area of this vegetation type.

Ferns: Austral Bracken (*Pteridium esculentum*) forms extensive, dense patches.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is scattered through the most natural area of this vegetation type. The Small-leafed Clematis (*Clematis decipiens*) is scarce.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is scarce.

Grasses, rushes and sedges: Abundant in the most natural areas, with many species. The densest species are Thatch Saw-sedge (*Gahnia radula*) and Tall Sword-sedge (*Lepidosperma elatius*), followed by Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), then Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Bristly Wallaby-grass (*Rytidosperma setaceum*) and Purplish Wallaby-grass (*Rytidosperma tenuius*). Other species are scarce.

Other groundcover: Mosses are abundant, particularly the (questionably indigenous) Common Feather-moss (*Eurhynchium praelongum*), followed by *Calliergonella cuspidata*. Other indigenous species are severely depleted, with Tasman Flax-lily (*Dianella tasmanica*) being the only species that isn't scarce.

Perennial stream and stream channel (no EVC or conservation status have been assigned by the Victorian Government)

Trees: Suckering patches of Swamp Paperbark (*Melaleuca ericifolia*) are fairly frequent in the channel, extending onto the adjacent bank. Blackwood (*Acacia melanoxylon*) is scarce. The introduced Desert Ash (*Fraxinus angustifolia*) is also scarce.

Shrubs: Manuka (*Leptospermum scoparium*) and Tree Everlasting (*Ozothamnus ferrugineus*) are represented by only one and two individuals, respectively.

Fern: Maroondah's only known plant of Downy Ground-fern (*Hypolepis glandulifera*) grows near the dead-end of Strathfield Parade.

Creepers: Introduced creepers such as Wandering Trad, Cape Ivy and a hybrid bindweed are abundant but the only indigenous representation is from a few of the wood-sorrel, *Oxalis exilis/perennans*.

Mosses and liverworts: *Rhynchostegium tenuifolium* is abundant, mainly on rocks that protrude from the water during low flow. Moonwort (*Lunularia cruciata*) becomes abundant in a certain phase following floods. Fine silt becomes colonised by *Ditrichum difficile* and *Fissidens taylorii* for a period following floods.

Amphibious species: Green Rush (*Juncus gregiflorus*) and Slender Knotweed (*Persicaria decipiens*) are abundant. The following species are fairly abundant or scattered: Nodding Club-rush (*Isolepis cernua*), Swamp Club-rush (*I. inundata*) and Loose-flower Rush (*Juncus pauciflorus*). Lesser Joyweed (*Alternanthera denticulata*), Broom Rush (*Juncus sarophorus*), Angled Lobelia (*Lobelia anceps*), Water Pepper (*P. hydropiper*) and Common Reed (*Phragmites australis*) are scarce.

Aquatic species: Blunt Pondweed (*Potamogeton ochreatus*) is abundant, competing with increasing amount of the introduced Dense Waterweed (*Egeria densa*). Patches of the two cumbungi species, *Typha domingensis* and *T. orientalis*, are fairly frequent. Water Plantain (*Alisma plantago-aquatica*) was surprisingly scarce at the times Site 23 was surveyed but numbers may be higher at other times.

Significant plants

Rare (but not otherwise threatened) throughout Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its

geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. A single, large plant was found near Golden Grove in 2018. There is a chance that it was planted there.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 24 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – recorded by the author in 1996 but not found in this study;
- *Chiloglottis reflexa* (Autumn Bird-orchid) – a healthy colony of roughly 400 plants grows near Golden Grove and a colony near Glen Cairn Avenue had dwindled to just one visible plant in 2018;
- *Chiloglottis trapeziformis* (Dainty Bird-orchid) – one of only two colonies in Maroondah, comprising roughly 100 plants. It grows near Golden Grove, suffering from trampling by orchid photographers;
- *Eucalyptus macrorhyncha* (Red Stringybark) – a single, mature, healthy tree grows near 74 Jeffrey Drive, right on the creek banks where its root system may one day be undermined by floodwater;
- *Hypolepis glandulifera* (Downy Ground-fern) – a healthy, substantial patch was found during this study near the dead-end of Strathfield Parade; and
- *Senecio minimus* (Shrubby Fireweed) – one individual grows near Golden Grove and a few are scattered along the creek. This species is generally subject to large population fluctuations.

Significant trees

Four very large eucalypts that are probably over a century old are marked on the aerial photograph on p. 164. One of them is just outside Site 24, on the southern side of the Ringwood Bypass. It is a very healthy, very large Manna Gum (*Eucalyptus viminalis*).

The tree marked on the northern side of the Ringwood Bypass is a hybrid *Eucalyptus viminalis* × *obliqua* recognised by Moss and Lorimer (1996) as 'Notable Tree' number 30. It was ringbarked with an axe several years ago. It sprouted below the ringbarking but the sprouts were cut off. The tree then died. It stands testament to the attitude that some people have to our natural heritage.

The tree marked on the aerial photograph at the end of Junction Street is another healthy, very large Manna Gum. It is recognised by Moss and Lorimer (1996) as 'Notable Tree' number 31 and in the Maroondah Planning Scheme under Heritage Overlay HO31.

The final tree marked on the aerial photograph is a very large Bundy (*Eucalyptus goniocalyx*) next to the footbridge near Glen Cairn Avenue. It is in good (but not excellent) health. It is unusual for a Bundy to grow on a stream bank.

Significant fauna

- Platypus – a mauled Platypus was discovered in 2015 at the upstream end of Site 24. It is likely that Platypus are not resident in the site but move along it in search of habitat, e.g. when a young animal is evicted from its parental range;
- Rakali (or Water Rat) – recorded periodically in the site. A dog-walker encountered during this study's fieldwork told the author that his dog caught and killed one near Oliver Street in 2018;
- Common Galaxias (a species of fish) – one was detected by electrofishing in 2000 and the author saw a mass migration in 2018.

Fauna habitat

- The water and stream channel provide habitat for fish, aquatic invertebrates, common waterbirds, Rakali and (apparently rarely) Platypus;
- The fertility of the valley favours high production of carbohydrates by plants and hence strengthens the base of the food chain;
- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, possums, kangaroos and invertebrates;

- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The barrier-free stream and the near-continuity of treed habitat along Mullum Mullum Creek to (and along) the Yarra River greatly amplify the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the site's vegetation varies from poor to good, or between ratings 'D' and 'B' on the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The site's native vegetation is fragmented into so many parts, and the condition varies so much over short distances, that estimating the amount of vegetation within each category of ecological condition is beyond the capacity of this study.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

An area of Valley Heathy Forest at Mullum Mullum Reserve and an area of Swampy Riparian Woodland just northeast of Wingrove Place are marked with stars on the aerial photograph on p. 164. Both areas easily meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Both vegetation types are listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that both patches meet standard criterion 3.2.3 for a site of **State** significance.

The area of Herb-rich Foothill Forest near Golden Grove also meets the same definition of a 'patch'. The present author is confident that its habitat score is at least 0.3. Combining that assessment with the 'vulnerable' status of Herb-rich Foothill Forest, the vegetation would have a 'High' or 'Very High' conservation significance under the 'Native Vegetation Framework'. In either case, standard criterion 3.2.3 then leads to a rating of **State** significance. An abutting area of Swampy Riparian Woodland (which is listed as 'endangered') forms part of the same patch and adds to the **State** significance.

Rare or threatened plant species

The colonies of *Chiloglottis reflexa* and *Chiloglottis trapeziformis* near Golden Grove are maintaining their numbers well despite the species being critically endangered in Maroondah as a whole. They therefore fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The other occurrence of *Chiloglottis reflexa*, near the end of Glen Cairn Avenue, has dwindled to only one visible plant in recent years due to out-competition by other species. If the competition is reduced and the colony recovers, the colony would represent Local significance.

Ecological corridor

As discussed above, the Mullum Mullum Creek corridor is probably the most important habitat corridor in Melbourne's outer east. Consequently, Site 24 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords **Local** significance to such a site.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest, Swampy Riparian Woodland and Herb-rich Foothill Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people within the site and also neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors and those who pass through.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens.

The natural ambience also encourages people to get exercise by walking, running or cycling through the site.

The site's vegetation contributes substantially to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. The very large, very old eucalypts marked on the aerial photograph on p. 164 have particular heritage significance as vestiges of the landscape more than a century ago.

The site's location along a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017:

- The only loss of habitat detected beyond deaths of individual trees was the destruction of approximately 0.02 ha near the dead-end of Strathfield Parade;
- Approximately 0.2 ha of revegetation with indigenous plants has replaced introduced trees (possibly willows) immediately upstream of Kalinda Road;
- 0.7 ha of revegetation with indigenous plants has been planted downstream of Kalinda Road; and
- Growth of indigenous trees has caused their crowns to spread over a total of (very roughly) 2 ha of lawn and paths.

It is therefore estimated that revegetation added roughly 3 ha of tree canopy or understorey to the site between 2001 and 2017.

The amount of revegetation may have been underestimated above because the 2001 aerial photographs were not clear enough to confidently detect all cases where introduced trees have been replaced by revegetation. Also, most of the revegetation that was present in 2001 was much sparser than now, so while the extent of vegetation within a revegetation area may not have enlarged much, the amount of vegetation is often much greater.

Change in the ecological condition of habitat

The site's native vegetation is fragmented into so many parts, and the condition varies so much over short distances, that estimating the amount of vegetation within each category of ecological condition is fraught with difficulty. It is therefore not possible here to reliably determine changes in ecological condition.

Changes in the species present

Leaving aside mosses and liverworts (for which there is no data prior to this study), 104 naturally-occurring, indigenous plant species have been recorded in Site 24 either in this study or in the 1996 flora survey for *'Sites of Biological Significance in Maroondah'*. To summarise the differences in species detected in the two investigations:

- 14 species that were recorded in 1996 were not found in 2018–2019, six of them perhaps due to seasonal factors;
- 27 species that were recorded in 2018–2019 were not found in 1996, none of which can be explained by seasonal factors but a few of which might be due to mistaking planted plants for naturally-occurring plants.

Some of the increase in numbers of species observed in 2018–2019 appears to be due to colonisation of the creek channel by aquatic or amphibious species. Most of the remaining differences are probably due to normal variability in a species' detectability between two flora surveys.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continuing loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Displacement of indigenous plants by introduced plants;
- Trampling of locally rare orchids by orchid photographers;
- Water pollution, affecting vegetation, aquatic invertebrates, fish, frogs, waterbirds, Rakali (or Water Rats) and perhaps Platypus;
- Further killing of Platypus and Rakali (or Water Rat) by pet dogs or foxes;
- Debilitation of indigenous plants, particularly eucalypts, by over-competition from the unnaturally high densities of eucalypts in revegetation areas (see pp. 89–90 of Volume 1). Over-competition will have its worst effects during drought, which is predicted to worsen with climate change; and
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and further urbanisation of the catchment.

Strategic planning

The zoning in the site is:

- 'Public Park and Recreation Zone' in Mullum Mullum Reserve, Peter Vergers Reserve and (oddly) behind 5–21 Marcus Road (upstream of Kalinda Road);
- 'General Residential Zone – Schedule 1': (a) between Oban Road and Peter Vergers Reserve; (b) on the northwestern side of the creek upstream of Kalinda Road; and (c) also on the southeastern side of the creek for a distance of 130 m upstream of Kalinda Road;
- 'Road Zone – Category 2' for a distance of up to 30 m on the downstream side of Oban Road; and
- 'Urban Floodway Zone' elsewhere.

The state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions apply throughout. Schedule 4 of the Significant Landscape Overlay applies: (a) in a tiny area at the site's

upstream tip; (b) on the southeastern side of the creek for a distance of 300 m upstream of Kalinda Road; (c) between Kalinda Road and Oban Road; and (d) downstream from Glen Cairn Avenue except that Schedule 3 applies at Mullum Mullum Reserve and at the downstream tip of the site.

The Vegetation Protection Overlay (VPO) applies to a rough approximation of the area recommended for that overlay in the 1997 report, *'Sites of Biological Significance in Maroondah'*.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole of Site 24 as outlined in mid-blue on the aerial photographs on p. 164. If Maroondah City Council plans to provide more native tree cover on the reserve abutting Site 24 at the end of Jennifer Court (off Jeffrey Drive), that reserve should be added to the area covered by ESO1.

Restoration opportunities

The highest priority opportunities for habitat restoration in Site 24 that became evident in this study are:

- Control introduced plants in the area around the Autumn Bird-orchids near the end of Glen Cairn Avenue;
- Carefully remove pines from the vegetation hotspot near Golden Grove. Some pines may have to remain because the process of their removal might threaten to kill some of the locally threatened plants, such as the bird-orchids; and
- Control introduced plants in the patch of Valley Heathy Forest in Mullum Mullum Reserve.

There are also extensive areas of introduced grass that could be revegetated, subject to avoidance of obstructing floodwaters.

Information sources

The analysis above draws on the following sources of information about the site:

- 18 hours of ecological survey in the site for this study during 4/2/18–25/4/19, including: (a) compiling a list of indigenous plant species (including mosses and liverworts) for each of four vegetation types; (b) documenting the details of rare plants and significant trees; (c) mapping the vegetation, rare plants and the course of the creek; and (d) recording all observations of fauna during the work. Thirteen herbarium specimens were taken, including *Hypolepis glandulifera*, *Epilobium billardierianum* subsp. *intermedium*, *Persicaria odorata* and ten species of moss;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- Electrofishing observations by Wayne Koster and Paul Close on 29/3/2000 near Glen Cairn Avenue, the data available in the Victorian Biodiversity Atlas;
- A list of birds (all common) seen on a short walk at Mullum Mullum Reserve by a Birds Australia member on 23/3/99;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork in March 1996 that included a flora survey, frog call survey and incidental fauna observations;
- Information in *'Flora and Fauna of the Koonung and Mullum Mullum Valleys (Proposed Eastern Arterial Road and Ringwood Bypass), Victoria*' (1990) by J. Yugovic, D. Crosby, K. Ebert, P. Lillywhite, S. Saddlier, M. Schulz, P. Vaughan, J. Westaway and A. Yen,
- A field data sheet for flora quadrat E10167 by John Westaway on 12/10/89 (for the report just cited) at a location later covered by the Ringwood Bypass, c. 150 m upstream of Warrandyte Rd;
- A 1968 record of Shorthead Lamprey, available in the Victorian Biodiversity Atlas (VBA);
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the VBA, Atlas of Living Australia or eBird. Note that much of the VBA data mapped in or near the site was actually gathered from well outside the site, such as Donvale or Ringwood North. The state government's vegetation mapping should be regarded as only a

rough, simplified guide to the distribution of the site's vegetation types and the locations where native vegetation occurs.

Site 25. Mullum Mullum Valley, Section 2

Biological Significance Level: *State* due to threatened vegetation types



The orange star near the right edge above matches the one near the left edge below.

Legend

Mullum Mullum Creek	Site 24	Vegetation types
Municipal boundary	Site 25	SRC Swampy Riparian Complex
Properties	Site 139	VHF Valley Heathy Forest



Boundaries

The image above shows an aerial photograph from February 2017 in two panels, the upper panel showing Site 25's western half and the lower panel showing the rest. The boundary of Site 25 is shown in mid-blue.

Site 25 extends no further west than the municipal boundary, solely because that is this report's geographic limit. As much as practicable of the rest of the site boundary follows property fences, bridge abutments or the edges of roads or paths. As with all sites in this report, the precise site boundary is available as a shapefile for geographic information systems.

The boundary of Site 25 adopted here is substantially different from the original version in the 1997 report, *'Sites of Biological Significance in Maroondah'* due to the construction of Eastlink and the Ringwood Bypass in the interim. The part that was located north of Loughnan Road is now so cut off from the rest that it has been segregated here as the new Site 139, outlined in magenta on the upper panel on the previous page. At least half of the remainder of the original Site 25 is now occupied by the new roads, and is therefore omitted here. The strip from New Street to Warrandyte Road has been added to the site because revegetation has made it a viable habitat corridor, almost connecting to Site 24.

Land use and tenure

The land is almost all either government road or Crown land council reserve. The exceptions are a 695 m² council reserve at the northern end of New Street and a drainage reserve 5 m wide × 170 m long, just downstream of Acacia Court. The land is variously used for transport (vehicular and pedestrian), recreation, drainage, sewerage and passive treatment of water runoff from the Ringwood Bypass.

General description

Site 25 extends 1.5 km from end to end as the crow flies and it occupies 10.2 ha. It is part of the most ecologically important habitat corridor in Melbourne's outer eastern suburbs.

An aerial photograph from 1945 shows that the site's upstream (western) half and half of the remainder were almost treeless. The rest of the site had young regrowth forest, only a handful of trees having crown diameters over 10 m (which is still smaller than a fully-grown eucalypt). As with most sites reviewed in this volume, there is more cover of indigenous trees today than in 1945 and the trees are generally larger.

It is quite possible that the site had been cleared of trees more than once prior to 1945, e.g. in the 19th Century to fuel the boilers of the Ringwood antimony mines and the Warrandyte gold mines. More vegetation removal occurred in the second half of the 20th Century to lay sewers and stormwater pipes.

Another phase of clearing occurred when Eastlink and the Ringwood Bypass were constructed during 1995–2008. Some of that clearing was permanent, the land now covered by road surfaces. Some of the remainder has been revegetated and the road cuttings are slowly regenerating naturally with indigenous plants.

Fortunately, some areas of regrowth forest with indigenous understorey have persisted from 1945 to now. Those areas are west of Eastlink and in the middle of the Eastlink – Ringwood Bypass interchange. The latter area includes the site's only patch of the endangered vegetation type called Valley Heathy Forest. It is on a steep, south-facing slope. The rest of the site's remnant vegetation is on the creek's floodplain or the adjacent lower slopes.

Altogether, eighty-two naturally-occurring, indigenous plant species were observed in the reserve during this study.

Progressively through the past century, clearing and urbanisation of the catchment caused Mullum Mullum Creek's flow rate to vary increasingly between pulses of high flow and long lulls of low flow. In response, engineering works in the latter part of the 20th Century altered the creek's course and fortified its banks with rocks. The creek was again diverted and fortified for the Ringwood Bypass. However, the creek escaped the usual engineering approach of constructing retarding basins and replacing the creek with a straightened drain over a pipe that takes the base flow. Since the opening of the Dight's Falls fishway in Abbotsford in 2012, there is no longer any significant barrier to fish and Platypus moving between Port Phillip Bay and Site 25.

Some of the site's revegetation is in four artificial wetlands used to improve the quality of stormwater. Three of those wetlands take runoff from the new roads and a small one at the dead end of Acacia Court drains the adjacent residential area. The largest wetland, near the left edge of the lower aerial photograph on the previous page, has been planted with a range of aquatic plant species, some of which are indigenous. That wetland is well visited by common waterbirds and it has potential to attract rarer waterbirds.

Apart from the wetlands, the site's revegetation will develop to simulate the natural structure of the original riparian (or streamside) forest. It has significantly ameliorated a previous shortage of understorey, which was constraining the habitat for wildlife. The revegetation has also almost filled a substantial gap in the Mullum Mullum valley habitat corridor.

Relationship to other land

The Mullum Mullum Creek and its fringing vegetation form the foremost habitat corridor in Melbourne's outer-eastern suburbs. Eels, Galaxias and possibly other native fish species migrate along the creek from the sea to Site 24 (upstream of Site 25) and back. (All but one local native fish species must reach the sea to complete their lifecycle.) Platypus evidently move along the corridor, as evidenced by the discovery of a mauled Platypus at the upstream end of Site 24 in 2015. These movements would not be possible if there was an impassable barrier downstream of Site 25.

Forest birds can be seen moving along Mullum Mullum Creek daily. Kangaroos can rarely be seen moving along it. These animals cannot live solely within Site 25; they use the site as supplementary habitat and to travel between other sites, e.g. between the Yarra Valley Grammar School's forest (Site 22) near the creek's source, Ringwood Lake Park (Site 26) and Yarran Dheran in the City of Whitehorse.

Flying insects may also use the corridor in similar ways.

Pollination that occurs from these movements of birds and insects improves the reproductive success and genetic diversity of plants in all the visited sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

The ecological functions of Site 25 are critically dependent on the creek's catchment. Increased subdivision, land development and impermeable surfaces are causing increasing problems of pulsed flows in the creek. Water pollution significantly affects what can live in the creek and on its banks.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'. So many indigenous plants have been planted that one or two of the species presumed to be present naturally may have been planted, even though the author took care to assess that possibility and check the available planting lists.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion) in the middle of the Eastlink – Ringwood Bypass interchange

Canopy trees: Dominated by Yellow Box (*Eucalyptus melliodora*), followed by Red Stringybark (*E. macrorhyncha*). Bundy (*E. goniocalyx*) is scarce and two young Swamp Gums (*E. ovata*) have volunteered themselves on ground excavated for the Ringwood Bypass. Some Narrow-leaved Peppermints (*E. radiata*) grow on the boundary with Riparian Forest.

Lower trees: Hardly any other than a few Cherry Ballart (*Exocarpos cupressiformis*) and Black Wattle (*Acacia mearnsii*).

Medium to large shrubs: Fairly dense and with a fairly diverse range of species. Shiny Cassinia (*Cassinia longifolia*) is now abundant but was absent in the 1990s. Sweet Bursaria (*Bursaria spinosa*), Sifton Bush (*C. sifton*), Prickly Currant-bush (*Coprosma quadrifida*), Victorian Christmas-bush (*Prostanthera lasianthos*) and Australian Dusty Miller (*Spyridium parvifolium*) are fairly abundant. Although scarce due to the small area, the following additional species are typical of Valley Heathy Forest: Common Cassinia (*Cassinia aculeata*), Common Correa (*Correa reflexa*), Common Heath (*Epacris impressa*), Burgan (*Kunzea* sp.), Hop Goodenia (*Goodenia ovata*), Snowy Daisy-bush (*Olearia lirata*) and Tree Everlasting (*Ozothamnus ferrugineus*).

Small shrubs: Two Silky Daisy-bush plants (*Olearia myrsinoides*) are all that was found in this study, but Grey Parrot-pea (*Dillwynia cinerascens*) and Common Flat-pea (*Platylobium obtusangulum*) were present previously.

Ferns: Common Maidenhair (*Adiantum aethiopicum*) was recorded previously and the failure to detect it in this study could be due to the time of year (April).

Climbers: Love Creeper (*Comesperma volubile*) is scattered. Mountain Clematis (*Clematis aristata*) and Downy Dodder-laurel (*Cassytha pubescens*) are scarce.

Creepers: The wood-sorrel, *Oxalis exilis/perennans* is fairly abundant and the pennywort, *Hydrocotyle ?laxiflora*, is scattered. Kidney-weed (*Dichondra repens*) is scarce.

Grasses, rushes and sedges: Fairly abundant and rich in species. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Red-anther Wallaby-grass (*Rytidosperma pallidum*) are dominant. Kangaroo Grass (*Themeda triandra*) was also abundant in the 1990s but is no more. The following species are fairly abundant or scattered liberally: Variable Sword-sedge (*Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*), Soft Tussock-grass (*Poa morrisii*) and Bristly Wallaby-grass (*Rytidosperma setaceum*).

Other groundcover: Mosses and liverworts are fairly abundant, particularly Broody Swan-neck Moss (*Campylopus clavatus*), Heath Star Moss (*Campylopus introflexus*), Common Hypnum (*Hypnum cupressiforme*), Golden Weft-moss (*Thuidiopsis furfurosa*) and Green Worms (*Chiloscyphus semiteres*). Vascular species are greatly depleted, the only abundant ones detected in April 2019 being Tasman Flax-lily (*Dianella tasmanica*) and Small Poranthera (*Poranthera microphylla*). Variable Stinkweed (*Opercularia varia*), Honey-pots (*Acrotriche serrulata*) and Common Rice-flower (*Pimelea humilis*) are very scarce. Seasonal species were probably overlooked due to drought and the time of year.

Riparian Forest (EVC 18, Vulnerable in the bioregion) on the creek flats and lower slopes

Canopy trees: Strongly dominated by Manna Gum (*Eucalyptus viminalis*), followed by Swamp Gum (*E. ovata*) and Yellow Box (*Eucalyptus melliodora*). Messmate Stringybark (*E. obliqua*) is scattered thinly. A few Narrow-leaved Peppermint (*E. radiata*) are present near the western end of the Ringwood Bypass.

Lower trees: Strongly dominated by Silver Wattle (*Acacia dealbata*), with a few thickets of Swamp Paperbark (*Melaleuca ericifolia*). Blackwood (*Acacia melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are scarce.

Medium to large shrubs: Patchily dense in the more natural areas. Prickly Currant-bush (*Coprosma quadrifida*) forms a dense thicket in the middle of the Eastlink – Ringwood Bypass interchange. Sweet Bursaria (*Bursaria spinosa*), Sifton Bush (*Cassinia sifton*), Hop Goodenia (*Goodenia ovata*) and Victorian Christmas-bush (*Prostanthera lasianthos*) are fairly abundant in the more natural areas. The following species are scarce: Prickly Moses (*Acacia verticillata*), Common Cassinia (*Cassinia aculeata*), Yarra Burgan (*Kunzea leptospermoides*), Tree Everlasting (*Ozothamnus ferrugineus*), Large Kangaroo Apple (*Solanum laciniatum*), Australian Dusty Miller (*Spyridium parvifolium*) and Snowy Daisy-bush (*Olearia lirata*). Golden Bush-pea (*Pultenaea gunnii*) was present in the 1990s but was not found during this study.

Small shrubs: Absent.

Ferns: Austral Bracken (*Pteridium esculentum*) is abundant. Common Maidenhair (*Adiantum aethiopicum*), Rough Tree-fern (*Cyathea australis*) and Mother Shield-fern (*Polystichum proliferum*) were recorded in 1996 but not in this study.

Climbers: Mountain Clematis (*Clematis aristata*) was found in 1996 but not Small-leafed Clematis (*C. decipiens*). The reverse was true in 2018. There is a small patch of Coarse Dodder-laurel (*Cassytha melantha*).

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is scarce.

Grasses, rushes and sedges: Reduced in density by competition with introduced groundcover species. The most abundant species are Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) and a very large form of Variable Sword-sedge (*Lepidosperma laterale*). Scarcer species include Thatch Saw-sedge (*Gahnia radula*), Green Rush (*Juncus gregiflorus*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Clustered Wallaby-

grass (*Rytidosperma racemosum*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Forest Wire-grass (*Tetrarrhena juncea*). There is one patch of Common Reed (*Phragmites australis*) on a terrace next to the creek.

Other groundcover: Very depleted, restricted to scattered Tasman Flax-lily (*Dianella tasmanica*) and a very small number of Black-anther Flax-lily (*Dianella revoluta*).

Perennial stream and stream channel (no EVC or conservation status have been assigned by the Victorian Government)

Trees and shrubs: Absent.

Fern: Austral Bracken (*Pteridium esculentum*) on the banks extends into the channel in one or two places. Beside Eastland, there is one plant of Tender Brake (*Pteris tremula*), which is questionably indigenous.

Creepers: Introduced creepers are abundant but the only indigenous representation is from Bidgee-widgee (*Acaena novae-zelandiae*).

Mosses and liverworts: *Rhynchostegium tenuifolium* grows on rocks that protrude from the water during low flow. The pocket-moss, *Fissidens bifrons*, is present in silt and its abundance will depend on flooding.

Amphibious species: Green Rush (*Juncus gregiflorus*) is abundant. Hairy Willow-herb (*Epilobium hirtigerum*) and Slender Knotweed (*Persicaria decipiens*) are fairly abundant. Swamp Club-rush (*Isolepis inundata*) and Water Pepper (*P. hydropiper*) are scarce.

Aquatic species: Scarce, represented by Water Plantain (*Alisma plantago-aquatica*), Blunt Pondweed (*Potamogeton ochreatus*) and four patches of the cumbungi species, *Typha orientalis*.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 25 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – approximately eleven individuals grow in the Valley Heathy Forest, in variable health;
- *Amyema pendula* (Drooping Mistletoe) – seen in 1996 but probably now died out;
- *Chrysocephalum semipapposum* (Clustered Everlasting) – seen in 1996 but probably now died out;
- *Polystichum proliferum* (Mother Shield-fern) – seen in 1996 but probably now died out; and
- *Schoenus maschalinus* (Leafy Bog-rush) – seen in 1996 but probably now died out.

Significant trees

Site 25 contains many large eucalypts, particularly Manna Gums (*Eucalyptus viminalis*).

Other

The only local record of *Podolepis decipiens* is of plants rescued from the construction of the Ringwood Bypass Road. The location was just south of the junction of Poynton Avenue and Kean Street, which is no longer part of Site 25. The species not seen during previous flora surveys there. The species is treated here as a vagrant, i.e. a transient occurrence that probably would have died out naturally.

Significant fauna

- Platypus – a mauled Platypus was discovered in 2015 at the upstream end of Site 24. It must have passed through Site 25 to have got there. It is likely that Platypus are not resident in either site but move through it in search of habitat, e.g. when a young animal is evicted from its parental range;
- Common Galaxias (a species of fish) – the author saw a mass migration in 2018, drawing the attention of several Little Black Cormorants. The same species was found previously in electrofishing surveys.

Fauna habitat

- The water and stream channel provide habitat for fish, aquatic invertebrates, common waterbirds and (apparently rarely) Platypus;
- The artificial wetlands support waterbirds, frogs and aquatic invertebrates, particularly in the case of the wetland beside the pedestrian bridge over the Ringwood Bypass;
- The fertility of the valley favours high production of carbohydrates by plants and hence strengthens the base of the food chain;
- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, possums and invertebrates but the actual usage may be limited by the proximity to vehicular and pedestrian traffic;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The barrier-free stream and the near-continuity of treed habitat along Mullum Mullum Creek to (and along) the Yarra River greatly amplify the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the site's Valley Heathy Forest is good, fitting rating 'B' on the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The artificial wetland beside the pedestrian bridge over the Ringwood Bypass is also in rating 'B'. The creek channel and approximately 1 ha of treed land are in poor ecological condition (rating 'D'). The rest of the site is in fair ecological condition (rating 'C').

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The area of Valley Heathy Forest easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the patch meets standard criterion 3.2.3 for a site of **State** significance.

The area of Riparian Forest on the right bank west of Eastlink meets the same definition of a 'patch'. The present author is confident that its habitat score is at least 0.3. Combining that assessment with the 'vulnerable' status of Riparian Forest, the vegetation would have a 'High' or 'Very High' conservation significance under the 'Native Vegetation Framework'. In either case, standard criterion 3.2.3 then leads to a rating of **State** significance.

Part of the area of Riparian Forest in the middle of the Eastlink – Ringwood Bypass interchange has over 10% native understorey. Whether that area is large enough to meet the relevant definition of a 'patch' is uncertain, depending on exactly where one maps the boundary with Valley Heathy Forest. The habitat score may or may not reach 0.3. If both of these uncertain attributes are actually true, that area meets standard criterion 3.2.3 for State significance.

Rare or threatened plant species

The eleven or so Red Stringybarks in the site's Valley Heathy Forest appear to form a viable stand. The species falls into the 'critically endangered' category of dying out in Maroondah. The trees therefore fit

the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

As discussed above, the Mullum Mullum Creek corridor is probably the most important habitat corridor in Melbourne's outer east. Consequently, Site 25 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords **Local** significance to such a site.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest and Riparian Forest.

Note that the features giving the site State significance are all in the western third of the site. It would be appropriate to treat the rest of the site as being of Local significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people within the site and also neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors and those who pass through.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens.

The natural ambience also encourages people to get exercise by walking, running or cycling through the site.

The site's vegetation – particularly the very large Manna Gums – preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

The site's location along a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

The original version of Site 25 (Lorimer *et al.* 1997) only extended west from the extended alignment of New Street. Within that area, approximately 4.3 ha of natural or semi-natural habitat was permanently destroyed for Eastlink and the Ringwood Bypass in the mid-2000s. A small fraction of that amount was cleared and then revegetated following construction.

Upstream from the New Street alignment, revegetation associated with the Ringwood Bypass has increased the amount of indigenous vegetation cover by approximately 0.5 ha compared with 1997. The same amount of revegetation has replaced houses and their gardens in the southern tip of the current version of Site 25.

Change in the ecological condition of habitat

As described above, the ecological condition of the site's Valley Heathy Forest currently falls into rating 'B'. It was placed in the same category in the 1997 report, *'Sites of Biological Significance in Maroondah'*, so any change that has occurred is within that category.

In the middle of the Eastlink – Ringwood Bypass interchange is an area of Riparian Forest that was rated 'B' in 1997 and is rated 'C' here, which may reflect a deterioration resulting from the road construction. The rest of the Riparian Forest in the 1997 version of Site 25 was rated 'D' whereas 1.3 ha of it is rated 'C' here, reflecting improvement resulting from revegetation.

Changes in the species present

Because the boundary of Site 25 adopted here differs so much from the original (1997) boundary, there is limited capacity to compare the plant species seen in the 1996 and 2018–2019 flora surveys on a like-for-like basis. With that caveat, the following information is available:

- Fifty indigenous plant species seen in 1996 in the original version of the site were not seen in 2018–2019. About six of those species are highly seasonal and might have escaped detection in this study due to drought and the times of year. Many others were probably in areas destroyed for Eastlink or the Ringwood Bypass;
- Fourteen indigenous plant species seen in 2018–2019 within the original version of Site 25 were not seen in 1996, excluding mosses and liverworts (which were not sought in 1996). Four of those species only occur in the creek channel and may have been absent in the 1996 flora survey due to earlier engineering works.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This problem is most serious in the area of Valley Heathy Forest. It may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Water pollution, affecting vegetation, aquatic invertebrates, fish, frogs, waterbirds, Platypus and perhaps Rakali (or Water Rats);
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and further urbanisation of the catchment.
- Debilitation of indigenous plants, particularly large, old eucalypts, by over-competition from the unnaturally high densities of trees in revegetation areas (see pp. 89–90 of Volume 1). Over-competition will have its worst effects during drought, which is predicted to worsen with climate change; and
- Displacement of indigenous plants by introduced plants.

Strategic planning

The zoning in the site is:

- 'Urban Floodway Zone' in a band along the creek downstream from 38 Nelson Street;
- 'Public Park and Recreation Zone' south of the creek from 38 Nelson Street to Warrandyte Road;
- 'Public Park and Recreation Zone' also for the treed lawn immediately west of New Street; and
- 'Road Zone – Category 1' for the remainder of the site.

The state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions apply throughout. The Significant Landscape Overlay applies westward from Ringwood Street: mostly Schedule 4 but Schedule 3 for the Valley Heathy Forest and around the artificial wetlands marked on the lower aerial photograph on p. 176. The Heritage Overlay applies to three Manna Gums in the site but the trees appear to have been removed. The Bushfire Management Overlay applies to the site's western tip.

The Vegetation Protection Overlay (VPO) applies to the original version of Site 25, as per the 1997 report, *'Sites of Biological Significance in Maroondah'*.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the version of Site 25 outlined in mid-blue on the aerial photographs on p. 176.

Restoration opportunities

West of New Street, the expanses of lawn just inside and outside the site's southern boundary appear to receive little use. If that impression is confirmed, some or all of those areas could be revegetated. Care would need to be taken not to overplant trees, particularly beneath the existing Manna Gums. That caution is explained on pp. 89–90 of Volume 1.

Information sources

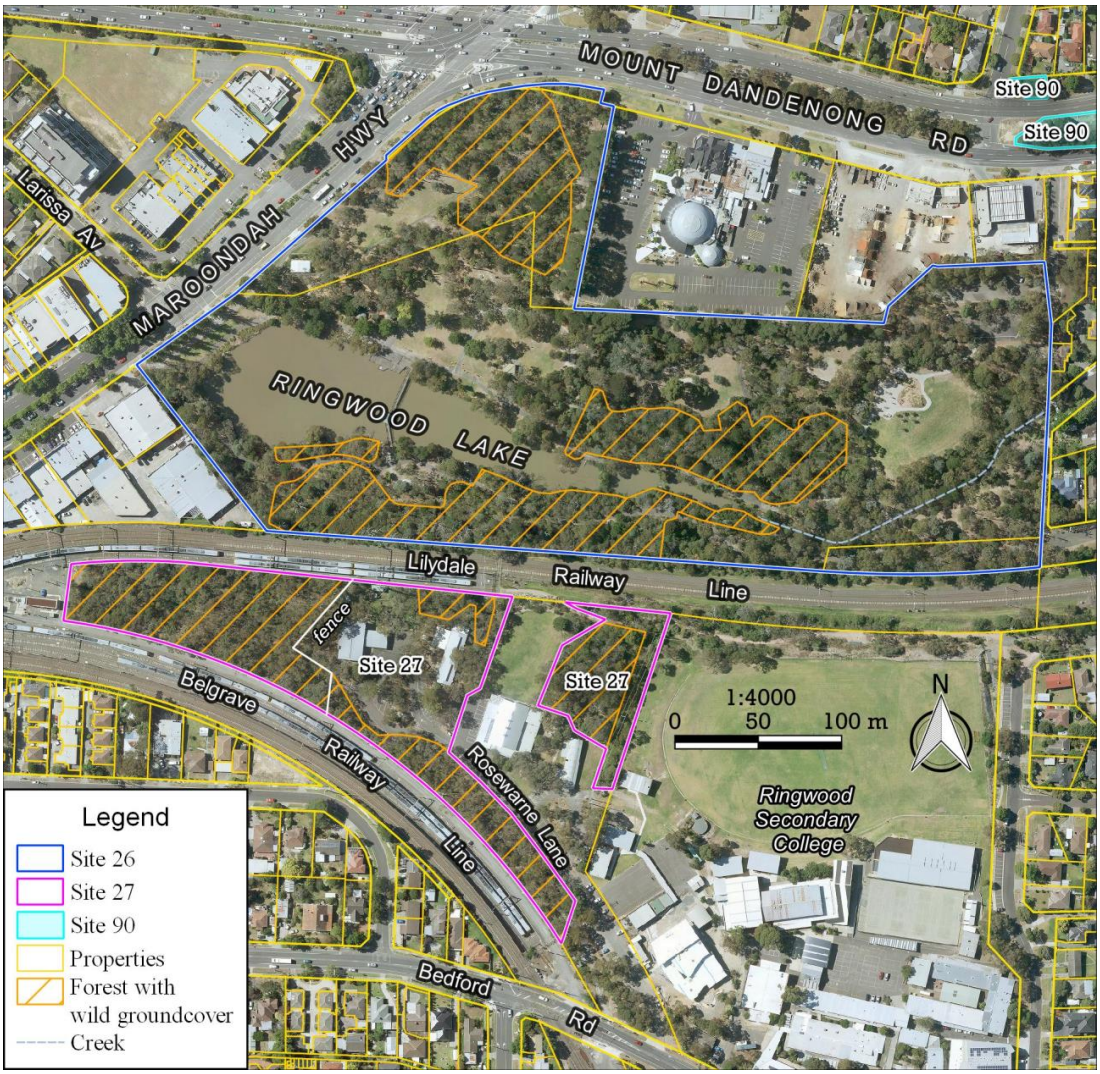
The analysis above draws on the following sources of information about the site:

- 3¼ hours of ecological survey in the site for this study during 8/3/18–26/4/19, including: (a) compiling a list of indigenous plant species (including mosses and liverworts) for each of three vegetation types; (b) documenting the details of rare or scarce plants and significant trees; and (c) mapping the vegetation and rare or scarce plants;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- Flora data from quadrat E2506500 by Simon Cropper on 27/6/98 (available in the Victorian Biodiversity Atlas (VBA)), supported by herbarium specimens of mosses and a liverwort;
- Electrofishing results by Paul Close, Matthew Jones, Wayne Koster, Jason Lieschke and Tarmo Raadik on 18/6/98–29/3/00, including Shortfin Eel, Common Galaxias and Flathead Gudgeon, the records stored in the VBA;
- Information used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), including fieldwork in March 1996 involving a flora survey, frog call survey and incidental fauna observations;
- Information in *'Flora and Fauna of the Koonung and Mullum Mullum Valleys (Proposed Eastern Arterial Road and Ringwood Bypass), Victoria*' (1990) by J. Yugovic, D. Crosby, K. Ebert, P. Lillywhite, S. Saddlier, M. Schulz, P. Vaughan, J. Westaway and A. Yen;
- Field data sheets for five flora quadrats by John Westaway on 11–12 October 1989 (for the report just cited), three of them at locations later destroyed for Eastlink or the Ringwood Bypass. (Note that the locations are wrongly mapped in the VBA – refer to the data sheets and the map in the report.);
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the VBA, Atlas of Living Australia (ALA) or eBird. Note that much of the data in the VBA and ALA mapped in or near the site was actually gathered from well outside the site, sometimes contrary to the claimed locational precision. Although the VBA presents herbarium specimen MEL 2065372C as being a specimen of an *Acaena* species, it is actually a specimen of *Chiloscyphus*. Similarly, MEL 2065372D is not a specimen of *Acer* but of *Ptychomnion*. The state government's vegetation mapping should be regarded as an approximate guide to the distribution of the site's vegetation types and the locations where native vegetation occurs.

Site 26. Ringwood Park Lake

Biological Significance Level: *State* due to an endangered vegetation type



Aerial photograph taken February 2017

Boundary, land use and tenure

The site boundary (blue, above) follows property boundaries except that: (a) the northeastern entrance from Mount Dandenong Road is excluded; and (b) near the corner of Maroondah Highway and Mount Dandenong Road, the site extends to the footpath.

The land is managed as a major amenity park, as well as to conserve the indigenous flora and fauna and provide thoroughfare via shared paths. As seen above, there are three properties. The northwestern property is Crown land, most of it zoned for road construction. The other two properties are council land.

General description

This site occupies 9.7 hectares. The 1.2-hectare lake is one of the park's habitat features, particularly for waterbirds. The hatched areas on the aerial photograph above are forested and have indigenous understorey

including shrubs, wildflowers and grasses. There are large, old eucalypts in the lawns north of the lake. Other than the areas just mentioned, nearly all the park's trees that can be seen on the aerial photograph have been planted progressively over decades – most of them native to other parts of Australia. The exception is an old cypress windbreak along the boundary with a hotel.

The lake is artificial and fed by two stormwater pipes: one that enters the park's eastern edge and flows as a creek to the lake; the other from the southeast that drains the southern half of Ringwood East. The catchment is quite urbanised, so the water is rather polluted. The lake has to be drained and dredged periodically to remove contaminated sediment and the lake's water has to be oxygenated artificially. The lake is stocked with introduced species of fish and two non-indigenous species of turtle. It also contains two native fish species: Flathead Gudgeon and Shortfin Eel. The latter migrate over 2,000 km to the lake from their birthplace in the Coral Sea, to where they must return to breed.

The lake has a fringe of wetland plants such as rushes and cumbungis. Some of these have been planted and others have arrived on the wind or waterbirds.

An aerial photograph from 1945 shows that near where the sound shell now sits north of the lake, there were five mature trees in a lawn area. Three of those trees appear to correspond to large-trunked eucalypts that one can see there today, still surrounded by lawn. A large Bundy (*Eucalyptus goniocalyx*) next to the picnic shelter south of the lake also appears to be visible as a mature tree on the 1945 aerial photograph. There were only 5–9 other mature trees present in the whole park in 1945. In and north of the park's slender, southeastern property was a paddock with an eroded creek and a single tree. The park's northwestern property and a small area south of the lake had young regrowth forest with well-spaced tree crowns up to 7 m diameter (compared with over 12 m for a mature eucalypt). These areas now support the most diverse range of indigenous plants in the park. The easternmost of the park's hatched areas on the aerial photograph had very sparse, young trees over grass, except for some scrub at the eastern end. That hatched area now looks rather natural, with mature, naturally-occurring eucalypts, dense indigenous understorey, wildflowers and many forest birds.

Considering the sparse and mostly immature vegetation present in the park in 1945, it is surprising how many naturally-occurring, indigenous plant species grow there today: 135 were detected in this study, plus eight that may or may not have been planted. The vegetation now supports a substantially more diverse range of forest birds and mammals than is normal for an urban park, including Sugar Gliders and a resident pair of kangaroos.

The park's features and history just described make it an excellent venue for environmental education and tours but that potential has not been tapped.

Relationship to other land

As can be seen from the aerial photograph on p. 185, Ringwood Lake Park and Bedford Park (Site 27) are separated only by the Lilydale Railway Line. One must expect many forest birds, bats and flying insects to move between these sites, as neither site provides adequate habitat on their own for most species. By far the most probable explanation for kangaroo droppings observed at Bedford Park during this study is that at least one of Ringwood Lake Park's resident kangaroos has crossed the railway line, and may well do so repeatedly.

Kangaroos have only been noticed in Ringwood Park Lake in recent years. They appear to have reached there by heading 270 m southeast from the Mullum Mullum valley (Site 24, p. 164), where small numbers of kangaroos have been known for more than a decade. Kangaroos are reported (rarely) on the Ringwood Bypass.

Birds, bats and flying insects are also likely to fly between Ringwood Lake Park and the Mullum Mullum valley. Waterbirds are much more accepting of habitat fragmentation and can easily fly between Ringwood Lake and other wetlands, even for long distances over suburbia. Ringwood Lake is likely to become a refuge for waterbirds in time of drought, when rural wetlands dry up.

Pollination that occurs from the various movements of birds and insects between the Mullum Mullum valley, Ringwood Lake Park and Bedford Park improves the reproductive success and genetic diversity of

plants in all the visited sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

It is remarkable that Shortfin Eels manage to reach the lake at the end of their 2,000–3,000 km migration from their birthplace in the Coral Sea (the only known spawning ground on Earth). They must reach Ringwood via Mullum Mullum Creek and then head south along Larissa Avenue to the lake, by swimming up a stormwater pipe and/or slithering over land (as they are capable of doing in wet weather).

The ecological functions of Ringwood Lake are strongly affected by the creek's catchment. Increased subdivision and impermeable surfaces are causing increasing problems of pulsed flows. Water pollution significantly affects what can live in the water and on the banks.

A section of forest south of the eastern end of the lake is substantially affected by runoff from the railway land. There appears to have been a change in the drainage from the railway land in the past few years and some of the park's vegetation is not adapting well.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*). There are also substantial numbers of Messmate Stringybark (*E. obliqua*), Swamp Gum (*E. ovata*) and Narrow-leaved Peppermint (*E. radiata*). Bundy (*E. goniocalyx*) is scarce. Red Stringybark (*E. macrorhyncha*) was recorded in the previous (1995) flora survey but appears to have died out.

Lower trees: Swamp Paperbark (*Melaleuca ericifolia*) forms dense thickets next to the creek and lake. Elsewhere, the lower tree layer is dominated by Black Wattle (*Acacia mearnsii*) and Blackwood (*A. melanoxylon*). Golden Wattle (*A. pycnantha*) and Cherry Ballart (*Exocarpos cupressiformis*) are also fairly abundant in some areas.

Medium to large shrubs: Patchily dense. Dominated by Sweet Bursaria (*Bursaria spinosa*), Hop Goodenia (*Goodenia ovata*) and Burgan (*Kunzea* sp.). There are also quite a few scattered plants of Myrtle Wattle (*Acacia myrtifolia*), Prickly Moses (*A. verticillata*), Shiny Cassinia (*Cassinia longifolia*), Sifton Bush (*C. sifton*), Snowy Daisy-bush (*Olearia lirata*), Golden Bush-pea (*Pultenaea gunnii*) and Large Kangaroo Apple (*Solanum laciniatum*). The following species are scarce or very localised: Hop Wattle (*Acacia stricta*), Silver Banksia (*Banksia marginata*), Common Cassinia (*Cassinia aculeata*), Prickly Currant-bush (*Coprosma quadrifida*), Common Heath (*Epacris impressa*), Furze Hakea (*Hakea ulicina*), Manuka (*Leptospermum scoparium*), Tree Everlasting (*Ozothamnus ferrugineus*), Elderberry Panax (*Polyscias sambucifolia*) and Kangaroo Apple (*Solanum aviculare*). Narrow-leaf Bitter-pea (*Daviesia leptophylla*) was recorded in 1995 but not in this study.

Shrubby herb: There are substantial numbers of Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*Senecio quadridentatus*), plus very few Floodplain Groundsel (*Senecio campylocarpus*) as outliers from the lake shore.

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is abundant. Silky Daisy-bush (*Olearia myrsinoides*) is fairly abundant. Grey Parrot-pea (*Dillwynia cinerascens*) and Erect Guinea-flower (*Hibbertia riparia*) are scarce. Common Beard-heath (*Leucopogon virgatus*) was recorded in 1995 but not in this study.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over substantial areas. Common Maidenhair (*Adiantum aethiopicum*), Rough Tree-fern (*Cyathea australis*) and Screw Fern (*Lindsaea linearis*) are all scarce.

Climbers: Common Apple-berry (*Billardiera mutabilis*) and Love Creeper (*Comesperma volubile*) are fairly abundant. The small-leafed clematis, *Clematis decipiens*, is scarce and only a single plant of Purple Coral-pea (*Hardenbergia violacea*) was found.

Creepers: Ivy-leaf Violet (*Viola hederacea*) is abundant. Bidgee-widgee (*Acaena novae-zelandiae*) and Trailing Goodenia (*Goodenia lanata*) are fairly abundant in certain areas, as is the Swamp Isotome (*Isotoma fluviatilis*) in the lawn near the sound shell. The wood-sorrel, *Oxalis exilis/perennans*, is scattered thinly and only a single plant of Creeping Bossiaea (*Bossiaea prostrata*) was found.

Grasses, rushes and sedges: Abundant and rich in species. Dominated in different areas by Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), the broad-leafed form of Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*) or Clustered Wallaby-grass (*Rytidosperma racemosum*). The following species are abundant but not dominant anywhere: Slender Sword-sedge (*Lepidosperma gunnii*), Purplish Wallaby-grass (*Rytidosperma tenuius*), Common Bog-rush (*Schoenus apogon*) and Small Grass-tree (*Xanthorrhoea minor*). The following species are fairly abundant but less so than the previous group: Fibrous Spear-grass (*Austrostipa semibarbata*), Reed Bent-grass (*Deyeuxia quadriseta*), Broom Rush (*Juncus sarophorus*), the narrow-leafed form of Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Forest Wire-grass (*Tetrarrhena juncea*) and Kangaroo Grass (*Themeda triandra*). Ten or more other species are scarce.

Other groundcover: Mosses are fairly abundant, particularly Heath Star-moss (*Campylopus introflexus*), Common Hypnum (*Hypnum cupressiforme*) and Golden Weft-moss (*Thuidiopsis furfurosa*). The liverwort, Green Worms (*Chiloscyphus semiteres*) is also fairly abundant, as are the small shrublets, Honey-pots (*Acrotriche serrulata*) and Common Rice-flower (*Pimelea humilis*). Forbs (i.e. non-grassy, non-woody species) are abundant in the more natural areas and represented by at least 36 species. Of those, the following are fairly abundant (but quite localised in some cases): Chocolate Lily (*Arthropodium strictum*), Pale Grass-lily (*Caesia parviflora*), Common Cotula (*Cotula australis*), Spreading Crassula (*Crassula decumbens*), Pale Flax-lily (*Dianella longifolia*), Black-anther Flax-lily (*Dianella revoluta*), Tasman Flax-lily (*Dianella tasmanica*), Tall Sundew (*Drosera auriculata*), Common Raspwort (*Gonocarpus tetragynus*), Yellow Pennywort (*Hydrocotyle foveolata*), Toad Rush (*Juncus bufonius*), Jersey cudweed (*Laphangium luteoalbum*), Broad-leaf Stinkweed (*Opercularia ovata*), Variable Stinkweed (*Opercularia varia*) and Yellow Rush-lily (*Tricoryne elatior*).

Creek and artificial lake (no EVC or conservation status have been assigned by the Victorian Government). Note: one or two of the species below may be the result of planting.

Trees: In places, suckering patches of Swamp Paperbark (*Melaleuca ericifolia*) extend from the banks into the mud.

Other woody plants: None.

Ferns: None.

Scramblers: Angled Lobelia (*Lobelia anceps*) is abundant at water's edge.

Mosses and liverworts: *Rhynchostegium tenuifolium* and Moonwort (*Lunularia cruciata*) are fairly abundant.

Amphibious species: The following species are fairly abundant: Lesser Joyweed (*Alternanthera denticulata*), Tall Sedge (*Carex appressa*), Swamp Crassula (*Crassula helmsii*), Hairy Willow-herb (*Epilobium hirtigerum*), Swamp Club-rush (*Isolepis inundata*), Toad Rush (*Juncus bufonius*), Green Rush (*J. gregiflorus*) and Slender Knotweed (*Persicaria decipiens*). The following species are scarce: Common Blown Grass (*Lachnagrostis filiformis*), Pale Rush (*Juncus pallidus*), Broom Rush (*Juncus sarophorus*), Common Cudweed (*Euchiton involucratus*) and Streaked Arrow-grass (*Triglochin striata*).

Aquatic species: There are patches of the cumbungi, *Typha orientalis*. Water Plantain (*Alisma plantago-aquatica*) is scarce.

Significant plants

Rare (but not otherwise threatened) in Victoria

Under the right conditions (as occurred in 2018), the short-lived Floodplain Groundsel (*Senecio campylocarpus*) forms dense clusters beside Ringwood Lake, with one or two outliers in the surrounding forest. The species occurs sporadically on drying mud throughout southeastern Australia.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Ringwood Lake Park can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Austrostipa semibarbata* (Fibrous Spear-grass) – at least twelve individuals grow close to the Maroondah Highway footpath near the Mount Dandenong Road corner (probably rather more but the count was done out of season). This is the only occurrence of this species in Maroondah or for many kilometres beyond. The species was first recorded in Ringwood in 1891. The population does not appear to have changed much since the author examined it in 1995, so it appears quite viable;
- *Banksia marginata* (Silver Banksia) – there is a cluster of plants (perhaps suckering off one root system) just northeast of the concrete ford over the creek. It might have been planted but the species was recorded as occurring naturally in the park in 1995;
- *Cynoglossum suaveolens* (Sweet Hound's-tongue) – one patch was reported near the railway line by Ruth Jackson in 2001 and it may have been overlooked in this study due to the times of year when that location was inspected;
- *Eucalyptus macrorhyncha* (Red Stringybark) – recorded in 1995 but not in this study;
- *Gratiola peruviana* (Austral Brooklime) – one patch occurs on a revegetated bank of the creek near its upstream end, probably planted;
- *Hakea ulicina* (Furze Hakea) – one apparently wild plant grows approximately 12 m west of the path to the pedestrian railway crossing. Another plant seen in this study may have been planted. The species was recorded as wild in 1995, supporting the probability that at least one of the two existing plants is wild;
- *Isotoma fluviatilis* (Swamp Isotome) – quite a few substantial patches grow in lawn near the sound shell, as in 1995;
- *Muellerina eucalyptoides* (Creeping Mistletoe) – recorded in 1995 but not detected in this study;
- *Persicaria praetermissa* (Spotted Knotweed) – one plant grows at the western corner of the lake, where it may have been planted;
- *Senecio minimus* (Shrubby Fireweed) – scattered around the lake in substantial numbers, with a few outliers in the forest;
- *Solanum aviculare* (Kangaroo Apple) – three plants grow beside a footpath junction south of the historical exhibit for antimony mining. The only other occurrences in Maroondah in recent years are one individual in Bayswater North (which has since died) and several at Warrien Reserve.

Significant fauna

Listed as near-threatened in Victoria

- Nankeen Night Heron – one individual was resident during this study, as was the case in the 1995 study;

Rare or threatened in Maroondah

- Australasian Darter – an adult female, an adult male and a possible juvenile female each spent extended periods at the lake during 2018–2019 but their periods of tenure did not overlap much;
- Great Cormorant – reported only once: five of them (with photographic evidence on eBird) by Dan Forster on 25/8/18;
- Buff-banded Rail – an occasional visitor, seen in 2018;
- Southern Boobook – photographed in 2020 near the sound shell;
- Scarlet Honeyeater (or Scarlet Myzomela) – two seen on 5/1/18, reported to eBird by Steve Clark;

- White-browed Woodswallow – rare visitor, last recorded in March 2006;
- Grey Shrike-thrush – reported only once, on 3/12/11 in eBird, so presumed to be a vagrant;
- Sugar Glider – resident, seen in 2018;
- Eastern Grey Kangaroo – a resident pair, significant only because of the urbanised surroundings and the opportunity provided for park visitors to see an iconic Australian species.

Fauna habitat

- The water provides habitat for aquatic invertebrates, fish, frogs and waterbirds;
- The structure and composition of the native vegetation in the hatched areas on the aerial photograph on p. 185 represents suitable habitat for a range of forest birds, bats, possums, kangaroos and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the 2.4 ha of vegetation within Ringwood Lake Park's hatched areas on the aerial photograph on p. 185 comprises approximately 0.2–0.3 ha that rates 'B' (or very good) and 2.1–2.2 ha that rates 'C' (or fair). The rest of the park's native vegetation rates 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The three largest of Ringwood Lake Park's hatched areas on the aerial photograph on p. 185 easily meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. They contain Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that all three areas meet standard criterion 3.2.3 for a site of **State** significance.

Rare or threatened species

The Nankeen Night Heron is listed by the Victorian Government as 'Near threatened'. Its natural range extends beyond Victoria. A single bird was resident in the park during this study, as was the case in the previous study in 1995. These conditions meet standard criterion 3.1.2 for Regional significance.

Referring to the section above headed 'Significant plants', *Senecio campylocarpus* is listed as 'rare' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. It occurs sporadically across southeastern Australia. Ringwood Lake Park's clusters of the species meet standard criterion 3.1.2 for a site of Regional significance.

Referring to the section above headed 'Critically endangered in Maroondah', the park's populations of *Austrostipa semibarbata*, *Isotoma fluviatilis*, *Senecio minimus* and *Solanum aviculare* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The same applies to the park's Sugar Gliders, which are considered to be threatened in Maroondah.

The park's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting or travelling through the park. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The park's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors and those who pass through.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens.

The park's natural ambience also encourages people to get exercise by walking, running or cycling through the park.

The park's resident kangaroos represent a natural attraction that few urban parks can offer – a feature that should perhaps be publicised.

The park also represents an excellent venue for environmental education and engaging the local community with nature. However, that potential is not being realised at present.

The park preserves something of the area's natural landscape in a heavily visited location. It, and the associated birds, kangaroos and other wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

No difference can be discerned in the extent of the park's habitat seen on aerial photographs from 2001 and 2017.

Changes in the species present

Leaving aside mosses and liverworts (for which there is no data prior to this study), 131 naturally-occurring, indigenous plant species have been recorded at Ringwood Lake Park either in this study (2018–2019) or in the 1995 flora survey for *'Sites of Biological Significance in Maroondah'*. Four of those species are each represented by two distinct subspecies. To summarise the differences in plant species detected in the two investigations:

- 11 species that were recorded in 1995 were not recorded in 2018–2019, two of them perhaps due to seasonal factors; and
- 87 species that were recorded in 2018–2019 were not recorded in 1995, two of which might be explained by seasonal factors.

The two surveys were conducted by different people (John C. Reid in 1995 and the author in 2018–2019). The author judges that the difference in the skill and effort of each observer might account for up to about

quarter of the greater number of species detected in 2018–2019. That leaves over fifty species that appear to have regenerated from soil-borne seed or colonised by seeds brought in by wind or birds. Such a large increase in species is remarkable.

Change in the ecological condition of habitat

The abovementioned increase in indigenous plant species indicates a significant improvement in the ecological condition of the habitat where the 'new arrivals' occur. Most of the 'new arrivals' grow in the southernmost hatched area on the aerial photograph on p. 185. The apparent stimulus for regeneration in that area is the removal of woody weeds such as Sallow Wattle (*Acacia longifolia* subsp. *longifolia*). Further regeneration should be expected if more woody weeds are removed in that area.

Several 'new arrival' species occur around the edge of the lake. Such environments are prone to rapid recolonisation of indigenous plants following disturbance. The *'Sites of Biological Significance in Maroondah'* report refers to the lake having been drained and desilted shortly before the 1995 survey, which would have temporarily eliminated some species.

Threats

This study has identified the following threats to the site's biodiversity (in approximately decreasing order except that the first is of unknown likelihood):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Potential future road construction in the vicinity of the corner of Maroondah Highway and Mount Dandenong Road, where 1.3ha of the park is zoned 'Road Zone – Category 1' (for main roads);
- Displacement of indigenous plants by introduced plants, particularly Sallow Wattle (*Acacia longifolia* subsp. *longifolia*) and other woody weeds;
- Suppression of indigenous groundcover species by excessive growth of Burgan (*Kunzea* species);
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Water pollution, affecting vegetation, aquatic invertebrates and fish; and
- If the apparent recent increase in bogginess around the eastern end of the southernmost hatched area on the aerial photograph on p. 185 is due to a change in drainage from the railway line, that represents a significant threat to the survival of many indigenous plants there.

Strategic planning

The zoning in the site is:

- 'Road Zone – Category 1' over 1.3 ha in the vicinity of the corner of Maroondah Highway and Mount Dandenong Road (representing most of the Crown land property in the park's northwest);
- 'Neighbourhood Residential – Schedule 4' in the remainder of the Crown land property;
- 'General Residential Zone – Schedule 1' in the slender lot in the park's southeast corner (1B Patterson Street, Ringwood East); and
- 'Public Park and Recreation Zone' in the remaining 8 ha.

The Special Building Overlay covers the lake and its immediate surrounds, affecting construction activity than might affect the flow or quality of water.

Schedule 4 of the Significant Landscape Overlay and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions apply throughout the site. The Vegetation Protection Overlay (VPO) applies to the original version of the site in the 1997 report, *'Sites of Biological Significance in Maroondah'*, which differs very slightly from here.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole of Site 26 as outlined in blue on the aerial photograph on p. 185.

Opportunities for environmental action

The remarkable natural regeneration of indigenous groundcover plants in the southernmost hatched area on the aerial photograph could be increased by further removal of 'environmental weeds' such as Sallow Wattle (*Acacia longifolia* subsp. *longifolia*), and by keeping Burgan (*Kunzea* species) in check. A similar treatment could be tried in the easternmost hatched area.

It would be desirable to investigate the apparent recent increase in bogginess around the eastern end of the southernmost hatched area. If it is found to reflect a change in the drain beside the railway line, consideration could be given to restoring the *status quo*.

Regardless, that same area would be good habitat for planting some of the locally rare *Isotoma fluviatilis*. That would be achieved by propagating plants from the lawn near the sound shell (which is not a very secure environment for the plants) and from the only other known population in Maroondah (Dorset Recreation Reserve, in Site 62).

As discussed above, the park offers wonderful opportunities for environmental education and community engagement, which would be directed toward increasing the enjoyment, health, wellbeing, childhood development and quality of life of participants.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately 10 hours of ecological survey for this study on 6/4/18, 27/9/18, 19/11/18, 2/5/19 and 1/11/19, including: (a) compiling separate lists of indigenous plant species (including mosses and liverworts) for the forest and the lake shore; (b) documenting the details of rare plants and significant trees; (c) mapping the vegetation, rare plants and the course of the creek; and (d) recording observations of fauna during the work;
- Maroondah City Council's records of planting in the reserve;
- Records of Sugar Glider, Nankeen Night Heron, Australasian Darter and some plant species by Karin Smith in 2018;
- 23 bird lists in the eBird online resource, containing 50 species during 2005–2019;
- An observation of an unknown number of White-browed Woodswallows on 8/3/06, reported in the Birds Australia 'Eremaea Birdline' newsletter;
- Records in the Victorian Biodiversity Atlas (VBA) of non-indigenous turtles from 2011–2016 and fish in the 1980s and 1990s;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the park was based on fieldwork (mostly by John C. Reid) in December 1995 that included a flora survey, frog call survey and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the VBA, Atlas of Living Australia or eBird. Note that the state government's vegetation mapping is inaccurate in the extent of native vegetation, the lack of recognition that there is a lake, and the presumed width of Swampy Riparian Complex (of which there are actually only vestiges).

Acknowledgement

Thanks to Karin Smith – a gardener at Ringwood Lake Park – for records in 2018–2020 of ten flora and fauna species that are very scarce in the park or rare in Maroondah.

Thanks also to Ruth Jackson for her record of *Cynoglossum suaveolens* in 2001.

Site 27. Bedford Park, Ringwood

Biological Significance Level: *National* due to an endangered plant and its habitat

See page 185 for a 2017 aerial photograph that includes this site.

Boundary, land use and tenure

The site occupies two parts of Bedford Park, as outlined in magenta on the aerial photograph on p. 185. A large part of the boundaries follows property boundaries. Another part follows the gutter on the southwestern edge of Rosewarne Lane. As with all sites in this volume, the precise boundary is available as a shapefile for geographic information systems.

Bedford Park occupies a single property, which is a council reserve. Within Site 27, there is a hall used for ballet and a former scout hall now used by a pipe band. There is also car parking and a mobile phone tower. The rest of the site is managed to conserve the indigenous flora and fauna.

General description

The larger part of this site measures 2.1 hectares and the smaller, northeastern part, 0.4 hectares.

An aerial photograph from 1945 shows a clearing that lay between 40 m and 90 m from the western end of the park. That clearing remained bare apart from a few woody weeds until revegetation commenced sometime between 2001 and 2011.

The rest of the site's vegetation in 1945 was young regrowth forest. The biggest trees were saplings whose crown diameters were 5 m, compared with 12 m today. (In 1945, very little of Maroondah's native vegetation was more mature than young regrowth following one or more bouts of clearing.) The trunk diameters of the trees present today suggest that some of the trees present in 1945 have been removed and newer generations have arisen.

The site's vegetation has developed greatly since 1945, now containing at least 83 naturally-occurring, indigenous species of vascular plants – some of them rare. All the vegetation belongs to the vegetation type called Valley Heathy Forest but it approaches another type called Swampy Woodland in the northwest. Both vegetation types are listed as endangered in the relevant bioregion (the Gippsland Plain).

The westernmost 0.8 hectares of the site is enclosed by tall fences and a padlocked gate. The vegetation within includes the former clearing mentioned above as well as forest with all natural strata of understorey. It receives considerable care to maintain and restore its naturalness.

The forest continues to the southeast in a strip along the southwestern side of Rosewarne Lane. Midway along that strip is the most natural vegetation in the whole site and one of the best examples of the understorey of Valley Heathy Forest in metropolitan Melbourne. However, the eucalypts are not fully mature.

Around the buildings on the opposite side of Rosewarne Lane, there is a fragmented canopy of naturally-occurring eucalypts with small patches of understorey.

To the northeast of the park's buildings, there is an area of forest and a strip along the eastern boundary with a well-revegetated drain beneath power lines. The forest was in rather poor ecological condition until around a decade ago but it is now fenced and has been actively restored to a more natural state.

Relationship to other land

As can be seen from the aerial photograph on p. 185, Bedford Park and Ringwood Lake Park (Site 26) are separated only by the Lilydale Railway Line. One must expect many forest birds, bats and flying insects to move between these sites, as neither site provides adequate habitat on their own for most species. By far

the most probable explanation for kangaroo droppings observed at Bedford Park during this study is that at least one of Ringwood Lake Park's resident kangaroos has crossed the railway line, and may well do so repeatedly.

Pollination that occurs from the various movements of birds and insects between Ringwood Lake Park and Bedford Park improves the reproductive success and genetic diversity of plants in both sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

Apart from Ringwood Lake Park, Bedford Park's only other local-scale ecological association is with vestigial native vegetation scattered along the Lilydale Railway Line to the east. Pollen from both the parks may help the survival of indigenous plant species along the railway line to a small degree but there is probably hardly any ecological benefit to the parks from the railway line vegetation.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Messmate Stringybark (*E. obliqua*), combined with Red Stringybark (*E. macrorhyncha*) co-dominant in the southeast. Bundy (*E. goniocalyx*) and Narrow-leaved Peppermint (*E. radiata*) are also fairly abundant. Yellow Box (*E. melliodora*) is fairly abundant in the southeast and was recorded in 1996 as having been planted.

Lower trees: Fairly sparse in general but Golden Wattle (*Acacia pycnantha*) is dense in localised stands. Black Wattle (*A. mearnsii*), Blackwood (*A. melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are scattered widely.

Medium to large shrubs: Patchily dense and diverse in species. Dominated by Sweet Bursaria (*Bursaria spinosa*), Hop Goodenia (*Goodenia ovata*) and Burgan (*Kunzea* sp.). The following species are widely scattered or abundant in certain areas: Myrtle Wattle (*Acacia myrtifolia*), Common Cassinia (*Cassinia aculeata*), Sifton Bush (*C. sifton*), Common Correa (*Correa reflexa*), Furze Hakea (*Hakea ulicina*), Prickly Tea-tree (*Leptospermum continentale*) and Elderberry Panax (*Polyscias sambucifolia*). The following species are scarce: Hedge Wattle (*Acacia paradoxa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Common Heath (*Epacris impressa*), Manuka (*Leptospermum scoparium*), Tree Everlasting (*Ozothamnus ferrugineus*) and Golden Bush-pea (*Pultenaea gunnii*). Victorian Christmas-bush (*Prostanthera lasianthos*) was not recorded in 1996, so the plants currently present are presumed to have been planted.

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*), Erect Guinea-flower (*Hibbertia riparia*) and Common Flat-pea (*Platylobium obtusangulum*) are fairly abundant. Common Beard-heath (*Leucopogon virgatus*) and Silky Daisy-bush (*Olearia myrsinoides*) are scarce.

Ferns: There are scattered patches of Austral Bracken (*Pteridium esculentum*). Three Rough Tree-ferns (*Cyathea australis*) grow north of the ballet hall and Screw Fern (*Lindsaea linearis*) is present (but very scarce) in the western fenced enclosure.

Climbers: Common Apple-berry (*Billardiera mutabilis*), Love Creeper (*Comesperma volubile*) and Small-leafed Clematis (*Clematis decipiens*) are fairly abundant. In the strip beside Rosewarne Lane, there are one or two of the hemi-parasite, Downy Dodder-laurel (*Cassytha pubescens*) and the scrambler, Purple Coral-pea (*Hardenbergia violacea*).

Creepers: Creeping Bossiaea (*Bossiaea prostrata*) and Trailing Goodenia (*Goodenia lanata*) are fairly abundant in certain areas. One patch of the endangered flat-pea *Platylobium infecundum* grows in the western fenced enclosure.

Grasses, rushes and sedges: Abundant and rich in species. Weeping Grass (*Microlaena stipoides*) is dominant in some less natural areas and elsewhere, multiple species share dominance, the most abundant being Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Slender Sword-sedge

(*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea* and subsp. filiformis), Cluster-headed Mat-rush (*L. longifolia* subsp. *exilis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Red-anther (or Silvertop) Wallaby-grass (*R. pallidum*), Slender Wallaby-grass (*R. penicillatum*), Clustered Wallaby-grass (*R. racemosum*), Bristly Wallaby-grass (*R. setaceum*), Purplish Wallaby-grass (*R. tenuius*) and Small Grass-tree (*Xanthorrhoea minor*). Other species are scarce or highly localised.

Other groundcover: The small shrublets, Honey-pots (*Acrotriche serrulata*) and Common Rice-flower (*Pimelea humilis*) are fairly abundant. Forbs (i.e. non-grassy, non-woody species) are abundant in the more natural areas, with lilies and orchids particularly well represented. The following are the most abundant forb species (but quite localised in some cases): Chocolate Lily (*Arthropodium strictum*), Pale Grass-lily (*Caesia parviflora*), Black-anther Flax-lily (*Dianella revoluta*), Rosy Hyacinth-orchid (*Dipodium roseum*), Common Raspwort (*Gonocarpus tetragynus*) and Common Hovea (*Hovea heterophylla*). Other forbs are scarce.

Significant plants

Globally endangered

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. One patch of the species was found in the western fenced enclosure during this study, comprising one or more individuals.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Bedford Park can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Allittia cardiocarpa* (Swamp Daisy) – photographed in the reserve by Eva Buchanan in 1995 but not recorded at any other time;
- *Correa reflexa* (Common Correa) – scattered thinly in the western fenced enclosure, without signs of hybridisation with garden correas;
- *Eucalyptus macrorhyncha* (Red Stringybark) – a dozen or so grow on the southwestern side of Rosewarne Lane and a few grow in the western fenced enclosure;
- *Hakea ulicina* (Furze Hakea) – fairly abundant on the southwestern side of Rosewarne Lane;
- *Muellerina eucalyptoides* (Creeping Mistletoe) – one dead plant was found next to the northern fence of the western enclosure during this study; and
- *Pterostylis nana* (Dwarf Greenhood) – three plants were photographed by Manu Thomas in the western fenced enclosure on 18/8/16.

Fauna habitat

- The structure and composition of the native vegetation in the hatched areas on the aerial photograph on p. 185 represents suitable habitat for a range of forest birds, bats, possums and invertebrates;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the 1.6 ha of vegetation within Bedford Park's hatched areas on the aerial photograph on p. 185 comprises approximately 0.07 ha that rates 'A' (or excellent), 0.6 ha that rates 'B' (or very good), 0.8 ha that rates 'C' (or fair) and 0.1 ha that rates 'D' (poor). The rest of the site's native vegetation rates 'D'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened plant species

One patch of the flat-pea *Platylobium infecundum* grows in Bedford Park's fenced enclosure. The species is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. Its global distribution is confined to Victoria. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance. The whole enclosure and the strip of vegetation on the southwestern side of Rosewarne Lane are high-quality habitat for the species, which qualifies those areas for National significance under standard criterion 3.1.3.

Referring to the section above headed 'Significant plants', the park's populations of *Correa reflexa*, *Eucalyptus macrorhyncha*, *Hakea ulicina* and *Pterostylis nana* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Regionally threatened Ecological Vegetation Class

The largest of Bedford Park's hatched areas on the aerial photograph on p. 185 easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. It contains Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that it meets standard criterion 3.2.3 for a site of State significance (which does not override the National significance above).

The hatched area on the aerial photograph in the northeastern corner of Bedford Park is on the threshold between meeting or not meeting the definition of a 'patch' – a detailed assessment would be required to resolve the uncertainty. If it does comply, it meets standard criterion 3.2.3 for a site of State significance in the same way as the larger patch.

The park's overall 'National' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of *Platylobium infecundum*, which had not even been described as a species in 1997.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the park. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The park's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors to the park and its community facilities.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into Ringwood Secondary College and neighbouring streets and gardens.

The park preserves something of the area's natural landscape in a well-visited location. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, the detectable loss of native vegetation over that period comprises approximately:

- 100 m² of eucalypt canopy at the northwest corner of the smaller of the two polygons that make up Site 27; and
- 150 m² of eucalypt canopy that has been replaced by an extension to the ballet hall (the second building from the west).

These losses have been more than compensated. Approximately 1,100 m² of the western fenced enclosure was described in a 1996 assessment of the site as a 'mowed patch with a few woody weeds'. That area has been progressively restored to a semi-natural state since 2001, through weed removal, revegetation and natural recruitment of indigenous plants.

Bedford Park has therefore experienced a net increase of approximately 850 m² of habitat since 1996.

Changes in the species present

Leaving aside mosses and liverworts (for which there is no data prior to this study), 92 naturally-occurring, indigenous plant species have been recorded at Bedford Park at any time from the 1996 flora survey for *'Sites of Biological Significance in Maroondah'* to this study in 2018–2019. Two of those species are each represented by two distinct subspecies. To summarise the differences in plant species detected in the two investigations:

- 12 species that were recorded in 1996 were not recorded in 2018–2019; and
- 22 species that were recorded in 2018–2019 were not recorded in 1996.

Some of the differences between the investigations may be due to different survey effort or natural variability in how many species are detectable in one year compared with another. Allowing for those possible factors, the figures above suggest that there may have been a small increase in the number of naturally-occurring, indigenous species since 1996. That may well be a positive outcome from Maroondah City Council's increased management effort directed at improving the condition of the habitat.

Change in the ecological condition of habitat

The abovementioned increase in indigenous plant species indicates an improvement in the ecological condition of the habitat, consistent with the increased management effort.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by introduced plants (except that this is being controlled by council staff);
- Suppression of indigenous groundcover species by excessive growth of Burgan (*Kunzea* species);
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and

- Recurrence of the past practice of dumping builder's waste and rubble in the most significant area of forest (next to Rosewarne Lane), during any future building work or roadwork. This could be countered by a requirement to erect a temporary webbing fence beside the lane during construction work.

Strategic planning

The whole park is zoned 'Public Park and Recreation Zone' and covered by the Vegetation Protection Overlay (VPO) and Schedule 4 of the Significant Landscape Overlay.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the whole park and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 27 as outlined in magenta on the aerial photograph on p. 185.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately three hours of ecological survey for this study on 23/4/18, 20/1/19 and 2/5/19, including: (a) compiling separate lists of indigenous plant species (including mosses and liverworts) for the fenced enclosure and the rest of the site; (b) documenting the details of rare or scarce plants; and (c) mapping the vegetation and rare plants;
- Four bird lists in the eBird online resource, containing 27 species during 2018–2019;
- Records of *Cryptostylis subulata* and *Lomandra multiflora* in 2018 from Annette O'Sullivan;
- A 2016 photograph of *Pterostylis nana* in the park by Manu Thomas;
- Maroondah City Council's records of planting in the reserve;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the park was based on fieldwork (mostly by John C. Reid) in March 1996 that included a flora survey, frog call survey, spotlighting and incidental fauna observations;
- A 1995 photograph of *Allittia cardiocarpa* in the park by Eva Buchanan;
- A 1960 specimen of Nodding Greenhood stored at the National Herbarium of Victoria; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the VBA, Atlas of Living Australia or eBird.

Site 28. Lilydale Railway Line, Ringwood East

Biological Significance Level: *State* due to the presence of a threatened vegetation type, or *National* if a globally endangered plant species is still present, out of sight



The orange star near the right edge above matches the one near the left edge below.



1:7000
0 50 100 150 200 m



Aerial photos taken Feb 2017

Legend

Site 28, ESO1 recommended
Site 28, ESO2 recommended
Site 37, ESO1 recommended
Site 37, ESO2 recommended
Site 36, ESO1 recommended
Properties

Boundary, land use and tenure

The site comprises parts of the railway reserve, the abutting road reserves and pipe tracks. Much of it is fenced to exclude the public.

The site boundary is complicated, reflecting the distribution of native vegetation. An effort has been made to exclude areas with no significance for nature conservation, such as the train tracks. Much of the site extends from the edge of the railway ballast to the nearest road kerb or to the edge of the eucalypt canopy.

As with all sites in this volume, the precise boundary is available in a shapefile for geographic information systems.

General description

Site 28 occupies a total of 4.9 hectares in narrow strips on each side of the Lilydale Railway Line. Most of it contains remnant native vegetation. The exceptions are the roadside of Hillside Drive and the orange-hatched area above; both of those areas have more planted vegetation than remnant native vegetation.

The low points along the railway line have little native vegetation other than a canopy of Swamp Gums (*Eucalyptus ovata*). The greatest density of indigenous understorey plants occurs on the brows and embankments of railway cuttings just west of the Eastfield Road bridge and abutting Cheong Wildflower Sanctuary (Site 36). Among the plants in those areas are some plant species that are rare locally or throughout Victoria.

Herbicide is used regularly and extensively within the site, with little if any regard to what species are being sprayed. Herbicide spraying increased and mowing decreased when fences were erected along both sides of the tracks in c. 2013. Some rare plants were destroyed as a result. It is nevertheless remarkable that so many indigenous plants persist despite the spraying.

The site includes a strip 49 m × 4.5 m on the railway embankment immediately west-northwest of the platform of Ringwood East station. The rest of that embankment is regularly sprayed with herbicide and most indigenous plant species have been destroyed. However, the strip that has been included in Site 28 has received less spraying and it retains a small number of indigenous species. One of them is a Silver Banksia (*Banksia marginata*), which falls into the 'critically endangered' category of risk of dying out in Maroondah.

Altogether, sixty naturally-occurring, indigenous plant species were observed in the site during this study.

Relationship to other land

As can be seen from the aerial photograph on p. 200, Site 28 abuts the 'environmental living precinct' of Site 37 to the north and Cheong Wildflower Sanctuary (Site 36) to the south. 130 m north of Site 37 is Site 38, on the median strip of Mount Dandenong Road. Birds and insects fly between all these sites. To a substantial extent, Sites 36, 37, 38 and the eastern half of Site 28 form a single patch of habitat.

Some of the more mobile fauna in that patch probably take excursions to the western half of Site 28 to make use of the food resources there. That probably applies to the flock of Yellow-tailed Black-Cockatoos seen opposite Bona Street during this study. The area surrounding the western half of the site would be expected to have less birdlife if the vegetation of the site were not there to act as an attractant.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'. Some species are likely to have escaped detection due to the site inspection being in May and particularly because the assessment had to be done from publicly accessible land.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*). Narrow-leaved Peppermint (*E. radiata*) is co-dominant west of Eastfield Road and Messmate Stringybark (*E. obliqua*) is co-dominant east of Eastfield Road. Red Stringybark (*E. macrorhyncha*) and Bundy (*E. goniocalyx*) are scattered throughout. There are six White Stringybarks (*E. globoidea*), all east of Ruthven Way.

Lower trees: Cherry Ballart (*Exocarpos cupressiformis*) is by far the main subcanopy species east of Eastfield Road but scarce to the west, where Black Wattle (*Acacia mearnsii*) and Golden Wattle (*A. pycnantha*) are the main subcanopy tree species. Blackwood (*A. melanoxylon*) is scattered thinly. Swamp Paperbark (*Melaleuca ericifolia*) grows opposite 54–56 Hillside Drive.

Medium to large shrubs: Sifton Bush (*Cassinia sifton*) is abundant west of Eastfield Road and absent to the east. Yarra Burgan (*Kunzea leptospermoides*) is dominant east of Eastfield Road and fairly abundant to the west. Myrtle Wattle (*Acacia myrtifolia*) is fairly abundant west of Eastfield Road and Sweet Bursaria (*Bursaria spinosa*) is fairly abundant to the east, but neither was seen in the opposite half of the site during this study. Small numbers of Common Heath (*Epacris impressa*) and Prickly Tea-tree (*Leptospermum continentale*) grow in each half. Silver Banksia (*Banksia*

marginata) and Narrow-leaf Bitter-pea (*Daviesia leptophylla*) are scarce and confined to the western half of the site but they are good environmental indicator species.

Small shrubs: Absent east of Eastfield Road. Grey Parrot-pea (*Dillwynia cinerascens*), Erect Guinea-flower (*Hibbertia riparia*), Common Beard-heath (*Leucopogon virgatus*) and Common Flat-pea (*Platylobium obtusangulum*) are scarce west of Eastfield Road.

Ferns: There are scattered patches of Austral Bracken (*Pteridium esculentum*). At least one living and two dead Rough Tree-ferns (*Cyathea australis*) grow on the shady embankment on the opposite side of the tracks from 62 Hillside Drive, where they are subject to periodic slashing and herbicide.

Climbers: There is a colony of Coarse Dodder-laurel (*Cassytha melantha*) immediately northeast of the Ringwood East train station. One or two Small-leafed Clematis (*Clematis decipiens*) grow nearby.

Creepers: None seen.

Grasses, rushes and sedges: Thatch Saw-sedge (*Gahnia radula*) is by far the most abundant indigenous grass species, due to its resistance to herbicide. Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) is also abundant, for the same reason. The following species are fairly abundant or scattered widely: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Spiny-headed Mat-rush (*L. longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Clustered Wallaby-grass (*R. racemosum*), Bristly Wallaby-grass (*R. setaceum*), Purplish Wallaby-grass (*R. tenuius*), Forest Wire-grass (*Tetrarrhena juncea*) and Small Grass-tree (*Xanthorrhoea minor*). Other species are scarce or highly localised.

Other groundcover: Very depleted. The only conspicuous indigenous species is Black-anther Flax-lily (*Dianella revoluta*). The other species found in this study (in May 2019) are Common Raspwort (*Gonocarpus tetragynus*), Common Rice-flower (*Pimelea humilis*) and Yellow Rush-lily (*Tricoryne elatior*).

Swampy Riparian Complex (EVC 126, **Endangered** in the bioregion) between the extended alignments of Miller Grove and Fairview Avenue

Canopy trees: Swamp Gum (*Eucalyptus ovata*) is the only indigenous eucalypt species.

Lower trees: Blackwood (*Acacia melanoxylon*) is the only subcanopy tree species detected in the 2019 flora survey but the Swamp Paperbark (*Melaleuca ericifolia*) seen in the Valley Heathy Forest would once have extended into the Swampy Riparian Complex.

Shrubs: None seen in this study.

Ferns: None seen in this study.

Climbers: None seen in this study.

Creepers: None seen in this study.

Grasses, rushes and sedges: Thatch Saw-sedge (*Gahnia radula*) is by far the most abundant indigenous grass species, due to its resistance to herbicide. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are fairly abundant. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) are scarce.

Other groundcover: None seen in this study.

Artificial wetland (no EVC or conservation status applicable), opposite 29 Cheong Street, outlined on the aerial photograph on p. 200.

Many (if not all) of the following species may have been planted. The species present in such a wetland tend to vary greatly, seasonally and over the years.

Grasses, rushes and sedges: Possibly all planted. Represented only by a few Swamp Club-rush (*Isolepis inundata*), two Joint-leaf Rush (*Juncus holoschoenus*), two Broom Rush (*J. sarophorus*), one Clustered Rush (*J. vaginatus*, probably planted), one Tall Sedge (*Carex appressa*) and one Tassel Sedge (*C. fascicularis*, almost certainly planted).

Other species: Upright Water-milfoil (*Myriophyllum crispatum*, probably planted) and Thin Duckweed (*Spirodela punctata*) were both abundant when seen in May 2019, covering almost all the water. Water Plantain (*Alisma plantago-aquatica*) was abundant. Swamp Crassula (*Crassula helmsii*) and Lesser Loosestrife (*Lythrum hyssopifolia*) were somewhat less abundant. Hairy Willow-herb (*Epilobium hirtigerum*) was scarce.

Significant plants

Endangered globally

The previous (1996) flora survey of the site recorded the presence of the flat-pea, *Platylobium formosum*, on the northern side of the tracks, somewhere west of Ruthven Way (but not near the low point with the artificial wetland). The number of plants was not recorded. As a result of a recent taxonomic revision, local plants that were formerly identified as *Platylobium formosum* are now regarded as belonging to the new species, *P. infecundum*. That species is listed as endangered in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. It does not occur anywhere on Earth outside Maroondah and abutting municipalities.

This study did not detect *Platylobium infecundum*, which could easily be because much of the native vegetation in the relevant part of the site cannot be seen from publicly accessible land.

Rare (but not otherwise threatened) in Victoria

One species and one subspecies in Site 28 are listed in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'* as 'rare (but not otherwise threatened)' in Victoria.

A subspecies of Veined Spear-grass (namely *Austrostipa rudis* subsp. *australis*) grows just east of the Eastfield Road railway bridge on the southern side of the tracks. Hundreds of individuals grew there until a fence was erected through the colony in c. 2013 and a program of regular herbicide spraying along the fence commenced. It appears that at least a few plants remain but mowing and lack of access prevented confirmation during this study. The subspecies is scattered across southern Victoria, coastal NSW and eastern Tasmania.

A single plant of the Floodplain Groundsel (*Senecio campylocarpus*) was found growing in a very localised wet spot, within 10 cm of the abovementioned fence, 130 m east of the Eastfield Road railway bridge. This species is highly opportunistic and can come and go within a year or two.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 28 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Because this study's investigation had to be done from outside the fences that enclose most of the site, some species could have escaped detection, partly or wholly.

- *Amyema pendula* (Drooping Mistletoe) – recorded in 1996 but not seen in May 2019;
- *Banksia marginata* (Silver Banksia) – at least five living stems and one dead stem grow on the southern cutting embankment, 90–100 m west of the Eastfield Road bridge. Another plant grows on the railway embankment next to the car park at Ringwood East Railway Station;
- *Eucalyptus globoidea* (White Stringybark) – three or four individuals grow beside Cheong Street near its dead end, one particularly large one (close to death) grows 50 m east of the dead end and one grows behind 19 The Pass;
- *Eucalyptus macrorhyncha* (Red Stringybark) – in 2019, four were seen west of Eastfield Road and one at the top of the ridge near Ruthven Way;
- *Hakea nodosa* (Yellow Hakea) – recorded in 1996 at Ringwood East Railway Station but not found in 2019;
- *Juncus fockei* (Slender Joint-leaf Rush) – two plants grow in the artificial wetland opposite 29 Cheong Street. There is a chance that they have been planted but the same species was present in 1996;
- *Juncus vaginatus* (Joint-leaf Rush) – one plant grows beside the artificial wetland opposite 29 Cheong Street where it has most likely been planted, as this is the only record of the species in Maroondah's history. However, the species does tend to volunteer itself sporadically from wind-borne seed carried large distances;
- *Kennedia prostrata* (Running Postman) – recorded in 1996 but not seen in May 2019;
- *Muellerina eucalyptoides* (Creeping Mistletoe) – one individual grows on a large *Eucalyptus radiata*, 30 m east of the dead end of Cheong Street;

- *Myriophyllum crispatum* (Upright Water-milfoil) – abundant in the artificial wetland opposite 29 Cheong Street but it has probably been planted.

Fauna habitat

- The structure and composition of the native vegetation and planted 'Australian natives' represent suitable habitat for common forest birds, bats, possums and invertebrates;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for common invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The artificial wetland opposite 29 Cheong Street provides habitat for tadpoles, frogs, White-faced Herons and perhaps occasional ducks; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the vegetation within Site 28 rates between 'B' (good condition) and 'D' (poor). The main area with rating 'B' is on the southern railway embankment between 80 m and 135 m west of the Eastfield Road bridge, approximately 650 m² in area. A tiny area near the ridgetop next to Cheong Wildflower Sanctuary (Site 36) also rates 'B'. Other parts of the site that are visible from publicly accessible land are divided more or less evenly between ratings 'C' (fair) and 'D' (poor). The Swampy Riparian Complex vegetation is all in rating 'D'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State or National (depending on whether *Platylobium infecundum* remains present)

Threatened plant species

Referring to the section above headed 'Significant plants', the flat-pea species, *Platylobium infecundum*, was recorded in Site 28 in 1996 and there is a substantial probability that it remains there. That species does not occur outside Victoria. It is listed as 'endangered' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **National** significance, as long as the site is deemed to provide 'known habitat' for the species.

Referring further to the section above headed 'Significant plants', *Austrostipa rudis* subsp. *australis* appears to still grow within Site 28 despite most of the population having been killed by repeated spraying of herbicide since c. 2013. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Senecio campylocarpus is also listed as 'rare' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. It occurs sporadically across southeastern Australia. Site 28's solitary plant will probably die out soon without replacement as it is growing in habitat that is quite marginal for the species. The solitary plant is therefore not regarded here as a 'population' of the species and hence it is taken to not meet the conditions of standard criterion 3.1.2 for a site of significance.

Referring again to the section above headed 'Significant plants', the site's populations of *Banksia marginata*, *Eucalyptus globoidea* and *Eucalyptus macrorhyncha* are all apparently viable. The solitary *Muellerina eucalyptoides* may or may not be part of a viable population but it is important in

Maroondah's context because even an isolated plant may attract a Mistletoebird and help the recovery of mistletoes following their decimation in the Millennium Drought. Each of these four species fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Regionally threatened Ecological Vegetation Classes

The part of the site on the southern side of the tracks between 50 m and 215 m west of Eastfield Road appears to meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. There is some uncertainty because measuring the area accurately and determining the percentage of native understorey would require access to the steep railway cutting embankment, for which no permission was obtained. The vegetation in that area is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that it meets standard criterion 3.2.3 for a site of **State** significance, unless a more precise assessment of the area just described determines that it does not form a 'patch'.

The site's overall 'State' or 'National' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest and *Platylobium infecundum*.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people living next to the site, parking in the trees' shade or walking within or next to the site. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site's vegetation and the presence of birds attracted to the site add to the area's amenity and Maroondah's prized 'green and leafy' landscape character.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, no material loss of native vegetation could be detected over that period. However, on-ground inspection reveals the destruction by herbicide of a band of groundcover typically 1 m wide along the wire mesh fences that run along both sides of the tracks for most of the site's length.

The site's area has enlarged since the 1997 version because many tree crowns have expanded over roads adjoining the site. This represents an increase in the extent of tree canopy but not understorey.

Changes in the species present

Leaving aside plant species that may have been planted, the following four plant species were detected in May 2019 and not in the 1996 flora survey:

- *Acacia ulicifolia* would have been present as seeds in the soil in 1996 and approximately 16 have since germinated;
- *Clematis decipiens* has been spreading rapidly through Maroondah and is sometimes becoming an ecological problem;
- *Muellerina eucalyptoides* may have been overlooked in 1996 (as would be easy to do); and
- *Senecio campylocarpus* can be regarded as an opportunistic blow-in that is unlikely to persist for more than a year or two.

By contrast, no fewer than 45 plant species that were recorded in 1996 were not seen in May 2019. About one-third of those might have been overlooked in 2019 due to the time of year or the mowing of grass. *Amyema pendula* has probably died out, as it has at most sites in Maroondah. Several species of rush (*Juncus*) have probably died out but they may recur in wet years. The remainder of the 45 species might be still present but unable to be detected because of lack of visibility from publicly accessible land.

Change in the ecological condition of habitat

The section above headed 'Ecological condition' indicates that vegetation on the southern railway embankment between 80 m and 135 m west of the Eastfield Road bridge was rated 'B' (good) in 2019. The same area was rated 'C' (fair) in 1996. An aerial photograph from 2001 indicates that the vegetation was quite immature at that stage, so there has probably been a genuine improvement in ecological condition there.

The repeated spraying of herbicide along the fences on each side of the tracks has killed most of the native vegetation close to the fences. The small amount of native vegetation that has survived the spraying is in considerably worse ecological condition than in 1996.

Regular spraying of herbicide on the lower parts of the railway cutting embankments is supressing the ecological condition of the vegetation there. However, that was also the case in 1996 and it is not clear whether the ecological condition has changed.

The condition of vegetation beside Patterson Street next to the Ringwood East train station seems to have deteriorated significantly due to loss of understorey, apparently due to herbicide spraying.

No other changes in condition could be determined in this study. Changes might have been detected if it had been possible to access within the fences that run along each side of the tracks.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Destruction of native vegetation (including rare species) by indiscriminate herbicide spraying on the railway cutting embankments and along the fences;
- Displacement of indigenous plants by introduced plants such as Sweet Pittosporum, Cotoneasters and Sallow Wattle;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Continued premature death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The site's zoning is:

- 'Public Use Zone – Transport' within the rail reserve;

- 'Public Use Zone – Service and Utility' within the pipe track reserves (east of Eastfield Road, both sides of the track);
- Various residential zones within the road reserves except for a sliver of 'Commercial 1 Zone' opposite the Ringwood East shops.

Schedules 1, 2 and 6 of the Design and Development overlay apply to various parts of the site.

There are also the following vegetation controls:

- Schedule 3 of the Significant Landscape Overlay applies east of the extended alignment of Fairview Avenue and Schedule 4 applies to the west;
- The Vegetation Protection Overlay (VPO) applies to most of the site; and
- The state-wide native vegetation controls of clause 52.17 of the Victoria Planning Provisions apply throughout.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to:

- Remove the VPO from the whole area;
- Apply the proposed schedule ESO2 of the Environmental Significance Overlay to the orange-hatched area on the aerial photograph on p. 200, where there is hardly any naturally-occurring native vegetation but 'Australian native' plants help habitat connectivity for wildlife movements; and
- Apply the proposed schedule ESO1 of the Environmental Significance Overlay to the rest of Site 28, as outlined in blue without orange tinting or hatching on the aerial photograph on p. 200.

Management suggestion

The width of spraying along the fences each side of the tracks (typically 1 m) appears excessive within areas of native vegetation. It is killing native vegetation – including listed rare species – and promoting the growth of opportunistic weeds with short lifecycles, such as thistles and annual grasses. Those opportunistic weeds are creating a spiral of worsening the problem the spraying is supposed to solve. It would be desirable to reduce the width of spraying in areas of native vegetation, particularly on the city-bound side of the tracks at the cutting on which the Eastfield Road bridge is located.

Information sources

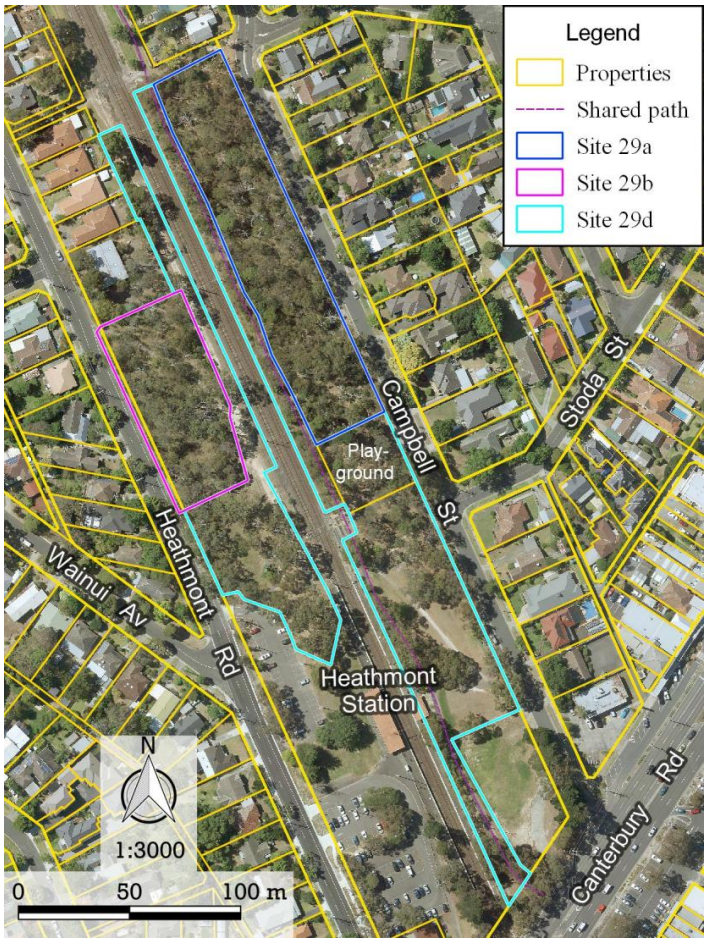
The analysis above draws on the following sources of information about the site:

- Approximately 4¼ hours of ecological survey for this study on 7/5/19, including: (a) compiling separate lists of indigenous plant species (excluding mosses and liverworts) for four different parts of the site; (b) documenting the details of rare plants and significant trees; and (c) mapping the vegetation, its condition and the locations of rare plants;
- The author's casual observations of the site on various occasions during 2002–2016 while a local resident;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on the author's fieldwork in April 1996, including a flora survey and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird. Note that the state government's mapping of the extent of native vegetation is unreliable for narrow strips like those in this site. It also fails to recognise that the vegetation near Victoria Street is Swampy Riparian Complex.

Site 29a. F.J.C. Rogers Reserve, Heathmont

Biological Significance Level: *State* due to the presence of an endangered vegetation type and rare plants



Boundary

The image above shows an aerial photograph from February 2017 overlaid with relevant boundaries, including that of Site 29a in mid-blue. A fence runs all around Site 29a. Strictly speaking, F.J.C. Rogers Reserve probably includes the playground and its mown surrounds to the southeast of Site 29a, within the same property.

Site 29a corresponds to part of Site 29 in the 1997 report, *'Sites of Biological Significance in Maroondah'*.

Land use and tenure

Site 29a plus the smaller area labelled 'playground' above comprise a Crown land property, on which Maroondah City Council has a 99-year lease. The part of the Crown land that lies within Site 29a is managed by Maroondah City Council and the Friends of F.J.C. Rogers Reserve, partly for nature conservation and partly as a showplace for cultivated Australian native plants.

General description

Site 29a measures 0.62 ha. The whole of the Crown land property measures 0.73 ha.

A 1945 aerial photograph shows the site with a moderate cover of trees whose crown diameters were up to approximately 6 m – half the diameter of mature local eucalypts. That indicates young regrowth following clearing. (Almost all of Maroondah had been cleared at least once by 1945.) The vegetation subsequently matured with a rich array of indigenous plants, including many wild orchids.

The reserve that occupies most of Site 29a is named after Fred Rogers (1927–1996), a Ringwood schoolteacher with a great love and knowledge of native plants. In 1967, he lobbied Ringwood City Council to have the land reserved. With others from the Maroondah Region of the Society for Growing Australian Plants (SGAP), he planted Australian native plants into the bushland as a kind of botanic garden. Fred's name was given to the reserve in 1973 and he left the district in 1976. Others in SGAP continued planting species from around Australia into the reserve. Some of the reserve's wild, indigenous plants have been displaced by the plantings but at least 106 persist to this day.

A voluntary group called Friends of F.J.C. Rogers Reserve was formed in 1992 and continue to have regular working bees. The Ringwood Field Naturalists Club and the Australian Plants Society Maroondah (formerly SGAP) assists the Friends group. In recent years, only indigenous species have been planted and many non-indigenous plants have been removed by Maroondah City Council. The remaining Australian native plantings will not be replaced when they die but some are reproducing.

Relationship to other land

Few of the fauna species in Site 29a would be able to meet their full habitat needs solely within the site, so they must travel to and from other habitat. Similarly, many of the plants would be at heightened risk of inbreeding or failed reproduction if not for pollen or seeds being exchanged with plants elsewhere. Ecological connections are therefore very important for Site 29a's ecological viability.

The most important ecological connection is with Site 29b on the opposite side of the train tracks (see the aerial photograph on the previous page). Many birds can be seen flying between the two sites. Insects are also very likely to fly between them. The birds and insects are expected to carry pollen and seeds.

These interactions extend to adjacent parts of Site 29d, which contain indigenous trees, grasses and a few wildflowers.

Across Canterbury Road, Site 29d provides a habitat corridor to the southeast, connecting with Site 32 ('Uambi'), Site 29c, Sites 73–75 and other sites along Dandenong Creek, Bungalook Creek and Tarralla Creek. The native vegetation along the railway corridor in Site 29d is sometimes very narrow or interrupted but the ecological connection is strengthened by indigenous trees in neighbouring streets and gardens.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives the corridor along the railway line 'moderate conservation priority', from Bedford Park to Dandenong Creek. There is currently little habitat connection between Bedford Park and F.J.C. Rogers Reserve.

While Site 29a's strongest ecological connections are with Site 29b and to the southeast along the railway line, it was apparent during this study's fieldwork that many forest birds have flight trajectories that extend further to the west. This provides circumstantial evidence of an ecological connection with Wieland Reserve (Site 119), which lies 180 m to the west of Site 29b. There may also be connections with Jubilee Park (Site 114), an additional 600 m to the west.

Regardless of the destinations to the west of Site 29b, the movement of birds in that direction mean that residents in the area traversed have the opportunity to enjoy those birds as they move through.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Red Stringybark (*Eucalyptus macrorhyncha*) and Messmate Stringybark (*E. obliqua*), followed by Bundy (*E. goniocalyx*) and Narrow-leaved Peppermint (*E. radiata*). Mealy Stringybark (*E. cephalocarpa*) and White Stringybark (*E. globoidea*) are scarce but were once more abundant.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). In certain areas, Lightwood (*Acacia implexa*), Black Wattle (*Acacia mearnsii*) and Golden Wattle (*Acacia pycnantha*) are fairly abundant but that appears to be solely due to planting. Blackwood (*A. melanoxylon*) is scarce.

Medium to large shrubs: Dense in patches. Sifton Bush (*Cassinia sifton*) is most abundant. The following species are scattered or fairly abundant: Myrtle Wattle (*Acacia myrtifolia*), Hedge Wattle (*Acacia paradoxa*), Shiny Cassinia (*Cassinia longifolia*), Common Correa (*Correa reflexa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Common Heath (*Epacris impressa*), Prickly Tea-tree (*Leptospermum continentale*) and Golden Bush-pea (*Pultenaea gunnii*). Other species of medium to large shrub are scarce.

Small shrubs: Fairly abundant, the most common species being Grey Parrot-pea (*Dillwynia cinerascens*), Erect Guinea-flower (*Hibbertia riparia* s.l.), Common Beard-heath (*Leucopogon virgatus*), Common Flat-pea (*Platylobium obtusangulum*), Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*S. quadridentatus*).

Ferns: Austral Bracken (*Pteridium esculentum*) and Screw Fern (*Lindsaea linearis*) are both scarce.

Climbers: Common Apple-berry (*Billardiera scandens*) is fairly abundant and is the only wild, indigenous climber.

Creepers: Trailing Goodenia (*Goodenia lanata*) and Purple Coral-pea (*Hardenbergia violacea*) are fairly abundant. Creeping Bossiaea (*Bossiaea prostrata*) and Kidney-weed (*Dichondra repens*) are scarce.

Grasses, rushes and sedges: Abundant and rich in species (21 indigenous species plus two extra subspecies). Consistent with the history of cultivation, the dominant species are Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Weeping Grass (*Microlaena stipoides*). The following species are also abundant: Thatch Saw-sedge (*Gahnia radula*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Leafy Wallaby-grass (*Rytidosperma fulvum*) and Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*). The following species are fairly abundant or scattered: Veined Spear-grass (*Austrostipa rudis* subsp. *australis* and subsp. *rudis*), Reed Bent-grass (*Deyeuxia quadriseta*), Finger Rush (*Juncus subsecundus*), Slender Sword-sedge (*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Soft Tussock-grass (*Poa morrisii*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Velvet Wallaby-grass (*Rytidosperma pilosum*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Small Grass-tree (*Xanthorrhoea minor*). Other species are scarce or highly localised.

Other groundcover: Rich in species of orchid and lily. The most abundant species are Black-anther Flax-lily (*Dianella revoluta*), Scented Sundew (*Drosera aberrans*), Nodding Greenhood (*Pterostylis nutans*), Grass Trigger-plant (*Stylidium armeria*) and Trim Sun-orchid (*Thelymitra peniculata*). The following species are fairly abundant or scattered: Mayfly Orchid (*Acianthus caudatus*), Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Blue Pincushion (*Brunonia australis*), Milkmaids (*Burchardia umbellata*), Pale Grass-lily (*Caesia parviflora*), Blue Stars (*Chamaescilla corymbosa*), Button Everlasting (*Coronidium scorpioides*), Common Cotula (*Cotula australis*), Wallflower Orchid (*Diuris orientis*), Leopard Orchid (*Diuris pardina*), Tall Sundew (*Drosera auriculata*), Wax-lip Orchid (*Glossodia major*), Common Raspwort (*Gonocarpus tetragynus*), Common Hovea (*Hovea heterophylla*), Brown-beaks (*Lyperanthus suaveolens*), Common Rice-flower (*Pimelea humilis*) and Blunt Greenhood (*Pterostylis* ?*curta*). Other species are scarce or highly localised, mostly orchids.

Significant plants

Rare in Victoria or globally

The following plant species that occur naturally in Site 29a are listed by the Victorian Government as 'Rare but not otherwise threatened' in Victoria:

- *Acacia stictophylla* (Dandenong Range Cinnamon Wattle) – only a few;
- *Austrostipa rudis* subsp. *australis* (a subspecies of Veined Spear-grass) – there are at least twelve, toward the southeastern corner of the reserve; and
- *Pterostylis clivosa* (Red-tip Greenhood) – numbers of visible individuals vary: nine were seen in 2018 and rather more in some other recent years.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 29a can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acianthus caudatus* (Mayfly Orchid) – numbers of visible individuals vary greatly from year to year, e.g. approximately fifty in 2003, perhaps as few as twelve in 2017 and approximately forty in 2019;
- *Caladenia carnea* (Pink Fingers) – Ruth Jackson has seen this species in various locations and years (including 23/9/05 and spring 2016) but only one in any one year;
- *Caladenia moschata* (Musky Caladenia) – one individual was observed by Ruth Jackson on 21/10/05;
- *Calochilus robertsonii* (Purplish Beard-orchid) – six were observed on 15/10/16 and three at the same location on 18/10/19;
- *Corunastylis morrisii* (Bearded Midge-orchid) – a single plant was seen by Ruth Jackson on 22/8/09 and 10/4/10;
- *Eriochilus cucullatus* (Parson's Bands) – one individual was observed by Ruth Jackson on 6/5/06 and 14/4/07 but searches in flowering season during each of the past few years have failed to find any;
- *Eucalyptus globoidea* (White Stringybark) – there is one quite large individual and another individual that is in imperfect health;
- *Eucalyptus macrorhyncha* (Red Stringybark) – co-dominant with *E. obliqua* but less abundant than the species once was, generally in poor health;
- *Gompholobium huegelii* (Common Wedge-pea) – three individuals were found in this study;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – one small patch was discovered during this study;
- *Microseris walteri* (Murnong) – one plant was seen during this study – by far the most recent record of the species in Maroondah and perhaps the last of its species in the municipality. Another plant was seen in the reserve on 8/10/07 by Ruth Jackson;
- *Thelymitra carnea* (Pink Sun-orchid) – two plants were discovered in 2019. In addition, a single plant with a single mutated, abnormally small, light green flower was photographed by Ruth Jackson on 30/9/05. Some aspects of the column structure undoubtedly match the distinctive features of *T. carnea* but other aspects do not;
- *Thelymitra ixioides/juncifolia* (Dotted Sun-orchid) – a single plant was seen by Ruth Jackson just once, in c. 2004 or 2005;
- *Thelymitra media* (Tall Sun-orchid) – seen in flower by Gwen Elliot on 5/11/03, apparently the last record of the species in Maroondah;
- *Thelymitra rubra* (Salmon Sun-orchid) – in 2019, the author saw 6 in one tight clump, 3 in a tight pair and 2 solitary plants. The only other recent records of the species in Maroondah are on the opposite side of the train tracks (in Site 29d) and at Bungalook Conservation Reserves;
- *Wahlenbergia gymnoclada* (Naked Bluebell) – a single plant was seen by Ruth Jackson in 2003 and 2005 but was inadvertently dug out soon after during the planting of an ornamental.

Probably (but not definitely) critically endangered in Maroondah

The following species in F.J.C. Rogers Reserve probably fall into the 'critically endangered' category of risk of dying out in Maroondah. However, there is some uncertainty about their rarity in Maroondah because they may have been overlooked in other sites due to similarity to the much more common Trim Sun-orchid, *Thelymitra peniculata*:

- *Thelymitra arenaria* (Forest Sun-orchid) – roughly eighty individuals in clusters of up to approximately fifty, widespread through the site;
- *Thelymitra brevifolia* (Peppertop Sun-orchid) – roughly 40-50 individuals in clusters of typically 10-15, north of the site's centre.

Significant fauna

A female Sugar Glider was found in November 2018. Sugar Gliders are quite uncommon in Maroondah.

Fauna habitat

- The structure and composition of the native vegetation are suitable for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the site has approximately 0.25 ha in excellent condition (rating 'A'), 0.2 ha in good condition ('B'), 0.2 ha in fair ecological condition ('C') and 0.1 ha in poor condition ('D'). The areas in poorest condition are mainly along the northern, eastern and southern boundaries. The most natural areas are in the middle and near the shared path, except that non-indigenous species are prominent in the tree canopy in part of that area.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally endangered Ecological Vegetation Class

The site easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed as 'endangered' in the relevant bioregion (the Gippsland Plain). As a consequence, the site meets standard criterion 3.2.3 for a site of **State** significance.

Threatened species

F.J.C. Rogers Reserve contains two plant species that are endemic to Victoria and listed as 'rare' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014', namely *Acacia stictophylla* and *Pterostylis clivosa*. Such populations meet standard criterion 3.1.2 for a site of **State** significance.

The reserve also contains another taxon on the 'rare' list – *Austrostipa rudis* subsp. *australis* – which occurs interstate as well as Victoria. Such a population meets standard criterion 3.1.2 for a site of Regional significance.

At least some of the plant species listed in the section above headed 'Critically endangered in Maroondah' have populations in the reserve that are either viable or important in the context of Maroondah. They are *Acianthus caudatus, Eucalyptus globoidea, E. macrorhyncha, Gompholobium huegelii, Microseris walteri* and *Thelymitra rubra*. They fit the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Sugar Gliders are so uncommon in Maroondah that the discovery of one in 2018 (presumably part of a population) meets standard condition 3.1.5 for Local significance in the same way that the abovementioned plants do.

Ecological corridor

In combination with Site 29b, Site 29a appears to act as an ecological 'stepping stone' or 'node' for forest birds. It fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site. The specific 'remnant habitat blocks' in this case include Sites 29a–d, 32, 73–76 and 119.

The site's overall 'State' significance rating differs from the 'Municipal' rating of Site 29 in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest, *Acacia stictophylla* and *Pterostylis clivosa*. (Neither of those species was even described as a species in 1997).

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit immediate neighbours, people within the site and people who park their cars in the trees' shade. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to be beneficial to the health, wellbeing and quality of life of people visiting or passing through the site (e.g. on the shared path). Many of those people do so on their way to and from work by train, and the ambience may provide a welcome grounding and contrast to the working day. The natural ambience may also encourage people to get exercise by taking a walk, run or bike ride along the shared path.

Birds, butterflies and other animals move to and from the site via neighbouring streets and gardens. This spreads nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

While the Friends of F.J.C. Rogers Reserve provides ecological benefits to the reserve, the reserve reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local

community. The prominence of the location maximises the contribution that the site makes to Heathmont's 'green and leafy' or 'bushy' character.

Changes

Change in the extent of habitat

There has been no material change in the extent of native vegetation within the site since at least as far back as 1996.

Change in the ecological condition of habitat

Aerial photographs from 2001, 2011 and 2017 show an increase in average size of eucalypt crowns since 2001 as well as a general thinning of crown foliage density. There has also been an increase in the number of dead trees, mainly between 2001 and 2011. These observations are consistent with native vegetation in Maroondah as a whole.

In other respects, this study found no prior information to make a meaningful assessment of the change of the ecological condition of the site's vegetation.

Changes in the species present

It seems extremely likely that Tall Sun-orchid (*Thelymitra media*), which Gwen Elliot observed in 2003, has since died out throughout Maroondah.

In other respects, this study found inadequate prior information to make a meaningful assessment of changes in the site's flora or fauna species. Among the site's many orchids, comparisons are confounded by the frequent tendency for some or all individuals of a species to remain underground in any particular year.

Threats

This study has identified the following threats to the site's biodiversity (all seeming to be of comparable seriousness):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Trampling of small indigenous plants such as orchids by people walking within the fenced area;
- Displacement of indigenous plants by non-indigenous plants, some of which are wild and a few of which are planted Australian natives;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Continuing premature death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change. The most important losses would be of the two *Eucalyptus globoidea*.

Strategic planning

The whole of Site 29a is zoned as 'Public Use Zone – Transport' (PUZ4) and is covered by Schedule 4 of the Significant Landscape Overlay. The Vegetation Protection Overlay (VPO) covers the whole site as well as the train tracks and a narrow walkway between the site and the residence to the immediate north.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended remove the VPO from the whole area and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 29a, i.e. the area outlined in mid-blue on the aerial photograph on p. 208. As described in the sections of this report dedicated to Sites 29b–d, those sites are also recommended to be covered by ESO1.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of 9–10 hours of flora survey specifically for this study on 20/5/17, 27/10/17, 24/1/18, 20/5/18, 26/5/18, 18/1/19, 15/10/19 and 18/10/19. This work included: (a) compiling a list of indigenous plant species (wild and planted, including mosses and liverworts); (b) documenting the details of rare or scarce plants; and (c) mapping the vegetation and the locations of rare plants;
- Incidental fauna observations during the work just described;
- Judith Cooke's record of two *Glossodia major* in flower in spring 2018;
- Searches for orchids and other seasonal plant species on 21/9/03, 19/5/06, 8/10/10 and 15/10/16;
- Ruth Jackson's recollections from her regular visits to the reserve over 45 years and her detailed records of usual plants in flower (mainly orchids);
- Gwen Elliot's record of *Thelymitra media* in flower on 5/11/03;
- Maroondah City Council's records of planting in the reserve;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), which included a flora survey and incidental fauna observations of the rail corridor on 12/4/96 (without separately itemising species present in F.J.C. Rogers Reserve);
- A written eulogy, "Fred J.C. ('Fred') Rogers 1927–1996" by Rodger and Gwen Elliot in *The Victorian Naturalist* **113**, 274–275; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

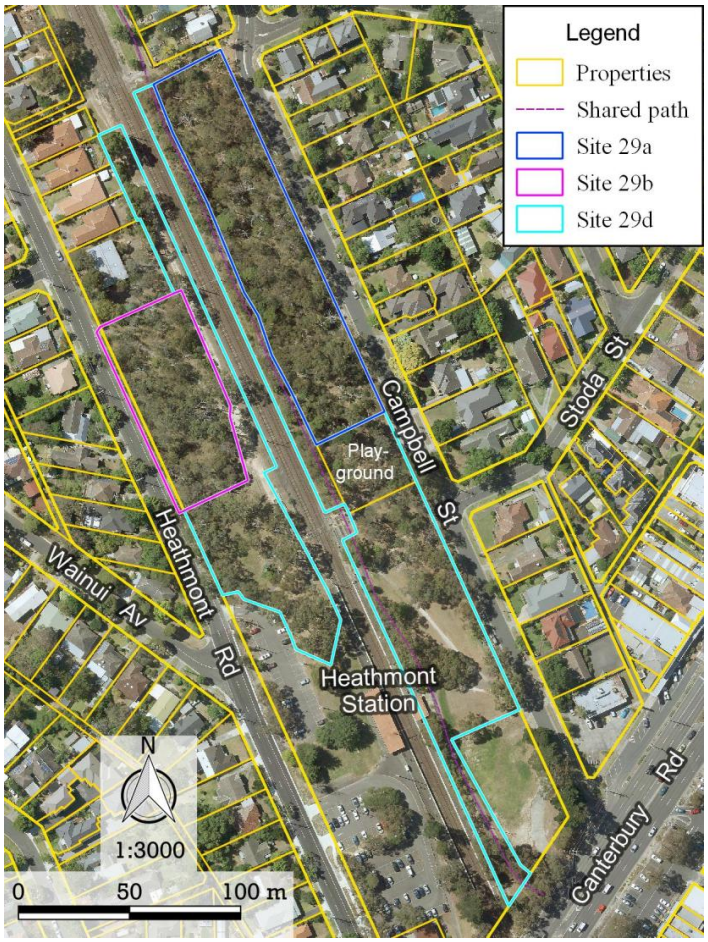
No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird. Note that the state government's mapping of the extent of native vegetation in and around the site is quite imprecise.

Acknowledgement

Thanks to Judith Cooke, Gwen Elliot and Ruth Jackson for providing records of flora in the site.

Site 29b. Heathmont Railway Station Sanctuary

Biological Significance Level: *National* due to the presence of an endangered species and *State* due to the presence of an endangered vegetation type



Boundary

The aerial photograph above is overlaid with relevant boundaries, including that of Site 29b shown in magenta. Site 29b contains two fenced enclosures separated by a footpath, as well as the abutting strip of land between the enclosures and the kerb of Heathmont Road.

The site corresponds to part of Site 29 in the 1997 report, *'Sites of Biological Significance in Maroondah'*.

Land use and tenure

The site is on railway land but it is leased by Maroondah City Council, who manages the land primarily for nature conservation.

General description

This site measures 0.36 ha. It is a piece of railway land that retains a remarkable range of indigenous plant species, including a flat-pea that is globally endangered (*Platylobium infecundum*) and a midge-orchid that

occurs nowhere else in (or near) Maroondah (*Corunastylis morrisii*). One hundred naturally-occurring, indigenous plant species were observed in the site during this study.

A 1945 aerial photograph shows Site 29b with a sparse cover of young trees, consistent with young regrowth following clearing. (Almost all of Maroondah had been cleared at least once by 1945.) The vegetation has since matured and now includes some large, old eucalypts.

The site was first documented as having value for nature conservation in the mid-1990s. As the land had not been used for railway purposes (other than dumping clay), the Public Transport Corporation leased the land to Maroondah City Council for conservation purposes in (or about) 1996.

Council has undertaken extensive weeding, leaving rather few introduced plants within the site today.

Council constructed fences and a surfaced path to avoid the previous haphazard creation of informal footpaths. The path takes substantial foot traffic to and from the Heathmont shops and train station, exposing many people to the site's natural ambience.

Relationship to other land

Few of the fauna species in Site 29b would be able to meet their full habitat needs solely within the site, so they must travel to and from other habitat. Similarly, many of the plants would be at heightened risk of inbreeding or failed reproduction if not for pollen or seeds being exchanged with plants elsewhere. Ecological connections are therefore very important for Site 29b's ecological viability.

The most important ecological connection is with F.J.C. Rogers Reserve (Site 29a) on the opposite side of the train tracks. Many birds can be seen flying between the two sites. Insects are also very likely to fly between them. The birds and insects are expected to carry pollen and seeds.

These interactions extend to the adjacent parts of Site 29d, which contain indigenous trees, grasses and a few wildflowers.

Across Canterbury Road, Site 29d provides a habitat corridor to the southeast, connecting with Site 32 ('Uambi'), Site 29c, Sites 73–75 and other sites along Dandenong Creek, Bungalook Creek and Tarralla Creek. These sites are depicted on p. 230. The native vegetation along the railway corridor in Site 29d is sometimes very narrow or interrupted but the ecological connection is strengthened by indigenous trees in neighbouring streets and gardens.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives the corridor along the railway line 'moderate conservation priority', from Bedford Park to Dandenong Creek. There is currently little habitat connection between Bedford Park and F.J.C. Rogers Reserve.

While Site 29b's strongest ecological connections are with F.J.C. Rogers Reserve (Site 29a) and to the southeast along the railway line, it was apparent during this study's fieldwork that many forest birds fly to and from the west. This provides circumstantial evidence of an ecological connection with Wieland Reserve (Site 119), which lies 180 m to the west. There may also be connections with Jubilee Park (Site 114), an additional 600 m to the west.

Regardless of the destinations to the west of Site 29b, the movement of birds in that direction mean that residents in the area traversed have the opportunity to enjoy those birds as they move through.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the more abundant or ecologically informative indigenous plant species. It is hoped that the full set of flora data will be made available online.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Red Stringybark (*Eucalyptus macrorhyncha*) is the most abundant species, closely followed by Messmate Stringybark (*E. obliqua*), then Narrow-leaved Peppermint (*E. radiata*). Mealy Stringybark (*E. cephalocarpa*) and Bundy (*E. goniocalyx*) are scarce.

Lower trees: Dominated variously by Cherry Ballart (*Exocarpos cupressiformis*) or Black Wattle (*Acacia mearnsii*). Blackwood (*A. melanoxylon*) is fairly abundant.

Medium to large shrubs: Quite dense, with abundant Sifton Bush (*Cassinia sifton*) and Golden Bush-pea (*Pultenaea gunnii*). The following species are scattered or fairly abundant: Myrtle Wattle (*Acacia myrtifolia*), Hedge Wattle (*Acacia paradoxa*), Common Correa (*Correa reflexa*), Common Heath (*Epacris impressa*), Hop Goodenia (*Goodenia ovata*) and Prickly Tea-tree (*Leptospermum continentale*). Other medium to large shrubs are scarce, notably including Silver Banksia (*Banksia marginata*).

Small shrubs: Fairly abundant, the most common species being Grey Parrot-pea (*Dillwynia cinerascens*), Erect Guinea-flower (*Hibbertia riparia* s.l.), Common Beard-heath (*Leucopogon virgatus*), Common Flat-pea (*Platylobium obtusangulum*) and Rough Fireweed (*Senecio hispidulus*).

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches.

Climbers: Common Apple-berry (*Billardiera scandens*) is fairly abundant. Small-leafed Clematis (*Clematis decipiens*) is scarce and Downy Dodder-laurel (*Cassytha pubescens*) is represented by one individual.

Creepers: Abundant and rich in species, dominated by Kidney-weed (*Dichondra repens*). The following species are moderately abundant: Bidgee-Widgee (*Acaena novae-zelandiae*), Trailing Goodenia (*Goodenia lanata*), Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel, *Oxalis exilis/perennans*. The remaining species are less abundant: Creeping Bossiaea (*Bossiaea prostrata*), Purple Coral-pea (*Hardenbergia violacea*) and the flat-pea, *Platylobium infecundum*.

Grasses, rushes and sedges: Abundant and very rich in species. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) are the most abundant, followed by Weeping Grass (*Microlaena stipoides*), Red-anther Wallaby-grass (*Rytidosperma pallidum*) and Purplish Wallaby-grass (*R. tenuius*). The next most abundant group of species includes Tall Spear-grass (*Austrostipa pubinodis*), Thatch Saw-sedge (*Gahnia radula*), Slender Sword-sedge (*Lepidosperma gunnii*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Soft Tussock-grass (*Poa morrisii*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Velvet Wallaby-grass (*R. pilosum*), Clustered Wallaby-grass (*R. racemosum*), Common Bog-rush (*Schoenus apogon*) and Kangaroo Grass (*Themeda triandra*). Notably, the scarcer species include Variable Sword-sedge (*Lepidosperma laterale*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Rich in species of orchid and lily. The most abundant species are Button Everlasting (*Coronidium scorpioides*), Black-anther Flax-lily (*Dianella revoluta*), Nodding Greenhood (*Pterostylis nutans*) and Trim Sun-orchid (*Thelymitra peniculata*). The next most abundant group of species includes Honeypots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Milkmaids (*Burchardia umbellata*), Blue Stars (*Chamaescilla corymbosa*), Wallflower Orchid (*Diuris orientis*), Scented Sundew (*Drosera aberrans*), Common Raspwort (*Gonocarpus tetragynus*), Common Hovea (*Hovea heterophylla*), Small StJohn's Wort (*Hypericum gramineum*), Wiry Buttons (*Leptorhynchos tenuifolius*), Slender Onion-orchid (*Microtis parviflora*), Variable Stinkweed (*Opercularia varia*), Common Rice-flower (*Pimelea humilis*), Blunt Greenhood (*Pterostylis curta*), Grass Trigger-plant (*Stylidium armeria*), Twining Fringe-lily (*Thysanotus patersonii*) and Yellow Rush-lily (*Tricoryne elatior*). Other groundcover species are scarce or very localised. Indigenous annual species have not been recorded because the flora surveys have been done at the wrong times of the year.

Significant plants

Globally endangered

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. Six patches of the species were found during this study, each one comprising one or more individuals.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 29b can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acianthus caudatus* (Mayfly Orchid) – one plant was seen on 8/10/10, presumably interbreeding with the larger number across the tracks in F.J.C. Rogers Reserve (Site 29a). No check could be made in this study due to the time of year;
- *Banksia marginata* (Silver Banksia) – 25 plants were mapped in a 1998 management plan for the site but only four could be found in this study;
- *Correa reflexa* var. *reflexa* (Common Correa) – eight plants were seen in this study, presumably interbreeding with the larger number across the tracks in F.J.C. Rogers Reserve (Site 29a);
- *Corunastylis morrisii* (Bearded Midge-orchid) – the only population left in Maroondah. Six individuals were seen in this study, compared with nine in 1998. That difference is within the expected variability from one year to another due to natural fluctuations in detectability;
- *Eucalyptus macrorhyncha* (Red Stringybark) – approximately 24 individuals, making Red Stringybark the dominant species even though it is less abundant than it once was. Many of the trees are not in good health;
- *Gompholobium huegelii* (Common Wedge-pea) – two individuals were seen in 1998. None could be found in this study;
- *Hypoxis hygrometrica* (Golden Weather-glass) – a cluster of 12 were seen in 1998. No check could be made in this study due to the time of year;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – the first discovery of the species in this site was during this study, when one plant was found.

Fauna habitat

- The structure and composition of the native vegetation are suitable for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the site has approximately 0.1 ha in excellent condition (rating 'A'), 0.2 ha in good condition ('B') and 0.1 ha in fair ecological condition ('C').

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Threatened plant species

The flat-pea *Platylobium infecundum* is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. It occurs in Site 29b and its global distribution is confined to Victoria. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance.

At least three of the other plant species listed in the section above headed 'Significant plants' have apparently viable populations in the reserve and they fall into the 'critically endangered' category of risk of dying out in Maroondah. Those species fit the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Regionally threatened Ecological Vegetation Class

The whole site easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed as 'endangered' in the relevant bioregion (the Gippsland Plain). As a consequence, the site meets standard criterion 3.2.3 for a site of **State** significance.

Ecological corridor

In combination with Site 29a, Site 29b appears to act as an ecological 'stepping stone' or 'node' for forest birds. It fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site. The specific 'remnant habitat blocks' in this case include Sites 29a–d, 32, 73–76 and 119.

The site's overall 'National' significance rating differs from the 'Municipal' rating of Site 29 in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of *Platylobium infecundum* and Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people walking through the site and also immediate neighbours, including the scouts. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to be beneficial to the health, wellbeing and quality of life of people who walk through it. Many of those people do so on their way to and from work by train, and the ambience may provide a welcome grounding and contrast to the working day.

Birds, butterflies and other animals move to and from the site via neighbouring streets and gardens. This spreads nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. The prominence of the location maximises the contribution that the site makes to Heathmont's 'green and leafy' or 'bushy' character.

Changes

Change in the extent of habitat

There has been no change in the extent of native vegetation within the site since at least as far back as 1998, when the vegetation was mapped for a management plan (Lorimer 1998f).

Change in the ecological condition of habitat

The health of the eucalypt canopy has declined markedly over the past two decades. Many eucalypts are now dead and few of the survivors are healthy.

Compared with the vegetation described in a 1998 management plan for the site (Lorimer 1998f), the cover of introduced species of shrubs and small trees has reduced.

Another gauge of change can be obtained by comparing the information in the paragraph above headed 'ecological condition' with the equivalent information in a 1998 management plan for the site. Within the precision that such a comparison allows, no difference can be discerned.

Changes in the species present

The number of indigenous plant species found in this study is very close to the number found in 1998. It seems likely that the Common Wedge-pea (*Gompholobium huegelii*) has died out, having been represented by only two plants in 1998. The population of Silver Banksia (*Banksia marginata*) has declined markedly, as it has more generally in Maroondah and surrounding areas. Conversely, there are now six patches of the globally endangered flat-pea, *Platylobium infecundum*, whereas there were none in 1998, and there are several other new indigenous plant species. Most other differences between the species detected in this study and those recorded previously could be explained by natural variability between years.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Development of the land for car parking to serve the needs of train travellers;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continuing premature death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The narrow strip of road reserve is zoned General Residential Zone (GRZ1). The rest of the site is zoned 'Public Use Zone – Transport' (PUZ4).

The whole site is affected by the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions, as well as Schedule 4 of the Significant Landscape Overlay.

The Vegetation Protection Overlay (VPO) was intended to cover this site but due to an apparent mapping error, the VPO covers the abutting scout property to the north-northwest and only 60% of Site 29b. The VPO should be removed from 29b and the scout property.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 29b, i.e. the area outlined in magenta on the aerial photograph on p. 208. As described in the sections of this report dedicated to Sites 29a, 29c and 29d, those sites are also recommended to be covered by ESO1.

Information sources

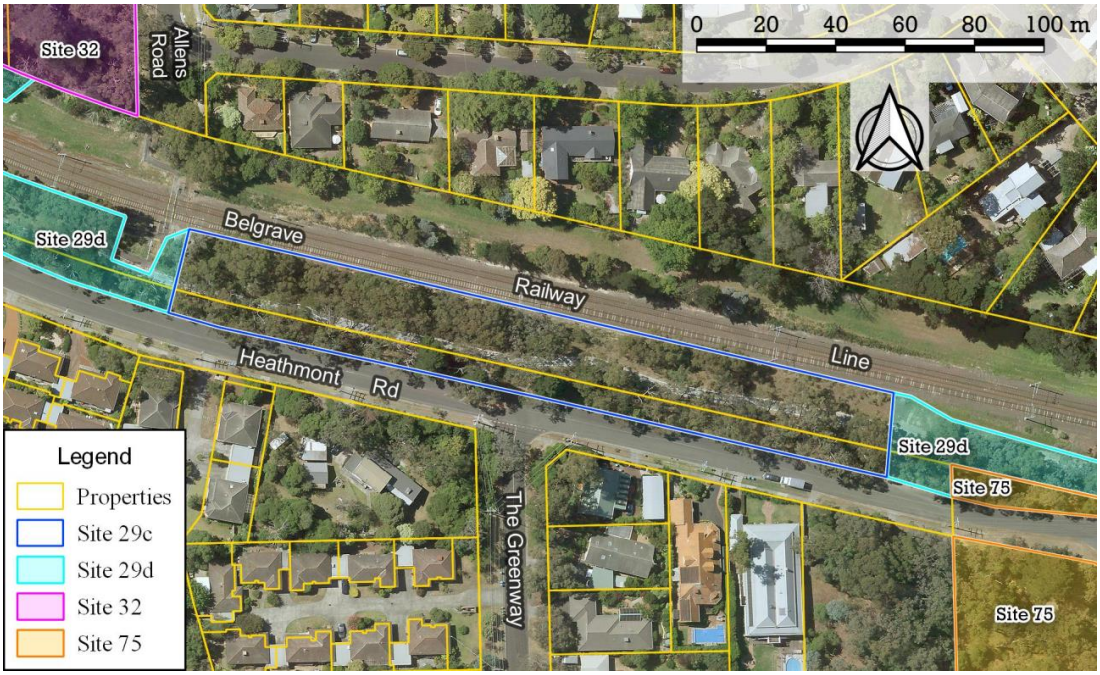
The analysis above draws on the following sources of information about the site:

- A total of approximately 6 hours of flora survey specifically for this study on 20/5/17, 21/5/17, 24/5/17, 24/1/18 and 26/5/18. This work produced a list of indigenous and introduced plant species (including mosses and liverworts) and their abundances. One herbarium specimen was taken;
- Incidental fauna observations during the work just described (41 species observed);
- A search for orchids on 24/8/10;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- Information in the *'Heathmont Railway Reserve Management Plan 1998'* (Lorimer 1998f), which included a flora survey of approximately eight hours duration in May 1998;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), which included a flora survey and incidental fauna observations of the rail corridor on 12/4/96 (without separately itemising species present in Site 29b);
- A plant list titled 'Brief Surveys, Heathmont Railway Station Land, 11/9/95, 20/9/95, 26/9/95' by Helen Moss; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird. Note that the state government's mapping of the extent of native vegetation in and around the site is quite imprecise.

Site 29c. Rail Reserve near The Greenway, Heathmont

Biological Significance Level: *State* due to the presence of a vulnerable vegetation type



Aerial photograph taken February 2017

Boundaries

Site 29c is bounded on the north by the base of a low railway cutting and on the south by the kerb of Heathmont Road. The western and eastern boundaries are each defined by a fence and its imaginary continuation to meet the northern and southern boundaries.

Site 29c corresponds to part of Site 29 in the 1997 report, *'Sites of Biological Significance in Maroondah'*. It has been separated from Sites 29a, 29b and 29d because of its separate management and particularly diverse vegetation.

Land use and tenure

Referring to the image above, the part of the site north of the yellow line is rail reserve and the rest is the verge of a council road. The image also shows a shared path (the 'Heathmont Rail Trail'). The vegetation north of the shared path is fenced and managed by Heathmont Bushcare for nature conservation. The vegetation south of the path is managed by Heathmont Bushcare and Maroondah City Council, but with less intensity than the fenced area.

General description

Site 29c comprises 0.52 ha of surprisingly natural Lowland Forest, which is a rare type of vegetation in Maroondah.

Aerial photographs from 1945 and 1946 show the road verge as having mature trees with some understorey and the rail reserve being practically bare. Some of those trees on the road verge remain today as large, old

eucalypts (mostly in poor health), while others have died and been replaced by more recent generations of trees. Although the rail reserve was practically bare in 1945–1946, the native vegetation has regenerated to a remarkable degree and today contains a rich range of indigenous plant species, some of which are rare in Maroondah. Eighty-eight naturally-occurring, indigenous plant species were observed in the site during this study.

The botanical significance of Site 29c was recognised at least as far back as 1987. In that year, plant expert Andrew Paget mentioned a 'fenced sanctuary' on his label of a pressed plant specimen from the site, stored at the National Herbarium of Victoria. It appears that the 'sanctuary' was then confined the western half of Site 29c. A fence was erected in the eastern half (north of the shared path) much more recently.

Heathmont Bushcare is a voluntary group of local residents who look after native vegetation. They run regular working bees in Site 29c, as well as nearby sites. The main activity is removal of introduced plants ('environmental weeds').

Relationship to other land

Very few, if any, of the fauna species in Site 29c would be able to meet their full habitat needs solely within the site, so they must travel to and from other habitat. Similarly, most of the plants would be at serious risk of inbreeding or failed reproduction if not for pollen or seeds being exchanged with plants elsewhere. Ecological connections are therefore critically important for Site 29c's ecological viability.

The position of Site 29c in relation to other areas of habitat is illustrated by the aerial photograph on page 230. The most important, ecologically interconnected areas of habitat are Site 29d, Site 32 ('Uambi'), Site 75 (H.E. Parker Reserve) and Site 76 (Dexters Bush). The ecological connection between those sites is strengthened by indigenous and Australian native trees in neighbouring streets and gardens.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives the Belgrave Railway Line corridor 'moderate conservation priority', from Bedford Park to Dandenong Creek. Site 29c is an integral part of that corridor.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the indigenous plant species. It is hoped that the full set of flora data will be made available online.

Lowland Forest (Ecological Vegetation Class no. 16, **Vulnerable** in the bioregion). Note the number of species below in the Protea family.

Canopy trees: Messmate Stringybark (*Eucalyptus obliqua*) dominates, or is co-dominant with Red Stringybark (*E. macrorhyncha*) at the western end. Mealy Stringybark (*E. cephalocarpa*), Bundy (*E. goniocalyx*) and Narrow-leaved Peppermint (*E. radiata*) are also present. There is a single Swamp Gum (*E. ovata*) and a hybrid that appears most likely to be *E. ovata* × *goniocalyx*.

Lower trees: Dominated variously by Golden Wattle (*Acacia pycnantha*) or Cherry Ballart (*Exocarpos cupressiformis*). Blackwood (*Acacia melanoxylon*) is unusually scarce.

Large and medium shrubs: Patchy. The most abundant species are Sifton Bush (*Cassinia sifton*), Shining Cassinia (*C. longifolia*) and Burgan (*Kunzea* sp.). The following species are fairly abundant: Myrtle Wattle (*Acacia myrtifolia*), Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*), Common Correa (*Correa reflexa* var. *reflexa*), Hop Goodenia (*Goodenia ovata*), Furze Hakea (*Hakea ulicina*), Prickly Tea-tree (*Leptospermum continentale*) and Golden Bush-pea (*Pultenaea gunnii*). Silver Banksia (*Banksia marginata*), Common Heath (*Epacris impressa*) and Victorian Christmas-bush (*Prostanthera lasianthos*) are scarce.

Small shrubs: The following species are fairly abundant: Erect Guinea-flower (*Hibbertia riparia*), Prickly Geebung (*Persoonia juniperina*), Common Flat-pea (*Platylobium obtusangulum*) and

Rough Fireweed (*Senecio hispidulus*). Grey Parrot-pea (*Dillwynia cinerascens*) and Common Beard-heath (*Leucopogon virgatus*) are scarce.

Ferns: *Pteridium esculentum* forms dense patches. Screw Fern (*Lindsaea linearis*) is scattered.

Climbers: Common Apple-berry (*Billardiera scandens*) is abundant. Small-leafed clematis (*Clematis decipiens*) and Love Creeper (*Comesperma volubile*) are scarce.

Creepers: Purple Coral-pea (*Hardenbergia violacea*) is fairly abundant and Creeping Bossiaea (*Bossiaea prostrata*) is scarce.

Grasses, rushes and sedges: Abundant and rich in species. Variously dominated by Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Red-anther Wallaby-grass (*Rytidosperma pallidum*) or Small Grass-tree (*Xanthorrhoea minor*). The Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*) is also abundant. The following species are fairly abundant: Tall Spear-grass (*Austrostipa pubinodis*), Common Plume-grass (*Dichelachne rara*), Slender Sword-sedge (*Lepidosperma gunnii*), Variable Sword-sedge (*Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Soft Tussock-grass (*Poa morrisii*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Velvet Wallaby-grass (*Rytidosperma pilosum*), Clustered Wallaby-grass (*Rytidosperma racemosum*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Kangaroo Grass (*Themeda triandra*). Common Bog-rush (*Schoenus apogon*) and the wallaby-grasses *Rytidosperma monticola* and *Rytidosperma penicillatum* are scarce. Notably, Common Rapier-sedge (*Lepidosperma filiforme*) was present in 1987 and Red-fruit Saw-sedge (*Gahnia sieberiana*) grows close by in Site 29c; both are excellent environmental indicators.

Other groundcover: The following species are abundant: Milkmaids (*Burchardia umbellata*), Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (*Gonocarpus tetragynus*), Nodding Greenhood (*Pterostylis nutans*) and Trim Sun-orchid (*Thelymitra peniculata*). The following species are fairly abundant: Pale Flax-lily (*Dianella longifolia*), Rosy Hyacinth-orchid (*Dipodium roseum*), Common Hovea (*Hovea heterophylla*), Variable Stinkweed (*Opercularia varia*), Common Rice-flower (*Pimelea humilis*) and Grass Trigger-plant (*Stylidium armeria*). The following species are scarce: Chocolate Lily (*Arthropodium strictum*), White Caladenia (*Caladenia catenata*), Musky Caladenia (*Caladenia moschata*), Button Everlasting (*Coronidium scorpioides*), Large Tongue-orchid (*Cryptostylis subulata*), Wax-lip Orchid (*Glossodia major*), Slender Bottle-daisy (*Lagenophora sublyrata*), Wiry Buttons (*Leptorhynchos tenuifolius*), an onion-orchid (*Microtis* sp.), Kopata (*Pelargonium inodorum*), Salmon Sun-orchid (*Thelymitra carnea*), Yellow Rush-lily (*Tricoryne elatior*), Sprawling Bluebell (*Wahlenbergia gracilis*) and Tadgell's Bluebell (*Wahlenbergia multicaulis*).

Significant plants

Rare (but not otherwise threatened) in Victoria

The wallaby-grass, *Rytidosperma monticola*, is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. Site 29c is one of seven sites in Maroondah to support plants that are best regarded as an undocumented form of *R. monticola* with some characters tending toward the Hill Wallaby-grass (*R. erianthum*). This species is very scarce in Site 29c and would be a good candidate for a project to breed up the numbers.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 29c can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Banksia marginata* (Silver Banksia) – only a few plants remain (having been more abundant 10–20 years ago); best regarded as a fragment of an original population whose remaining representatives also occur at 'Uambi' (Site 32) and Dexters Bush (Site 76);
- *Caladenia catenata* (White Caladenia) – one plant in flower was seen by Ruth Jackson on 22/10/07;
- *Caladenia moschata* (Musky Caladenia) – a single plant was seen in flower in 2007 and 2015;

- *Correa reflexa* (Common Correa) – moderately abundant, with no signs of hybridisation observed;
- *Eucalyptus macrorhyncha* (Red Stringybark) – approximately 35 mature individuals, concentrated toward the western end of the site;
- *Hakea ulicina* (Furze Hakea) – fairly abundant, one of the largest two or three stands in Maroondah and best regarded as an outlier of the stand at 'Uambi' (Site 32) and the former stand at Dexters Bush (Site 75);
- *Lepidosperma filiforme* (Common Rapier-sedge) – a specimen was collected by Andrew Paget in 1987 but could not be found in this study;
- *Pelargonium inodorum* (Kopata) – a single plant was found beside the path on 27/10/17. Seeds are likely to be stored in the soil, ready to germinate when conditions are right;
- *Persoonia juniperina* (Prickly Geebung) fairly abundant, one of the largest two or three stands in Maroondah and best regarded as an outlier of the stand that grew at 'Uambi' (Site 32) until at least 2001;
- *Thelymitra carnea* (Salmon Sun-orchid) – two plants seen in recent years but only one in 2018 – the only known plants in Maroondah's history except for a single, mutated plant in Site 29a in 2005;
- *Wahlenbergia multicaulis* (Tadgell's Bluebell) – four individuals were found in this study, just east of the site's centre.

Fauna habitat

- The structure and composition of the native vegetation are suitable for a range of forest birds, bats and invertebrates;
- Tree hollows (particularly in the site's large, old eucalypts) offer roost sites or nest sites for some animals, including microbats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The role of the site as part of a wildlife corridor amplifies the habitat value of the abovementioned features;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

On the A–D scale of ecological condition used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), The vegetation within the fenced enclosures is evenly divided between ratings 'A' (excellent) and 'B' (very good). The vegetation on the opposite (southern) side of the shared path is in fair ecological condition (rating 'C'), as is the embankment next to the train tracks (depressed by herbicide spraying and weeds).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The fenced enclosures of Site 29c are just large enough to meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The 'patch' contains Lowland Forest, which is listed as 'vulnerable' in the relevant bioregion (the Gippsland Plain). The author is confident that the 'habitat score' is at least 0.3, which gives the vegetation 'high conservation significance' under the Native Vegetation Framework. In combination, these characteristics give the site **State** significance under standard criterion 3.2.3.

Threatened plant species

The local form of *Rytidosperma monticola* occurs in Site 29c, albeit apparently scarce. That species' range is not confined to Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

The section above headed 'Significant plants' includes a list of eleven species in Site 29c whose risk of dying out in Maroondah is in the 'critically endangered' category. The populations of only two of those species (*Lepidosperma filiforme* and *Pelargonium inodorum*) could possibly be regarded as neither viable nor important in the context of Maroondah. The other nine species fit the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating. Note that some of these species may be interbreeding with plants in neighbouring sites, particularly 'Uambi' (Site 32) or H.E. Parker Reserve (Site 75).

Ecological corridor

Site 29c is an important part (or 'node') of a corridor recognised in the */Maroondah Habitat Corridors Strategy'* (Context 2005). It fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site. The specific 'remnant habitat blocks' in this case include Sites 29a–c, 32 and 73–76.

The site's overall 'State' significance rating differs from the 'Municipal' rating of Site 29 in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Lowland Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people walking or cycling through the site. The immediate neighbours also benefit. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the shared path is expected to be beneficial to the health, wellbeing and quality of life of people using the path. Many of those people do so on their way to and from work by train, and the ambience may provide a welcome grounding and contrast to the working day. The ambience of Sites 29c and 29d may also encourage people to take exercise by walking or cycling along the shared path, particularly because of the connection to H.E. Parker Reserve (Site 75) and the local shops and train station.

Birds, butterflies and other flying animals not only move along the rail corridor but they also digress to varying degrees into neighbouring streets and gardens. The digressions spread nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. It also contributes to Heathmont's 'green and leafy' or 'bushy' character.

Changes

Change in the extent of habitat

Comparing aerial photographs between 2001 and 2017, there was no change in the extent of native vegetation within Site 29c during that time interval.

Change in the ecological condition of habitat

Aerial photographs from 2001, 2011 and 2017 show an increase in average size of eucalypt crowns since 2001 as well as a general thinning of crown foliage density. There has also been an increase in the number of dead trees, mainly between 2001 and 2011. These observations are consistent with native vegetation in Maroondah as a whole.

In other respects, this study found no prior information to make a meaningful assessment of the change of the ecological condition of the site's vegetation over the past 25 years.

Changes in the species present

The only prior data about plant species specifically in Site 29c involves a few incidental records of individual species. Therefore, no conclusions can be drawn about trends in the species present. However, it appears that the Common Rapier-sedge (*Lepidosperma filiforme*) has probably died out since a specimen was collected in 1987.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Displacement of indigenous flora by introduced plants ('environmental weeds'), principally between the kerb of Heathmont Road and the shared path;
- Continuing premature death and decline of mature eucalypts, mainly during droughts, which are predicted to worsen with climate change; and
- Loss of indigenous plant species due to continued spraying of herbicide on the embankment beside the train tracks.

Strategic planning

The rail reserve is zoned 'Public Use Zone – Transport' (PUZ4). The road reserve is zoned 'Neighbourhood Residential Zone – Schedule 2'.

The whole site is affected by the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. Schedule 3 of the Significant Landscape Overlay affects the western half of the site and Schedule 4 affects the eastern half. The Vegetation Protection Overlay (VPO) covers the rail reserve but not the road reserve.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole of Site 29c, i.e. the area outlined in blue on the aerial photograph on page 223. As described elsewhere in this report, the other sites shown on the aerial photograph are also recommended to be covered by ESO1.

Suggested project

The purposes of Heathmont Bushcare's management of the vegetation would be well supported by breeding up and planting the rare wallaby-grass, *Rytidosperma monticola*. This could involve: (a) searching for plants in early December; (b) collecting seed in the ensuing few weeks; (c) growing a 'seed orchard' from the seeds over the subsequent year; (d) collecting the many seeds that would be produced by the seed orchard; (e) raising tubestock from the seeds (perhaps by CRISP Nursery); and (f) planting the tubestock into Site 29c when they are ready.

Information sources

The analysis above draws on the following sources of information about the site:

- A flora survey of approximately one hour on 15/10/15 in preparation for this study, particularly searching for *Thelymitra carnea* and similarly seasonal species;
- A total of 4½ hours of flora survey specifically for this study on 27/10/17 and 11/2/18. This work produced two lists of indigenous and introduced plant species (including mosses and liverworts) and their abundances – one list for each half of the site (east–west). Locations of significant species were mapped. A herbarium specimen of *Rytidosperma monticola* was collected;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), which included a flora survey of Sites 29a–d on 12/4/96 (without separately listing species found specifically in Site 29c);
- A pressed specimen of *Lepidosperma filiforme* at the National Herbarium of Victoria (MEL 0688688A) collected by Andrew Paget in 1987; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird, other than reproductions of data from the label of the abovementioned herbarium specimen. Note that the state government's mapping of vegetation wrongly depicts the EVC as Valley Heathy Forest and is too coarse in resolution to show the correct spatial extent of native vegetation in and around the site.

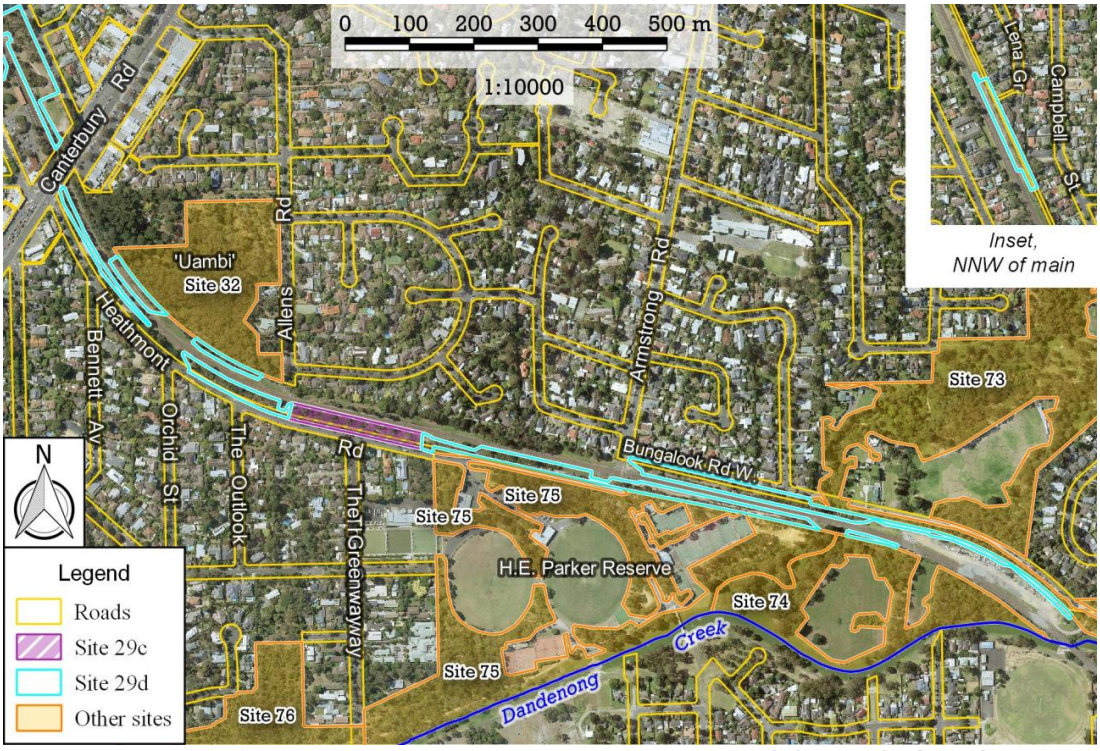
Acknowledgement

Thanks to Ruth Jackson for guiding the author to the *Thelymitra carnea* and providing observational records of two *Caladenia* species.

Site 29d. Belgrave Railway Line Corridor Links

Biological Significance Level: *National* near the entrance to H.E. Parker Reserve (type locality of an endangered species); otherwise *State* due to the presence of a patch of a vulnerable vegetation type

See page 208 for a 2017 aerial photograph that includes parts of this site not shown below.



Aerial photograph taken February 2017

Boundaries

Site 29d comprises seven segments southeast of Canterbury Road, one segment near the southern end of Lena Grove, Ringwood (in the inset above) and two segments at Heathmont Railway Station (mapped on the aerial photograph on p. 208, partly visible above). In each case, the segments are outlined in cyan on the aerial photographs. Other sites documented in this volume are also marked on the aerial photographs. As for all sites in this volume, the precise boundaries are available in a 'shapefile' for geographic information systems.

Site 29d corresponds to part of Site 29 in the 1997 report, *'Sites of Biological Significance in Maroondah'*. It has been separated from Sites 29a–c because of its separate management.

Land use and tenure

Most of the site is rail reserve, managed principally for the benefit of the train network and its users. The following lesser parts of the site abut the rail reserve:

- The playground area abutting Site 29a (see p. 208), which is Crown land managed by Maroondah City Council;
- Strips of land up to 7 m wide between the rail reserve and the kerb of Heathmont Road between H.E. Parker Reserve (Site 75) and Orchid Street;

- A 5-metre-wide strip (officially a road reserve) along the eastern edge of the segment of the site near Lena Grove; and
- The 8 m-wide strip of land between the kerb of Bungalook Road West and the rail reserve.

A shared path runs through the segment of the site near Lena Grove and the two segments that abut Site 29c.

General description

Site 29d comprises 4.3 ha of native vegetation beside the Belgrave Railway Line, from near the dead end of Lena Grove, Ringwood to Dandenong Creek in Heathmont. Sites 29a–d are only treated as separate sites because they are managed by different organisations with different priorities and approaches.

Aerial photographs from 1945 and 1946 show much of Site 29d as treeless and the remainder with only young trees. (Almost all of Maroondah had been cleared at least once by 1945.) The vegetation has since matured and now includes some large, old eucalypts. Some of the best examples of old eucalypts are beside Heathmont Station, where they play an important role in the local landscape.

The 1940s aerial photographs are too unclear to see understorey. Today, some of the understorey is quite rich in species and in good ecological condition. Altogether, ninety-eight naturally-occurring, indigenous plant species were observed in the site during this study. Some of the species are locally rare and one of them – the endangered flat-pea *Platylobium infecundum* – is a matter of National significance. However, the spraying of herbicide on railway embankments regularly kills some of the locally rare plants.

While some of the site's native understorey is in good condition, there is very little of it at Heathmont Railway Station and it is in poor ecological condition between Bungalook Creek and Dandenong Creek. Those areas are included in the site for their trees and their role as part of a habitat corridor.

Relationship to other land

Few of the fauna species in Site 29d would be able to meet their full habitat needs solely within the site, so they must travel to and from other habitat. Similarly, most of the plants would be at heightened risk of inbreeding or failed reproduction if not for pollen or seeds being exchanged with plants elsewhere. Ecological connections are therefore very important for Site 29d's ecological viability.

As can be seen on the aerial photographs on pages 208 and 223, Site 29d provides interconnecting habitat between Sites 29a–c, Site 32 ('Uambi'), Site 29c, Sites 73–75 and other sites along Dandenong Creek, Bungalook Creek and Tarralla Creek. The native vegetation along the railway corridor is sometimes very narrow or interrupted but the ecological connection is strengthened by indigenous and Australian native trees in neighbouring streets and gardens.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives the Belgrave Railway Line corridor 'moderate conservation priority', from Bedford Park to Dandenong Creek. Site 29d is an important part of that corridor. There is currently little habitat connection between Bedford Park and F.J.C. Rogers Reserve.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Lowland Forest (EVC 16, **Vulnerable** in the bioregion), from the segment abutting 'Uambi' (Site 32) to Armstrong Road.

Canopy trees: The canopy is strongly dominated by Messmate Stringybark (*Eucalyptus obliqua*). Red Stringybark (*E. macrorhyncha*) and Narrow-leaved Peppermint (*E. radiata*) are scattered. Mealy Stringybark (*E. cephalocarpa*) is scarce.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*) or Cherry Ballart (*Exocarpos cupressiformis*). Silver Wattle (*Acacia dealbata*) is forms small, dense stands. Black Wattle (*Acacia mearnsii*) and Golden Wattle (*Acacia pycnantha*) are scarce.

Large and medium shrubs: Very patchy. The main species are Sifton Bush (*Cassinia sifton*), Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*), Burgan (*Kunzea* sp.), Prickly Tea-tree (*Leptospermum continentale*) and Tree Everlasting (*Ozothamnus ferrugineus*). The remaining three species detected are scarce but good environmental indicators: Myrtle Wattle (*Acacia myrtifolia*), Sweet Bursaria (*Bursaria spinosa* subsp. *spinosa*), Common Heath (*Epacris impressa*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is abundant. Grey Parrot-pea (*Dillwynia cinerascens*) and Erect Guinea-flower (*Hibbertia riparia*) are fairly abundant.

Ferns: *Pteridium esculentum* is widespread and forms dense patches. There are also some Rough Tree-ferns on a shady embankment beside H.E. Parker Reserve.

Climbers: Common Apple-berry (*Billardiera scandens*) is fairly abundant. Downy Dodder-laurel (*Cassytha pubescens*) is represented by only one individual.

Creepers: Scarce. The endangered flat-pea *Platylobium infecundum* is the most numerous creeper species with 10–15 individuals, beside H.E. Parker Reserve. Bidgee-widgee (*Acaena novae-zelandiae*), Centella (*Centella cordifolia*) and Purple Coral-pea (*Hardenbergia violacea*) are scarce.

Grasses, rushes and sedges: No one species is dominant over a substantial part of the Lowland Forest. Species that dominate certain areas are Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Common Love-grass (*Eragrostis brownii*) and Red-fruit Saw-sedge (*Gahnia sieberiana*). The next most abundant group of species are Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Kangaroo Grass (*Themeda triandra*). There are also a few of Spiny-headed Mat-rush (*Lomandra longifolia*) and the sword-sedge *Lepidosperma elatius/laterale*. Only one patch of Spreading Rope-rush (*Empodisma minus*) was detected, but that is a significant species and an excellent environmental indicator.

Other groundcover: Common Raspwort (*Gonocarpus tetragynus*) is abundant. Wiry Buttons (*Leptorhynchos tenuifolius*) and Grass Trigger-plant (*Stylidium armeria*) are fairly abundant on the embankment next to 'Uambi' (Site 32). Milkmaids (*Burchardia umbellata*), Tasman Flax-lily (*Dianella tasmanica*) and Common Rice-flower (*Pimelea humilis*) are scarce. The following species are rare in Maroondah and were found by Andrew Paget near Orchid Street in 1985 or 1987 but mowing and spraying has probably destroyed them: Bearded Midge-orchid (*Corunastylis morrisii*), Golden Weather-glass (*Hypoxis hygrometrica*), Tiny Sundew (*Drosera pygmaea*) and Slender Bog-rush (*Schoenus lepidosperma*). Sun-orchids and onion-orchids are probably present but unable to be detected in March, when this study inspected the vegetation.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion), in two sections: (a) west of a north-south line passing midway between Bennett Av and Orchid St; and (b) between the Armstrong Road pedestrian railway crossing and the Bungalook Creek railway culvert.

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*), Red Stringybark (*E. macrorhyncha*), Messmate Stringybark (*E. obliqua*) and Bundy (*E. goniocalyx*). Close to Bungalook Creek, these species are accompanied by Yellow Box (*E. melliodora*) and Swamp Gum (*E. ovata*).

Lower trees: Patchy in density. Dominated by Golden Wattle (*Acacia pycnantha*) near Canterbury Road and Cherry Ballart (*Exocarpos cupressiformis*) east of Armstrong Road. Blackwood (*A. melanoxylon*) is also fairly abundant. Black Wattle (*Acacia mearnsii*) is scarce.

Medium to large shrubs: Fairly dense, in general. Sifton Bush (*Cassinia sifton*) is widespread and abundant, becoming quite dense east of Armstrong Road. The following additional species are also fairly abundant, at least in parts: Hedge Wattle (*A. paradoxa*), Sweet Bursaria (*Bursaria spinosa*), Hop Goodenia (*Goodenia ovata*), Burgan (*Kunzea* sp.) and Prickly Tea-tree (*Leptospermum continentale*). Although less abundant, the following species are useful environmental indicators: Myrtle Wattle (*Acacia myrtifolia*), Common Correa (*Correa reflexa* var. *reflexa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Common Heath (*Epacris impressa*) and Golden Bush-pea (*Pultenaea gunnii*). There are also six Furze Hakea (*Hakea ulicina*), outliers from the adjacent Lowland Forest.

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is abundant. Grey Guinea-flower (*Dillwynia cinerascens*) and Erect Guinea-flower (*Hibbertia riparia*) are fairly abundant. Common Beard-heath (*Leucopogon virgatus*) and Rough Fireweed (*Senecio hispidulus*) are scarce.

Ferns: None detected.

Climbers: Common Apple-berry (*Billardiera scandens*) is the only twiner found. It is fairly abundant.

Grasses, rushes and sedges: Mostly dominated by Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), joined in some areas by Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*) and/or Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*). Wallaby-grasses, as a group, are abundant and widespread, e.g. Purplish Wallaby-grass (*Rytidosperma tenuius*) and Bristly Wallaby-grass (*Rytidosperma setaceum*). Clustered Wallaby-grass (*Rytidosperma racemosum*) dominates mown areas. Slender Sword-sedge (*Lepidosperma gunnii*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*) are fairly abundant and widespread. Tall Spear-grass (*Austrostipa pubinodis*) and Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) are scarce or quite localised.

Other groundcover: Honey-pots (*Acrotriche serrulata*) and Trim Sun-orchid (*Thelymitra peniculata*) are abundant, though not throughout the site. The following species are either widespread in the site or fairly abundant in part of the site: Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (*Gonocarpus tetragynus*), Variable Stinkweed (*Opercularia varia*), Common Rice-flower (*Pimelea humilis*), Grass Trigger-plant (*Stylidium armeria*), Yellow Rush-lily (*Tricoryne elatior*) and Common Early Nancy (*Wurmbea dioica*). Other species are scarce or very localised, including Scented Sundew (*Drosera aberrans*), Tall Sundew (*Drosera auriculata*), a cudweed (*Euchiton* ?*japonicus*), Common Hovea (*Hovea heterophylla*), Jersey cudweed (*Laphangium luteoalbum*), Wiry Buttons (*Leptorhynchos tenuifolius*), Slender Onion-orchid (*Microtis* ?*parviflora*), Salmon Sun-orchid (*Thelymitra rubra*) and Tadgell's Bluebell (*Wahlenbergia multicaulis*).

Swampy Woodland (EVC 937, **Endangered** in the bioregion), from Bungalook Creek to Dandenong Creek. Only the structural dominants remain from the original indigenous flora of this EVC.

Canopy trees: Mealy Stringybark (*Eucalyptus cephalocarpa*), Messmate Stringybark (*Eucalyptus obliqua*) and Swamp Gum (*Eucalyptus ovata*).

Lower trees: Swamp Paperbark (*Melaleuca ericifolia*) forms a dense thicket toward Dandenong Creek. Blackwood (*Acacia melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are fairly abundant. Silver Wattle (*Acacia dealbata*) and Black Wattle (*Acacia mearnsii*) are scarce.

Shrubs: Sweet Bursaria (*Bursaria spinosa* subsp. *spinosa*) and Tree Everlasting (*Ozothamnus ferrugineus*) are fairly abundant. Hop Goodenia (*Goodenia ovata*) and the locally rare Hemp Bush (*Gynatrix pulchella*) were recorded in 1996.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches.

Climbers and creepers: None seen.

Grasses, rushes and sedges: Almost entirely introduced. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is scarce and Common Reed (*Phragmites australis*) was recorded in 1996.

Other groundcover: Entirely introduced.

Significant plants

Globally endangered

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. At the eastern end of Site 29d, there are at least two colonies of the species near the entrance to H.E. Parker Reserve (Site 75), comprising approximately 10–15 plants. In addition, there is another plant and a 2 m² patch of one or more plants opposite Bennett Avenue at the top of the railway cutting. More plants grow within a few metres of the site within Site 32 ('Uambi') and their habitat includes the surrounding vegetation, including Site 29d.

From a scientific perspective, the plants near H.E. Parker Reserve are more important than any others of the species because they are at the 'type locality' of *Platylobium infecundum*. That means a specimen of the species (called a 'Type') was taken from the same place to scientifically define the whole species. In this case, the Type is designated as '*I.R.Thompson 1104*' of 4th October 2008 and the location was recorded

as 'Near railway line at entrance to HE Parker Reserve, Heathmont Road, Heathmont'. The specimen is kept in the National Herbarium of Victoria.

A population of any species at its type locality helps to display the characteristics of the species in its natural habitat in ways that a specimen, alone, cannot do; e.g. its seasonal variability, life history, fecundity and relationships with other organisms. Any other population of the species (or what appears to be the species) is likely to be slightly different, genetically, from the Type and might one day be determined to be a different taxon.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 29d can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Banksia marginata* (Silver Banksia) – a single stem opposite Bennett Avenue and a dense cluster of nine stems (possibly suckers) 15–20 m closer to Canterbury Road;
- *Correa reflexa* var. *reflexa* (Common Correa) – two plants were seen in this study, less than 100 m southeast of Canterbury Road;
- *Corunastylis archeri* (Variable Midge-orchid) – recorded by Jeff Jeanes within 100 m west of the Armstrong Road pedestrian railway crossing during 1976–1981, but very unlikely to remain present there;
- *Corunastylis despectans* (Sharp Midge-orchid) – as for *C. archeri*;
- *Corunastylis morrisii* (Bearded Midge-orchid) – recorded by Andrew Paget within 100 m west of the Armstrong Road pedestrian railway crossing in 1987 and by Jeff Jeanes during 1976–1981, but very unlikely to remain present there;
- *Corunastylis* Midge-orchid) – recorded by Andrew Paget near Armstrong Road in 1987 and by Jeff Jeanes during 1976–1981, but very unlikely to remain present there;
- *Drosera pygmaea* (Tiny Sundew) – recorded by Andrew Paget near Orchid Street in 1985 but very unlikely to remain present there; Also recorded near Armstrong Rd by Andrew Paget in 1987, unable to be checked in 2019 due to the time of year;
- *Empodisma minus* (Spreading Rope-rush) – this study discovered one patch in mown grass beside the shared path, 70–75 m west of the Armstrong Road pedestrian railway crossing;
- *Eucalyptus macrorhyncha* (Red Stringybark) – one of the dominant species through most of the site, including around Heathmont Station. Approximately forty were counted altogether, many of them in good health;
- *Gynatrix pulchella* (Hemp Bush) – Recorded in the Swampy Woodland in 1996, perhaps overlooked in 2019;
- *Hakea ulicina* (Furze Hakea) – this study discovered a tight cluster of six plants, low on the railway cutting embankment, 50 m southeast of Canterbury Road;
- *Hypoxis hygrometrica* (Golden Weather-glass) – recorded in 1987 by Andrew Paget near Armstrong Road, unable to be checked in this study due to the time of year;
- *Persoonia juniperina* (Prickly Geebung) – one plant on the railway embankment, 100 m south of the accessway from Lena Grove;
- *Schoenus lepidosperma* (Slender Bog-rush) – recorded by Andrew Paget near Orchid Street in 1985 but unlikely to remain present there;
- *Thelymitra flexuosa* (Twisted Sun-orchid) – a single plant was recorded by Jeff Jeanes within 100 m west of the Armstrong Road pedestrian railway crossing during 1976–1981, but very unlikely to remain present there;
- *Thelymitra rubra* (Salmon Sun-orchid) – at least 23 individuals (but perhaps as few as five genetically distinct individuals) were discovered in 2019 on the brow of the railway embankment next to Site 29b (see p. 216). There is only one other (smaller) known occurrence left in Maroondah; and
- *Wahlenbergia multicaulis* ((Tadgell's Bluebell) – a cluster of twelve plants and a solitary plant grow opposite F.J.C. Rogers Reserve (Site 29a – see p. 208 for an aerial photograph).

Site 29d also has a large population of *Gahnia sieberiana* (Red-fruit Saw-sedge). There are only four other sites in Maroondah that have more than a few plants of the species, namely the neighbouring 'Uambi' (Site 32), Eastwood Golf Course (Site 68), Appletree Hill Reserve (Site 70) and Dexter's Bush (Site 76).

There is a single individual of the hybrid eucalypt, *Eucalyptus macrorhyncha* × *obliqua* (also named *Eucalyptus* × *brevirostris*) opposite 134 Heathmont Road. Although *Eucalyptus* × *brevirostris* is listed by the state government as 'Rare' in Victoria, that status was conferred in the erroneous belief that the name refers to a hybrid between *Eucalyptus macrorhyncha* and *Eucalyptus muelleriana*.

The population of Burgan (*Kunzea* species) in this site combines characteristics of *Kunzea leptospermoides* and the undescribed '*Kunzea* sp. Upright Form'. As noted by the Royal Botanic Gardens of Victoria in 'VicFlora' online, the distinctions between these two taxa are unclear and only tentative guidance about them is possible. In Site 29d, the pedicels are often 6–7 mm long (greater than VicFlora allows for either taxon). In addition, the leaves are sometimes 3½ mm wide and over 20 mm long – a combination that confounds VicFlora's descriptions.

Fauna habitat

- The structure and composition of the native vegetation are suitable for a range of forest birds, bats and invertebrates;
- Tree hollows (particularly in the site's large, old eucalypts) offer roost sites or nest sites for some animals, including microbats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The role of the site as a wildlife corridor amplifies the habitat value of the abovementioned features;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

On the A–D scale of ecological condition used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), Site 29d contains approximately:

- 0.13 ha of vegetation in good condition (rating 'B'), on the city-bound side of the tracks in a strip that extends between 5 m and 250 m southeast from the Canterbury Rd bridge;
- 1.8 ha in fair ecological condition (rating 'C'); and
- 2.2 ha in poor ecological condition (rating 'D'), including the entire two segments at Heathmont Railway Station, all the area east of Bungalook Creek and small patches scattered elsewhere.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National near the entrance to H.E. Parker Reserve; State elsewhere

Type locality

As discussed above, the type locality for the endangered flat-pea species, *Platylobium infecundum*, is in Site 29d near the entrance to H.E. Parker Reserve, where approximately 10–15 individuals of the species grow in 2019. Standard criterion 5.2 assigns **National** significance to such a site. However, it would be unreasonable to apply that rating to parts of the site that provide no support for the *Platylobium infecundum* plants at the type location. There is no recognised method for selecting how large an area at a type locality should be deemed to have National significance.

Threatened plant species

Platylobium infecundum is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. It occurs in Site 29d near H.E. Parker Reserve and near Bennett Avenue. It also occurs a few metres from the site in Site 32 ('Uambi'). The species' global distribution is confined to a small part of Victoria. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance.

The section above headed 'Significant plants' includes a list of Site 29d's species whose risk of dying out in Maroondah is in the 'critically endangered' category. Of those species, the populations of *Banksia marginata, Eucalyptus macrorhyncha, Hakea ulicina, Thelymitra rubra, Wahlenbergia multicaulis* and arguably *Empodisma minus* and *Gahnia sieberiana* each fit the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating. Note that each of these species is (or may well be) interbreeding with plants in neighbouring sites, particularly 'Uambi' (Site 32).

In addition, the site's large population of *Gahnia sieberiana* is important for the survival of the species in Maroondah. This represents Local significance under standard criterion 3.1.5, considering the quote above.

Regionally threatened Ecological Vegetation Class

The segment of Site 29d abutting the western edge of Site 29c meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The 'patch' contains Lowland Forest, which is listed as 'vulnerable' in the relevant bioregion (the Gippsland Plain). The 'habitat score' is likely to be at least 0.3, which gives the vegetation 'high conservation significance' under the Native Vegetation Framework. In combination, these characteristics give the site **State** significance under standard criterion 3.2.3.

Site 29c and the vegetation immediately to its east together form a 'patch' of Lowland Forest. Similarly, 'Uambi' (Site 32) and the more northwesterly of the abutting segments of Site 29d form a 'patch' of Lowland Forest. In each case, the vegetation within Site 29d is likely to have a habitat score below 0.3. These characteristics give Site 29d Regional significance under standard criterion 3.2.3, though that does not override the National and State ratings determined above.

Ecological corridor

Site 29d is recognised in the *'Maroondah Habitat Corridors Strategy'* (Context 2005) as a corridor. It fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site. The specific 'remnant habitat blocks' in this case include Sites 29a–c, 32 and 73–76.

The site's overall 'National' significance rating differs from the 'Municipal' rating of Site 29 in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of *Platylobium infecundum* and Lowland Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation

benefit people walking or cycling through the site, using the playground at F.J.C. Rogers Reserve or leaving their cars in the trees' shade. The immediate neighbours also benefit. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the shared path is expected to be beneficial to the health, wellbeing and quality of life of people using the path. Many of those people do so on their way to and from work by train, and the ambience may provide a welcome grounding and contrast to the working day. The ambience may also encourage people to take exercise by walking or cycling along the shared path, particularly because of the connection to H.E. Parker Reserve (Site 75) and the local shops and train station.

Birds, butterflies and other flying animals not only move within the confines of the site but they also digress to varying degrees into neighbouring streets and gardens. The digressions spread nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. It also contributes to Heathmont's 'green and leafy' or 'bushy' character. In particular, the impressive large eucalypts around Heathmont Station play an important role in the local landscape, aided by their conspicuousness in an area of heavy foot traffic.

The part of the site near Bungalook Creek and Dandenong Creek has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the part of the site east of Armstrong Road is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Comparing aerial photographs between 2001 and 2017, there was no material net change in the extent of native vegetation within Site 29d during that time interval. A small area of habitat near Armstrong Road was destroyed and a small revegetation bed was planted near Bennett Street.

A plant expert, Andrew Paget, collected specimens in 1985 and 1987 of the locally rare Slender Bog-rush (*Schoenus lepidosperma*) and Pygmy Sundew (*Drosera pygmaea*), growing 'in drain on edge of wet *Themeda australis* grassland' opposite 'Uambi' (Site 32). That drain is now overrun by introduced grass, indicating a loss of habitat. Paget recorded on the specimen labels a range of other locally rare plant species – particularly orchids – that were growing with the specimens, indicating highly significant habitat – none of which remains.

Change in the ecological condition of habitat

Aerial photographs from 2001, 2011 and 2017 show an increase in average size of eucalypt crowns since 2001 as well as a general thinning of crown foliage density. There has also been an increase in the number of dead trees, mainly between 2001 and 2011. These observations are consistent with native vegetation in Maroondah as a whole.

In other respects, this study found no prior information to make a meaningful assessment of the change of the ecological condition of the site's vegetation over the past 25 years. However, we can infer from the disappearance of some rare plants that the condition of the vegetation has deteriorated at specific locations. Jeff Jeanes and John Jeanes (experts in indigenous plants) reported locally rare plants including orchids and Pygmy Sundew from the 1980s, mainly near the Armstrong Road pedestrian railway crossing. Mowing and herbicide spraying are now heavily suppressing the native vegetation in that area.

Changes in the species present

Most prior records of plant species in the general area are not specific enough about the location to determine whether they were in Site 29d as opposed to neighbouring habitat. The plants discussed in the

previous two paragraphs are exceptions and indicate a loss of locally rare plant species since the past 25–30 years.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Decline or loss of the *Platylobium infecundum* population near the entrance to H.E. Parker Reserve (the type locality) due to deterioration of the plants' habitat by introduced species, particularly Sweet Pittosporum (*Pittosporum undulatum*);
- Loss of indigenous plant species (particularly rare ones) due to continued spraying of herbicide on embankments beside the tracks;
- Contraction of native vegetation due to continued spraying of herbicide along the edge of (and into) the native vegetation beside the shared path between Canterbury Road and Bennett Avenue;
- Displacement of indigenous flora by introduced plants ('environmental weeds');
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Possible future removal of trees to expand car parking at Heathmont Station;
- Continuing premature death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The rail reserve and the playground area at F.J.C. Rogers Reserve are zoned 'Public Use Zone – Transport' (PUZ4). The road reserves of Heathmont Road and Bungalook Road West are zoned 'Neighbourhood Residential Zone – Schedule 2'. A segment approximately 40 m long at Bungalook Creek is zoned 'Urban Floodway Zone'. A 5-metre-wide strip along the eastern edge of the segment of the site near Lena Grove is zoned General Residential Zone.

The whole site is affected by the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. Schedule 3 of the Significant Landscape Overlay affects the stretch from Canterbury Road to The Greenway and Schedule 4 affects the rest of the site.

The Vegetation Protection Overlay (VPO) covers the whole rail reserve south of Canterbury Road but not the abutting strips of road reserve within Site 29d. The VPO also affects some (but not all) of Site 29d northwest of Canterbury Road. The VPO extends into some adjacent areas that do not have significant vegetation.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from Site 29d and all abutting land, and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole of Site 29d, i.e. the areas outlined in cyan on the aerial photographs on pages 208 and 230. As described in the sections of this report dedicated to the other sites shown on those pages, those sites are also recommended to be covered by ESO1.

If desired, ESO1 could be expanded so that the boundaries are easier to recognise on the ground.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of approximately six hours of flora survey specifically for this study on 18/1/19, 3/4/19 and 9/10/19. This work produced five lists of indigenous plant species (excluding mosses and liverworts)

and their abundances – one list for each stretch with a different EVC. Locations of significant species were mapped, as were areas in different categories of ecological condition;

- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- Pressed plant specimens at the National Herbarium of Victoria collected by Andrew Paget in 1985–1987, by John C. Reid in c. 2007 and Ian R. Thompson in 2008;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site included a flora survey and incidental fauna observations on 12/4/96;
- Recollections by John and Jeff Jeanes about orchids they saw in the site in the early or mid-1980s;
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird, other than reproductions of data from the abovementioned herbarium specimens. Note that the state government's mapping of the extent of native vegetation in and around the site is quite imprecise.

Acknowledgements

Thanks to John and Jeff Jeanes for providing their records of orchids within the site during the 1980s.

Site 30. Former Eastlink Corridor (Discontinued)

Biological Significance Level: *Not Significant*

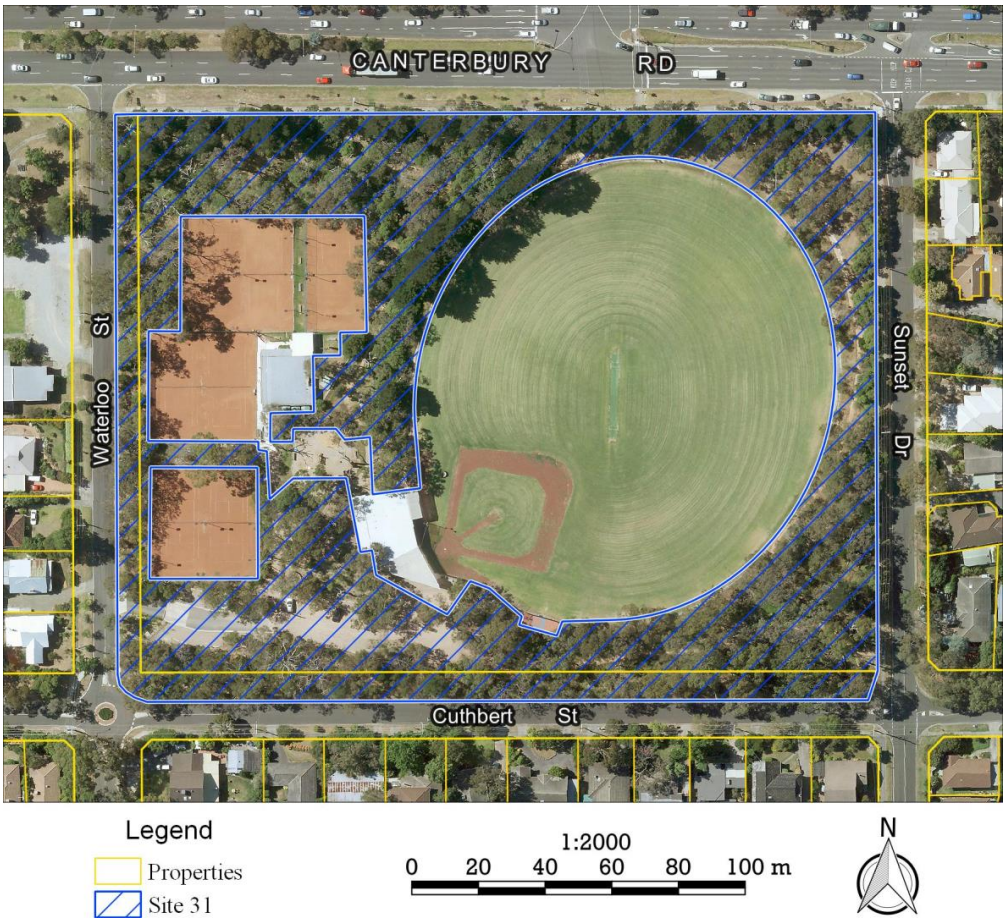
Site 30 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was part of the (then proposed) reservation for the Scoresby Freeway, which has since become Eastlink. It extended for a distance of 430 m northward from Canterbury Road, Ringwood. The area was completely cleared to construct Eastlink. Some roadside planting was undertaken after the road was constructed but it does not meet any criteria for a site of biological significance. The biological significance level is therefore 'Not significant' in the scheme of Amos (2004).

Strategic planning

The whole of Site 30 is covered by the Vegetation Protection Overlay. As the site no longer qualifies as a site of biological significance, it is recommended to remove the overlay.

Site 31. Heathmont Reserve

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundary

The image above shows an aerial photograph from February 2017 overlaid with relevant boundaries. The site extends to the footpaths along Canterbury Road and Sunset Drive and to the kerbs of Cuthbert Street and Waterloo Street. The tennis courts, oval, buildings and playground are excluded.

Land use and tenure

The site occupies part of a council recreation reserve and its abutting roadside on the western and southern sides, but the sports facilities and playground are excluded. There is a car park in the southwest. South of the oval and the car park, there are fenced areas set aside for nature conservation, extending 10–40 m north-south. The fenced areas are largely managed by the Heathmont Bushcare community group.

General description

The site, as delineated on the aerial photograph above, occupies 2.0 hectares. Most of it has a gentle slope to the west but the area south of the oval has a gentle southerly slope.

An aerial photograph from 1945 shows a smaller oval than today and no other facilities. The area north of the current-day oval and tennis courts had been recently cleared, with grass and scattered shrubs or saplings

to 3 m diameter. The rest of the reserve had young regrowth with tree crowns up to 6 m diameter (compared with 16 m for the reserve's biggest eucalypts today). This situation was typical of native vegetation in the Melbourne area in 1945.

In the subsequent couple of decades, a windbreak of Monterey Pines (*Pinus radiata*) was planted along the Canterbury Road frontage and others were planted on the northwestern embankment of the oval. Those pines are now having a major and increasingly adverse impact on the surviving native vegetation around them. The affected plants include the reserve's only plants of Red Stringybark (*Eucalyptus macrorhyncha*), Hedge Wattle (*Acacia paradoxa*), Tree Everlasting (*Ozothamnus ferrugineus*) and Yellow Rush-lily (*Tricoryne elatior*).

The reserve's history of clearing allowed some environmental weeds to establish. Today, Sweet Pittosporum (*Pittosporum undulatum*) is the main species displacing native vegetation, apart from the planted pines. Introduced grass species, particularly *Ehrharta* species, are also widespread and sometimes abundant but it is difficult to determine whether they are actively displacing native vegetation or occupying ground where indigenous species can no longer tolerate the current conditions. (See the discussion about environmental drivers and passengers in Section 5.3 of Volume 1 for more detail.) It is possible that removal of pines or Sweet Pittosporums will change the conditions of soil and sunlight enough for indigenous plants to re-establish.

The most diverse range of indigenous plants lies south of the oval and car park, within fenced areas tended by the volunteers of Heathmont Bushcare. A few species have been planted, apparently including some Furze Hakea (*Hakea ulicina*) to augment the wild plants of that locally rare species. It seems likely that some vigorous, non-indigenous forms or hybrids of *Correa reflexa* have also been planted and they are beginning to displace indigenous plants, as has happened in much of Maroondah and Knox. Most other environmental weeds are kept under control within the fenced areas.

Sixty naturally-occurring, indigenous plant species were observed in the reserve during this study.

The area with the most diverse range of indigenous plants is also the part of the reserve with the greatest loss of eucalypt canopy. Roughly quarter of the area south of the car park has no living eucalypt cover. Some of the dying trees show an excessive proportion of leaves chewed by possums, suggesting that possums are at least part of the cause of the eucalypt deaths. The abundance of very healthy grass-trees indicates that cinnamon fungus is not involved.

Relationship to other land

Almost all the fauna species observed in Site 31 during the ecological survey for this study cannot meet all their habitat needs solely within Site 31, so they must move between there and other areas of habitat.

Site 31 is relatively isolated from other patches of native vegetation, the closest being at Heathmont College (Site 81, 440 m away), the Dandenong Creek corridor (Sites 69 & 79, 460 m away) and the Belgrave Railway Line (Site 29d, 670 m away). However, the residential area within which the reserve is located retains enough remnant eucalypts and scattered understorey trees to foster movement of forest birds such as parrots, Spotted Pardalotes and thornbills between these sites and others. Street trees represent a substantial fraction of the habitat trees in the area.

Heathmont Reserve can therefore be viewed as an ecological 'stepping-stone' in a matrix of rudimentary habitat that assists fauna movement.

Pollination that occurs from the various movements of birds and insects through the matrix and between the stepping-stones improves the reproductive success of the pollinated plants and the genetic diversity of their offspring. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

The movement of wildlife between Heathmont Reserve and other sites has the important function of bringing native birds into the daily lives of local residents.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*). Messmate Stringybark (*E. obliqua*) and Narrow-leaved Peppermint (*E. radiata*) are also fairly abundant. There is a single Red Stringybark (*E. macrorhyncha*) beside Canterbury Road and a single Swamp Gum (*E. ovata*) on the eastern edge of the oval. A cluster of young Yellow Box (*E. melliodora*) trees in the southwest is presumed to have been planted, as it was absent in 1995.

Lower trees: Fairly abundant, dominated by Black Sheoak (*Allocasuarina littoralis*), combined with Golden Wattle (*Acacia pycnantha*) in the south. Black Wattle (*A. mearnsii*), Blackwood (*A. melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are scattered thinly. Silver Wattle (*A. dealbata*) is represented by only two neighbouring trees, in the west.

Medium to large shrubs: Fairly dense and diverse in species. Dominated variously by Sweet Bursaria (*Bursaria spinosa*), Sifton Bush (*Cassinia sifton*) and Yarra Burgan (*Kunzea leptospermoides*). Hop Goodenia (*Goodenia ovata*) is scattered fairly liberally. Common Correa (*Correa reflexa*) and various hybrids and cultivated forms are fairly abundant in the southwest. Fourteen plants of Furze Hakea (*Hakea ulicina*) were counted, of which it is unclear how many are wild and how many planted. Other naturally-occurring, indigenous species have fewer than five individuals.

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant in the south. Grey Parrot-pea (*Dillwynia cinerascens*), Erect Guinea-flower (*Hibbertia riparia*) and Common Beard-heath (*Leucopogon virgatus*) were recorded in 1995 but could not be found in May 2019.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*S. quadridentatus*) are scattered widely.

Ferns: There are scattered patches of Austral Bracken (*Pteridium esculentum*).

Climbers: Unusually scarce. The hemi-parasites, Coarse Dodder-laurel (*Cassytha melantha*) and Downy Dodder-laurel (*C. pubescens*) are each represented by two patches. Common Apple-berry (*Billardiera mutabilis*) and the scrambler, Purple Coral-pea (*Hardenbergia violacea*), are each represented by a single plant (the latter, just a seedling).

Creepers: Unusually scarce. Bidgee-widgee (*Acaena novae-zelandiae*) and Kidney-weed (*Dichondra repens*) are each represented by a single patch. Trailing Goodenia (*Goodenia lanata*) was recorded in 1995 but not found in May 2019.

Grasses, rushes and sedges: Abundant and rich in species. Thatch Saw-sedge (*Gahnia radula*) is widespread and often dominant in the ground flora. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Weeping Grass (*Microlaena stipoides*) and Clustered Wallaby-grass (*R. racemosum*) are dominant in some less natural areas. In the more natural areas, there are abundant Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea* and subsp. *filiformis*), Cluster-headed Mat-rush (*L. longifolia* subsp. *exilis*) and Small Grass-tree (*Xanthorrhoea minor*), followed by Leafy Wallaby-grass (*Rytidosperma fulvum*), Slender Wallaby-grass (*R. penicillatum*) and Bristly Wallaby-grass (*R. setaceum*). Common Bog-rush (*Schoenus apogon*) is abundant within a very localised patch where drainage is directed from the oval. Red-anther (or Silvertop) Wallaby-grass (*R. pallidum*) is notable among the many scarce grassy species.

Other groundcover: Almost confined to the area south of the oval and car park. In that area, Black-anther Flax-lily (*Dianella revoluta*) is one of the dominant groundcover species and the following species are fairly abundant: Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Common Raspwort (*Gonocarpus tetragynus*), Nodding Greenhood (*Pterostylis nutans*) and the moss, *Campylopus clavatus*. There is a cluster of Rosy Hyacinth-orchids in the southwest corner and a single Yellow Rush-lily (*Tricoryne elatior*) was found next to the Canterbury Road footpath. Pale Grass-lily (*Caesia parviflora*), Variable Stinkweed (*Opercularia varia*), Small Poranthera (*Poranthera microphylla*) and Cut-leaf Xanthosia (*Xanthosia dissecta*) were recorded in 1995 and could easily have escaped detection in the May 2019 flora survey.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Heathmont Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Correa reflexa* (Common Correa) – it appears that only one or two of the indigenous form of this species remain, being overrun now by hybrids and cultivated varieties that threaten the native vegetation as a whole in the areas fenced for nature conservation;
- *Eucalyptus macrorhyncha* (Red Stringybark) – a single, mature, multi-trunked tree grows beside Canterbury Road; and
- *Hakea ulicina* (Furze Hakea) – fourteen were counted but at least some of them were planted and several appear quite likely to be natural (e.g. two close to the southern end of the oval).

Significant fauna

There is a 2015 record of a Powerful Owl taking a Common Ringtail Possum on Cuthbert St by Elizabeth Manson. Attempts to contact Ms Manson to determine whether it was in or near Heathmont Reserve failed.

Fauna habitat

- The structure and composition of the native vegetation south of the oval, playground and tennis courts represents suitable habitat for a range of forest birds, bats, possums and invertebrates (but possums appear to be too abundant for the health of the eucalypts);
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), approximately:

- 0.1 ha is in good condition (rating 'B');
- 0.6 ha is in fair condition (rating 'C'); and
- 1.2 ha is in poor condition (rating 'D').

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Regionally threatened Ecological Vegetation Class

The area south of the oval and car park, and extending up the eastern oval embankment, easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. It contains Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that it meets standard criterion 3.2.3 for a site of State significance.

Locally threatened plant species

Referring to the section above headed 'Significant plants', the reserve's population of *Hakea ulicina* fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally

threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The reserve's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the reserve or living across the road. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The park's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors to the reserve and its facilities.

Some of those benefits are spread into neighbouring streets and gardens by birds, butterflies and other animals moving between the site and other areas of habitat.

While the members of Heathmont Bushcare provide ecological benefits to the bushland, the bushland reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The site preserves something of the area's natural landscape in a well-visited location. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, the detectable loss of native vegetation over that period comprises approximately:

- 300 m² of eucalypt canopy for an expansion of the car park;
- 250 m² of eucalypt canopy for the new baseball and cricket pavilion.; and
- 150 m² of eucalypt canopy from tree deaths at the playground.

Changes in the species present

Leaving aside mosses and liverworts (for which there is no data prior to this study), 72 naturally-occurring, indigenous plant species were recorded at Heathmont Reserve either in the December 1995 flora survey for *'Sites of Biological Significance in Maroondah'* or this study in May 2019. One of those species is represented by two distinct subspecies. To summarise the differences in plant species detected in the two investigations:

- 16 species that were recorded in 1995 were not recorded in 2019; and
- 15 species that were recorded in 2019 were not recorded in 1995.

Some of the differences between the investigations are probably due to the times of year of the surveys or natural variability in how many species are detectable in one year compared with another. The absence

from the 1995 data of the reserve's single, mature *Eucalyptus macrorhyncha* is presumably an oversight. Allowing for those possible factors, the only changes that can be inferred are:

- *Cassinia aculeata, Clematis decipiens, Dillwynia cinerascens, Epacris impressa* and *Prostanthera lasianthos* are such conspicuous species that they are unlikely to have been overlooked in 2019 and have therefore probably died out, at least temporarily;
- The reserve's single plant of *Hardenbergia violacea* (a seedling) appears to have regenerated from seed stored in the soil;
- *Rytidosperma racemosum* appears to have colonised (or at least become much more abundant), as it has in many other sites in Maroondah; and
- Two *Juncus* species appear to have volunteered themselves at a spot where drainage is directed from the oval.

Change in the ecological condition of habitat

Compared with the condition ratings given above in the section headed 'Ecological condition', the 1995 flora survey recorded less vegetation in all ratings. That could be explained by a general underestimate of areas, which were estimated from a sketch map on paper. Allowing for that, there is no reliable evidence of change in the reserve's ecological condition.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Displacement of indigenous plants by pines, pittosporums and (with much less confidence) veldt-grasses (*Ehrharta erecta* and *E. longiflora*) and cotoneasters;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Ongoing eucalypt deaths and debilitation, at least part of which is due to possum browsing; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The whole reserve is zoned 'Public Park and Recreation Zone' and covered by the Vegetation Protection Overlay (VPO) and Schedule 3 of the Significant Landscape Overlay.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the existing VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 31 as outlined and hatched in blue on the aerial photograph on p. 241. It would also be open to Council to extend ESO1 to the whole reserve if it can be justified by the added simplicity.

Information sources

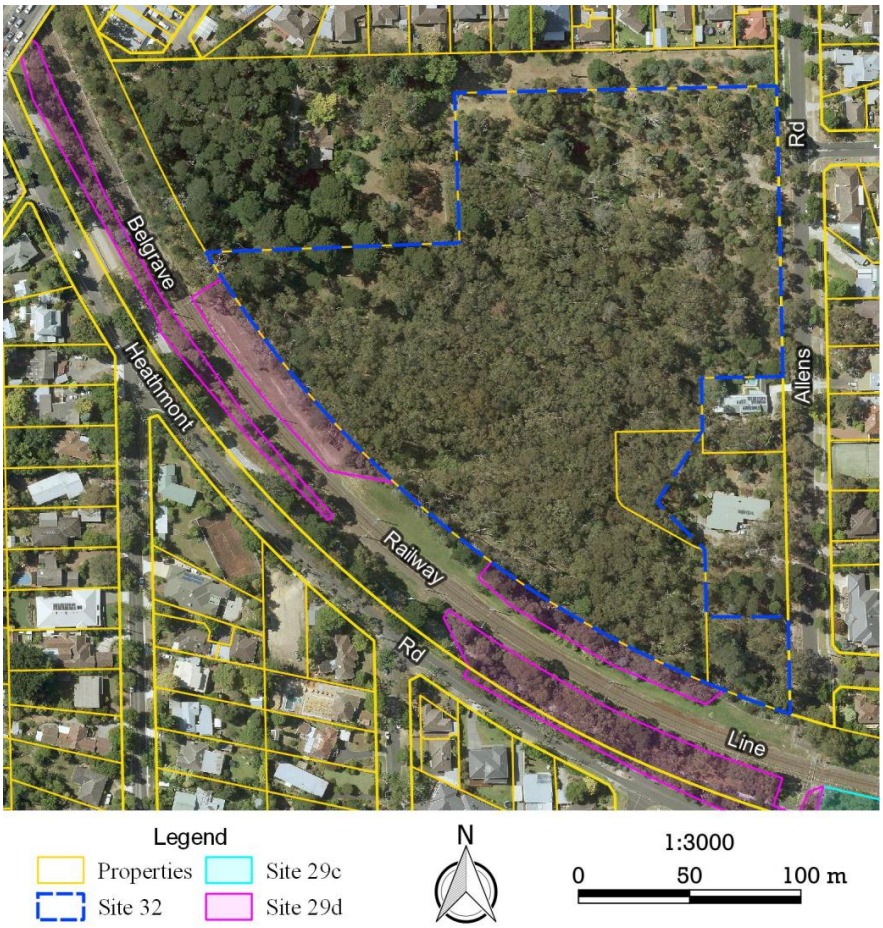
The analysis above draws on the following sources of information about the site:

- Two hours of ecological survey for this study on 25/5/19, including: (a) compiling a list of indigenous plant species (including mosses and liverworts); (b) documenting the details of rare or scarce plants; and (c) mapping the vegetation and rare plants;
- A 2015 observation of a Powerful Owl by Elizabeth Manson somewhere on Cuthbert St (location uncertain), stored in the Atlas of Living Australia;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on fieldwork by John C. Reid on 7/12/95 that included a flora survey, 20-minute bird census and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas or eBird.

Site 32. 'Uambi', Heathmont

Biological Significance Level: *National* due to the presence of an endangered plant species; *State* due to the presence of a threatened vegetation type



Boundaries, land use and tenure

The image above shows an aerial photograph from February 2017 overlaid with relevant boundaries. The site includes the whole of the Trust for Nature property, 'Uambi' (24 Allens Road) as well as southern and northwestern parts of 36 Allens Road. The Trust was created by the Victorian Government to conserve nature outside the government's reserve system, as in the case of Uambi. Management of Uambi is overseen by a voluntary Committee of Management under the Trust for Nature. The 'Heathmont Bushcare' group helps out with working bees on the land. 36 Allens Road is a private residential property with one dwelling, a garden, bushland and part of an old pine plantation. Only the bushland part of 36 Allens Road is included within the site boundary.

The site boundary adopted here is smaller than in the 1997 *'Sites of Biological Significance in Maroondah'* to more tightly circumscribe the area of significant habitat. Some areas of lesser habitat significance are retained within the site because of efforts to increase that significance.

General description

This 4.0-hectare site contains by far the largest patch of Lowland Forest in Maroondah. It has thriving populations of some plant species that are scarce or absent everywhere else in the municipality; e.g. Silver Banksia (*Banksia marginata*) and Red-fruit Saw-sedge (*Gahnia sieberiana*). The most recent botanical survey of the property (*'The Flora of Uambi in 2016'*, by G.S. Lorimer) detected 153 naturally-occurring, indigenous plant species.

The 1945 government aerial photograph, 'Ringwood A4B', shows Uambi to have been mostly covered with young eucalypts whose crown diameters were less than 7 m. (A mature crown is about 16 m across.) A small number of larger eucalypts were present. A few of those larger eucalypts remain today, estimated to be at least 100 years old.

The 1945 aerial photograph also shows a small part of Uambi with pines of various ages, some of which remained until recent years. Those pines proliferated within the regenerating forest but almost all of them have been removed in the past decade or so. A great deal of effort has also been taken to remove other non-indigenous plants from the forest.

The main south-flowing gully was cleared in the 1950s to lay pipes, which are exposed in some places due to erosion. The northern part of the gully appears to have been re-excavated in the 2000s. The undergrowth species that colonised the gully following each excavation are predominantly introduced.

Urbanisation of the catchment has resulted in the gullies flowing in a much more pulsed way than nature intended. That has exacerbated gully erosion and the decline of indigenous flora.

The movement of water through the site has also been substantially affected by the discharge of runoff from the adjacent railway cutting into the property. Although the discharge began many decades ago, the vegetation in the affected area has still not stabilised into a new equilibrium state. The eucalypt canopy has been decimated, small erosion gullies have been created and introduced plants have been the most successful in colonising the seasonally boggy ground. Interestingly, non-indigenous fern species form a substantial part of the current vegetation.

Approximately 0.7 ha in the site's northeast (abutting Allens Road) was a horse paddock until 1993. Immediately west of that, the 1945 aerial photograph appears to show a 0.3 ha pine plantation, since removed. These areas have been revegetated very successfully since the mid-1990s and now provide habitat for indigenous forest birds, lizards, invertebrates and a scattering of wild indigenous plants. The revegetation augments the habitat in the abutting regrowth forest and thereby makes Uambi more viable for wildlife.

Surprisingly, an Eastern Grey Kangaroo took up residence at Uambi in 2015 and has since produced a joey.

The local community is encouraged to be involved with Uambi, particularly through working bees and annual open days.

Relationship to other land

The railway reserve abutting Uambi (part of Site 29d) contains some native vegetation that is patchy but includes some of the same rare plant species as Uambi. So does Site 29c, in the southeast corner of the aerial photograph on p. 248. Pollination probably occurs between these sites and thereby aids the species' viability.

More generally, birds, bats, flying insects and even kangaroos move between these sites, as well as to H.E. Parker Reserve (Site 75, 250 m to the southeast), Dexter's Bush (Site 76, 400 m south) and the Dandenong Creek habitat corridor (Site 69, 550 m south). The intervening residential area includes gardens and nature strips that have a scattering of trees with habitat values. Uambi can be thought of as a major node in a matrix of wildlife habitat.

The movement of indigenous pollinating birds and insects around the matrix may well be quite important for the reproduction and survival of indigenous flora.

As fauna make their way between the nodes in the habitat matrix, they bring nature into the lives of local residents.

Bioregion: Gippsland Plain

Habitat types

Uambi's native vegetation forms four communities, as described in *'The Flora of Uambi in 2016'* (Lorimer 2016). The Department of Environment, Land, Water and Planning generally lumps them all under the broad Ecological Vegetation Class (EVC), 'Lowland Forest'.

One of the communities is confined to the gully floors – like a linear wetland exposed to periodic flows. It differs from the other three communities in its alluvial soil, hydrology, species mix, ecological functions and associated fauna. It is described below under the informal title, 'Gully floors'.

The other three communities are described together under the title 'Lowland Forest, excluding the gullies'. One of those communities is the result of the water runoff from the adjacent railway cutting being discharged into it, killing most of the original plants and replacing them with species adapted to soil that is boggy for extended periods following rain. One of the other two communities, allied to 'Swampy Woodland', is dominated by species that rely on consistent soil moisture, particularly *Gahnia sieberiana*, *Lepidosperma elatius* and *Centella cordifolia*. The final community is adapted to summer dryness.

The descriptions below include only the more abundant or ecologically informative indigenous plant species. A complete inventory is available in *'The Flora of Uambi in 2016'* (Lorimer 2016).

Gully floors (not a formally recognised EVC defined)

Soil: Alluvium washed off the surrounding terrain and deposited by flowing water.

Hydrology: Usually saturated for extended periods in winter but flowing only rarely and briefly. The soil becomes dry only for brief periods in a normal year but may do so for weeks or months during major droughts.

Canopy trees: Very scarce and confined to the margins – just a few outliers of the adjacent vegetation, except for a solitary *Eucalyptus ovata* abutting the revegetation area in the north.

Lower trees: Variable in density. Dominated by *Acacia mearnsii* except in one gully in the east, where *Acacia dealbata* dominates. Neither of those species occurs in the surrounding vegetation. *Acacia melanoxylon* is scattered along the gully floors. *Kunzea leptospermoides* and *Melaleuca ericifolia* are dense in patches but the former is probably a response to historical excavations and I suspect the latter to have been planted. (Andrew Paget did not record *Melaleuca ericifolia* on the property in 1985 but did so in 1989 after he had undertaken a planting program.)

Large and medium shrubs: Variable in density from absent to dense, with visibility reduced to 5 m in some places. *Cassinia aculeata* is most conspicuous, often 6 m tall (much taller than in the surrounding vegetation). *Coprosma quadrifida* is also fairly abundant. *Ozothamnus ferrugineus* is scattered. There is one plant of the locally rare *Cassinia trinerva*.

Small shrubs: Sparse, comprising only *Goodenia ovata* and *Senecio minimus*.

Climbers: Indigenous climbers and scramblers are represented only by scattered *Rubus parvifolius*. The introduced *Galium aparine* is present in the less natural segments.

Creepers: *Acaena novae-zelandiae* is scattered widely. The indigenous creeper *Lobelia anceps* is abundant in one patch but is otherwise very scarce (a situation that may vary from year to year). All other creepers are introduced, including *Oxalis incarnata* and *Viola odorata*.

Ferns: *Cyathea australis* is scattered in some gully headwaters. I suspect that *Blechnum minus* and perhaps *Blechnum cartilagineum* were once present.

Other ground flora: Indigenous species vary greatly in density. The more natural gully heads are dominated by *Lomandra longifolia* subsp. *longifolia*. Elsewhere, the dominant indigenous ground flora species is generally *Lepidosperma elatius*, accompanied by scattered *Gahnia sieberiana*, but one patch contains several indigenous *Juncus* species as well as *Isolepis inundata*. The introduced *Ehrharta erecta* is widespread and sometimes dense.

Lowland Forest, excluding the gully floors (EVC 16, **Vulnerable** in the bioregion).

Soil: Greyish, somewhat sandy loam of moderate fertility and good moisture-holding capacity. Derived from Upper Silurian sandstone of the Dargile formation. The area into which runoff from the adjacent railway cutting is discharged has a shallow layer of silt deposited over the natural soil.

Terrain: Mostly with gentle slopes (averaging 1:12) to the southeast or southwest but heavily dissected by steep-sided gullies that flow only intermittently. The steep gully sides support the same vegetation type as adjacent to the gullies. The areas where *Gahnia sieberiana* dominates the ground flora could perhaps be explained by soil having filled ancient gullies that now channel subterranean seepage.

Hydrology: Moist in most months (saturated where the railway cutting runoff discharges) but normally becoming quite dry from midsummer to mid-autumn, except in areas where seepage minimises the incidence of dryness.

Canopy trees: Almost 20 m tall with 25-30% projected foliage cover, mostly in good (but not excellent) health. The canopy is strongly dominated by *Eucalyptus obliqua*. *Eucalyptus radiata* and *Eucalyptus macrorhyncha* are scattered. *Eucalyptus cephalocarpa* is present along the edges of the gullies. There are also scattered *Pinus radiata*, but most of these have been killed.

Lower trees: Less than 5% projected foliage cover overall but denser in scattered thickets. Excluding the thickets, the main species are *Exocarpos cupressiformis* (to c. 7 m tall) and *Acacia melanoxylon* (to 5 m tall, all regrowth dating from the breaking of the Millennium Drought in 2010). The thickets are variously dominated by *Kunzea leptospermoides* or *Acacia pycnantha*. Unlike Valley Heathy Forest, *Acacia mearnsii* is absent (despite being dominant on the adjacent gully floors).

Large and medium shrubs: Fairly sparse (visibility typically 100 m or more) except for occasional thickets of *Leptospermum scoparium, Polyscias sambucifolia* or *Prostanthera lasianthos*. The main species are *Cassinia aculeata*, *Correa reflexa*, *Olearia lirata* and *Coprosma quadrifida*. Importantly, there are patches where *Banksia marginata* and/or *Hakea ulicina* are abundant, but not in areas of dense *Gahnia sieberiana*. *Acacia myrtifolia* and *Spyridium parvifolium* are scattered and probably become abundant following fire. *Acacia verticillata* is scattered along the gully edges and in the areas of dense *Gahnia sieberiana*.

Small shrubs: Moderately abundant in the more natural areas, though the number of species is low. The more abundant species include *Dillwynia cinerascens, Epacris impressa, Hibbertia australis, Olearia myrsinoides* and *Platylobium obtusangulum*. *Leucopogon virgatus* is scattered thinly. Within the Protea family, *Lomatia ilicifolia* is represented by just one plant and *Persoonia juniperinum* has not been seen since 2001, but both species are noteworthy as good indicators of Lowland Forest as opposed to similar EVCs in the region.

Ferns: *Lindsaea linearis* and patches of *Pteridium esculentum* are scattered around the forest. *Adiantum aethiopicum* is scattered within areas of dense *Gahnia sieberiana*. Introduced ferns are abundant in the area where runoff is discharged from the adjacent railway cutting.

Climbers: *Billardiera mutabilis* and *Pandorea pandorana* are abundant throughout. The latter was absent until the 1990s and now displaces some of the pre-existing indigenous plants, so Heathmont Bushcare has pulled out large numbers of the species at Uambi. *Clematis aristata* is scattered, somewhat more densely than the climbing parasite, *Cassytha pubescens*, and the light twiners *Thysanotus patersonii* and *Comesperma volubile*. The introduced *Asparagus scandens* is abundant in the least natural areas, posing a serious environmental threat.

Creepers: *Centella cordifolia* is abundant in the areas of dense *Gahnia radula*, *Hardenbergia violacea* is scattered elsewhere and *Oxalis exilis/perennans* is scattered throughout. *Platylobium infecundum* is localised in three small areas.

Other ground flora: There are two types of ground flora. In one type, *Gahnia sieberiana* is dense (25% or more projected foliage cover) and associated with various other species that favour soil which rarely dries out, e.g. the *Centella cordifolia* mentioned above. The presence of these moisture-reliant species suggests that seepage keeps the soil of these areas damper than the rest of the Lowland Forest, where *Gahnia sieberiana* is scarce or (mostly) absent. The layer of seepage is presumably shallow, or else the species of trees would be expected to differ.

In the areas of dense *Gahnia sieberiana*, *Lepidosperma elatius* is fairly abundant. Other ground flora species are less diverse than elsewhere in the Lowland Forest. Perhaps the most conspicuous and

distinctive of these species are *Centella cordifolia*, *Microlaena stipoides*, *Schoenus apogon* and *Dianella longifolia*. Notably, *Rytidosperma pallidum* (formerly *Joycea pallida*; a species of drier soil) is confined to the margins.

Within the areas where *Gahnia sieberiana* is scarce or absent, *Rytidosperma pallidum* is abundant, as are dense patches of *Lomandra longifolia* subsp. *longifolia*. These are accompanied by the following abundant species: *Acrotriche serrulata*, *Austrostipa rudis*, *Burchardia umbellata*, *Dianella revoluta*, *Gonocarpus tetragynus*, *Goodenia lanata*, *Lagenophora sublyrata*, *Lepidosperma gunnii*, *Lomandra filiformis*, *Opercularia varia*, *Poranthera microphylla*, *Tricoryne elatior*, *Viola hederacea* and *Xanthorrhoea minor*. *Brunonia australis* and *Xanthosia dissecta* are scattered. Only one plant of *Lepidosperma filiforme* appears to remain, but its presence is noteworthy as an indicator species. Other characteristic (but scarce) species include *Dipodium roseum*, *Coronidium scorpioides*, *Hovea heterophylla* and *Stylidium armeria*. *Gahnia radula* and *Tetrarrhena juncea* are surprisingly scarce.

Significant plants

Endangered globally

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. Three patches of the species were found during this study. The number of individuals could not be estimated.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 5 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acianthus pusillus* (Small Mosquito Orchid) – At least four colonies were seen during this study, two of them beside the railway line and the others slightly east of the site's centre;
- *Allittia cardiocarpa* (Swamp Daisy) – not recorded since the 1980s; presumed to have died out;
- *Amyema pendula* (Drooping Mistletoe) – not recorded since 1996; presumed to have died out;
- *Banksia marginata* (Silver Banksia) – plants were not counted but there are probably fewer than ten. The combination of this site and the neighbouring sites 29C and 76 have by far the largest population of the species in Maroondah, the others having seriously declined or vanished since 1997;
- *Baumea acuta* (Pale Twig-rush) – not recorded since 1998; presumed to have died out;
- *Caladenia carnea* (Pink Fingers) – a single plant was seen and precisely mapped in October 2015 and 2016 but searches in subsequent flowering seasons could not find it;
- *Caladenia* ?*parva* (Small Spider-orchid) – Recorded by Jeff and John Jeanes in the late 1970s at (or very close to) the location where a tennis court now sits, probably very slightly outside the site boundary chosen here;
- *Caladenia transitoria* (Eastern Bronze Caladenia) – 11 were recorded in 1998 and 'several' in 2001;
- *Calochlaena dubia* (Common Ground-fern) – a patch of approximately ½ m² grows in a minor gully;
- *Cassinia trinerva* (Three-nerved Cassinia) – one individual grows in the main gully;
- *Cheilanthes austrotenuifolia* (Green Rock-fern) – not recorded since 1997; presumed to have died out;
- *Chiloglottis reflexa* (Autumn Bird-orchid) – in 1989, Andrew Paget mapped this species as being generally within the area between the two north-south gullies. It has probably died out;
- *Comesperma ericinum* (Heath Milkwort) – last recorded in 2001; no longer present but may regenerate under suitable conditions;
- *Correa reflexa* (Common Correa) – moderately abundant, not showing signs of hybridisation with garden correas (unlike most populations in metro Melbourne);
- *Craspedia variabilis* (Variable Billy-buttons) – not recorded since the 1980s; presumed to have died out;

- *Cryptostylis leptochila* (Small Tongue-orchid) – recorded by Jeff Jeanes at some time during 1976–1981, unlikely to remain present;
- *Diuris chryseopsis* (Golden Moths) – As for *Cryptostylis leptochila*; The last record from Maroondah;
- *Empodisma minus* (Spreading Rope-rush) – four patches grow near the middle of the property, all very small for the species;
- *Eriochilus cucullatus* (Parson's Bands) – not recorded since the 1980s; may well have died out;
- *Eucalyptus macrorhyncha* (Red Stringybark) – estimated to number over 20, in fair health;
- *Gompholobium huegelii* (Common Wedge-pea) – not recorded since 1998 but there is a small chance that it may regenerate under suitable conditions;
- *Gonocarpus humilis* (Shade Raspwort) – recorded in 2001 without further information;
- *Hakea nodosa* (Yellow Hakea) – recorded until 2001, no longer present;
- *Hakea ulicina* (Furze Hakea) – approximately 20 plants – perhaps that largest population within the Urban Growth Boundary;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – scarce;
- *Lepidosperma filiforme* (Common Rapier-sedge) – formerly fairly abundant but now reduced to a single plant;
- *Lomatia ilicifolia* (Holly Lomatia) – 3 neighbouring plants (or perhaps suckering) – the only occurrence recorded in Maroondah's history;
- *Muellerina eucalyptoides* (Creeping Mistletoe) – a single plant grew on a limb that fell in 2017, causing it to die;
- *Persoonia juniperina* (Prickly Geebung) – not recorded since 2001; presumed to have died out;
- *Poa tenera* (Slender Tussock-grass) – scarce;
- *Pultenaea scabra* (Rough Bush-pea) – not recorded since 1997; presumed to have died out;
- *Schoenus lepidosperma* (Slender Bog-rush) – not recorded since 1989; presumed to have died out;
- *Senecio minimus* (Shrubby Fireweed) – 3 were seen in the last survey (in 2014–2015); numbers will fluctuate;
- *Thelymitra ixioides/juncifolia* (Dotted Sun-orchid) – not recorded since 1989; presumed to have died out;
- *Thelymitra media* (Tall Sun-orchid) – recorded by Jeff Jeanes at some time during 1976–1981, unlikely to remain present.

Other

- *Eucalyptus macrorhyncha* × *obliqua* (also named *Eucalyptus* × *brevirostris*) – a single, large individual of this hybrid grows beside Allens Road. Although *Eucalyptus* × *brevirostris* is listed by the state government as 'Rare' in Victoria, that status was conferred in the erroneous belief that the name refers to a hybrid between *Eucalyptus macrorhyncha* and *Eucalyptus muelleriana*;
- *Gahnia sieberiana* (Red-fruit Saw-sedge) – Uambi also has a large population. There are only four other sites in Maroondah that have more than a few plants of the species, namely the neighbouring Belgrave rail reserve (Site 29d), Eastwood Golf Course (Site 68), Appletree Hill Reserve (Site 70) and Dexter's Bush (Site 76);
- *Olearia phlogopappa* (Dusty Daisy-bush) – a solitary plant grows 15 m up the northwest-facing slope next to the pond in the retarding basin. This species is very rare in Maroondah, occasionally establishing from seed blown in from elsewhere. It does not qualify as a locally threatened species because the sporadic plants probably represent a 'sink population' in the terms of the IUCN Red List Regional Guidelines, i.e. their continued occurrence probably does not depend on the plants living within Maroondah.

Fauna habitat

- The presence of all strata of native vegetation represents good habitat for a range of forest birds, bats, other arboreal mammals and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including microbats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

A map of the ecological condition of Uambi's natural and semi-natural vegetation appears in the report, *'The Flora of 'Uambi' in 2016'* by the present author. It uses the A–D scale of *'Sites of Biological Significance in Maroondah*'. The condition ratings vary between 'B' (good) near the main north-south gully to 'D' (poor) at the furthest locations. The revegetation area in the northwest varies between ecological condition 'C' (fair) and 'D'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened plant species

The flat-pea *Platylobium infecundum* is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. It occurs in Site 29b and its distribution is confined to Victoria. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance.

Referring to the discussion under the preceding heading, 'Significant plants', there are viable populations of many species in the 'critically endangered' category of risk of dying out in Maroondah. The large population of *Gahnia sieberiana* is also important for the survival of the species in Maroondah. All these populations meet standard criterion 3.1.5 for Local significance.

Regionally threatened Ecological Vegetation Class

Lowland Forest of the Gippsland Plain is listed by the state government as a vulnerable EVC. The Lowland Forest at Uambi easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Under standard criterion 3.2.3, any patch of a vulnerable EVC in fair to excellent condition (habitat score ≥ 0.3) is a site of **State** significance. Most of Uambi's vegetation is in better than fair condition.

The site's overall 'National' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to more information becoming available, differences in the criteria and the state government's recognition in the interim of the conservation status of *Platylobium infecundum* and Lowland Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation

benefit residents of the properties and (to a lesser degree) abutting properties. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The forest receives all the water runoff from the outbound side of the Heathmont railway cutting. The water infiltrates the soil and migrates slowly toward Dandenong Creek. Otherwise, the water would need to be piped, leading to exacerbation of pulsed flow and its consequences such as stream erosion.

Uambi's natural ambience is expected to be beneficial to the health, wellbeing, childhood development and quality of life of neighbours and visitors, particularly those who walk through the property. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the site.

Uambi brings together members of the local community at working bees and open days, thereby forging bonds between the participants and building community spirit.

The site's vegetation preserves something of the area's natural landscape. It, and the associated wildlife such as kangaroos, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Comparison of aerial photographs from 2001 and 2017 indicates an increase in the area of native vegetation of 0.25 ha due to revegetation of a former horse paddock in the site's northeast.

The 2001 aerial photograph shows few dead eucalypts. An aerial photograph from 2011 shows considerably more dead eucalypts and the 2017 aerial photograph shows a similar increase. Between each pair of years, there was a noticeable decrease in the foliage density of the eucalypt canopy.

Other changes in the ecological condition of the native vegetation can be inferred, in part, by comparing a map of condition prepared in 1996 for *'Sites of Biological Significance in Maroondah'* with a similar map by the present author in 2016 (see below). That comparison (imprecise though it is) suggests a small deterioration in condition in the most natural areas and an improvement in the least natural areas. Another indicator of change in ecological condition since 1996 is that there has been a net decrease in the number of indigenous plant species present, again concentrated in the most natural parts. Some of the disappearances have probably been due to attrition caused by problems created decades earlier; others appear to be due to prolonged dry conditions during the Millennium Drought.

Overall, there appears to have been a small net decline in the ecological condition of the native vegetation that was present in 1996, somewhat counterbalanced by the creation of new habitat through revegetation.

Threats

The identified threats to the site's biodiversity are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous flora by non-indigenous species, the most serious of which are Sallow Wattle (*Acacia longifolia* subsp. *longifolia*), Asparagus Fern (*Asparagus scandens*), Ivy (*Hedera helix*), Wonga Vine (*Pandorea pandorana*) and Sweet Pittosporum (*Pittosporum undulatum*);
- Continuing loss of indigenous plant species as the soil becomes drier from climate change and/or increased impervious coverage of the catchment;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.
- Erosion and altered soil moisture availability due to pulsed flows of runoff water through the site, including runoff from the railway cutting; and
- Decline of eucalypt health due to unnaturally high densities of the trees or other factors such as possum browsing or possible soil-borne disease.

Strategic planning

All of Site 32 is covered by:

- The Vegetation Protection Overlay (VPO), which also extends to abutting land on all boundaries except Allens Road;
- Clause 52.17 of the Victoria Planning Provisions (the state-wide baseline controls over removal of native vegetation), which also extends to all abutting land except 26 Allens Road;
- Schedule 3 of the Significant Landscape Overlay, which affects removal of trees;
- Schedule 2 of the Design and Development Overlay, which affects subdivision potential; and
- Schedule 2 of the Neighbourhood Residential Zone.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 of the Environmental Significance Overlay over the whole site, i.e. the area outlined in blue on the aerial photograph on p. 248. This should be done in conjunction with removal of the VPO from the whole of the original 1997 version of Site 32 (in *'Sites of Biological Significance in Maroondah'*).

Information sources

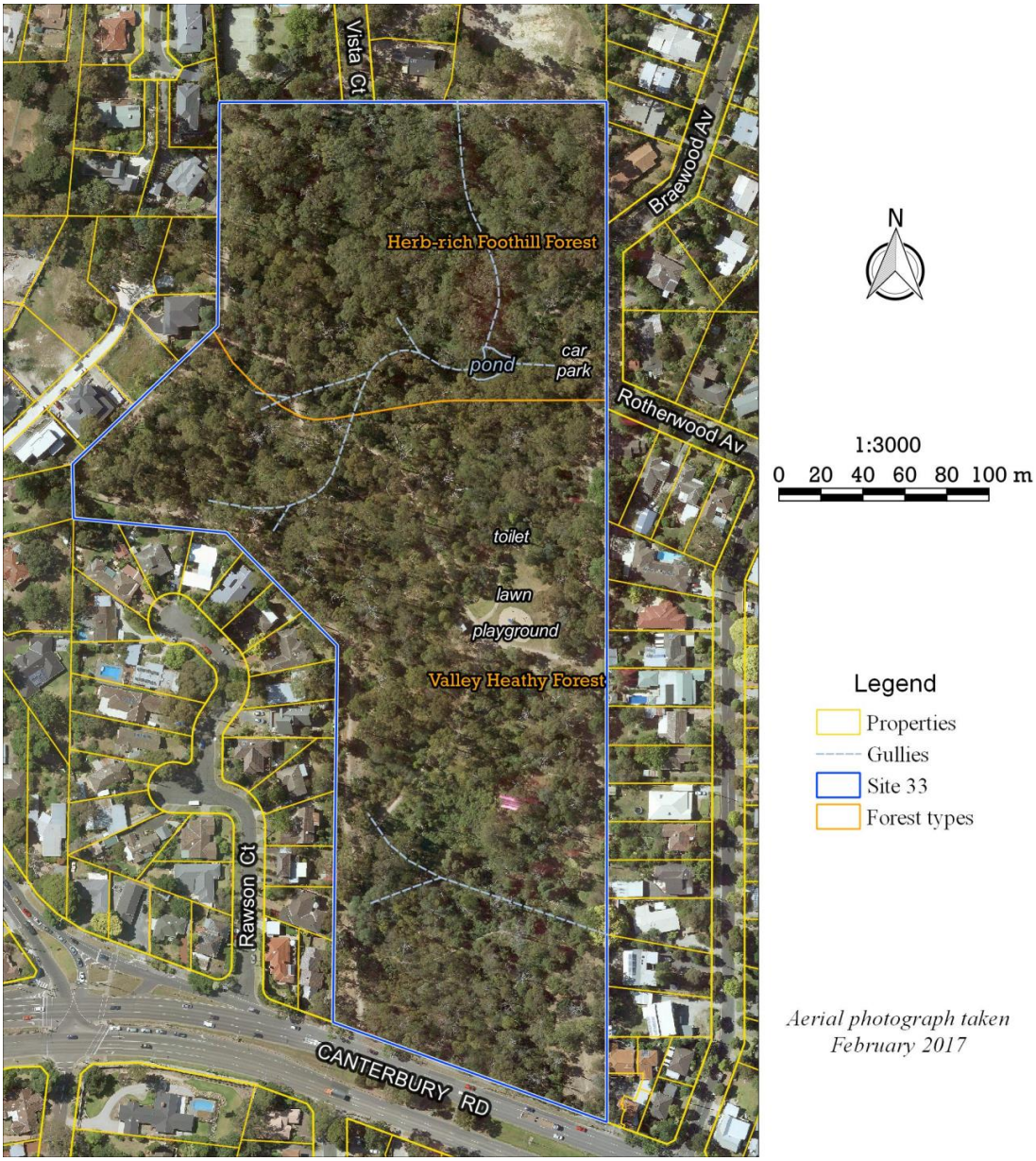
The assessment of 'Uambi' above is based on the following sources of information about the site:

- A brief inspection by the author in March 2019 to check the currency of the following information and update it as required;
- Incidental observations of locally rare flora by the author and other members of the Uambi Committee of Management in 2018;
- The information in the author's *'The Flora of Uambi in 2016'* and the associated investigation, which included over forty hours of flora surveys during the period 6/7/14 to 29/2/16;
- Cassia Read and Jen Brownscombe's *'Management Plan for 'Uambi' (Harpers Bush), Heathmont'*, written for the Trust for Nature in 2001;
- A brief flora survey by the present author on 7/7/13;
- Records of uncommon indigenous flora species found by the present author on 5/12/1998 and not recorded previously;
- The *'Flora and Fauna Survey Report, 'Uambi', 6-7 December 1997'*, based on fieldwork done largely by David Lockwood and Jason Stewart;
- The information in *'Sites of Biological Significance in Maroondah'* and the associated ecological investigation by the present author and John C. Reid. The investigation included flora and fauna surveys in November 1995 and May 1996;
- Andrew Paget's *'Harpers' Heathmont: Vegetation Management Plan'*, written for the Victorian Conservation Trust in 1989;
- A flora survey by Andrew Paget (aided, in part, by the present author) in September 1985;
- Recollections by John and Jeff Jeanes about orchids they saw on the property in the early or mid-1980s;
- Herbarium specimens from the abovementioned work by Andrew Paget and the present author; and
- Aerial photographs from 1945, 2001, 2011, 2013 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas. Note that the state government's vegetation mapping of the area shows the vegetation to be Valley Heathy Forest. That may have been a reasonable presumption in the absence of a site inspection but it is not correct.

Site 33. Wombolano Park, Ringwood East

Biological Significance Level: *National* due to an abundance of an endangered plant species



Boundaries, land use and tenure

The site coincides with the single property that comprises Wombolano Park. It is a bushland reserve with a public toilet, shelter and a lawn between the two. There is a car park on the eastern edge.

General description

Wombolano Park occupies 7.7 hectares with two main, east-flowing gullies and several tributary drainage lines. A pond has been constructed on the main northern gully near Rotherwood Avenue. Pipes have been laid along the main gullies to carry sewage and stormwater.

North of the northern gully, the land is moderately steep and faces south to southeast, causing it to be well shaded in the afternoons and winter. The rest of the park has more gradual slopes facing southeast to northeast, more exposed to the sun. These differences have led to the formation of two forest types: Herb-rich Foothill Forest in the northern third of the park and Valley Heathy Forest elsewhere.

An aerial photograph from 1945 shows approximately 20% of the site (1.8 ha) was open grass. A paddock extended 75 m into the site from the east, taking in the current-day lawn, the pond and everything between (totalling 1 ha). There were smaller clearings to the northwest and southwest. An additional 2.3 ha abutting Canterbury Road appears to have been young regrowth scrub, apart from trees along the main southern gully. The remaining 3.6 ha of the site was forest with gaps in the canopy from tree removal. At least fifteen of the trees from that time remain as very large trees today. The largest, with a trunk diameter of 1.2 m, is a Mountain Grey Gum – a species that does not grow anywhere else in Maroondah.

The park's history of past clearing, regrowth and pipelaying is typical of native vegetation in the Melbourne Region (indeed, most of Victoria). That history, and the incursion of environmental weeds from adjacent private land, have reduced the naturalness of the remaining vegetation. However, the park's northern third contains some quite natural vegetation with many rare plants.

Altogether, sixty-four naturally-occurring, indigenous plant species were observed in the park during this study.

Relationship to other land

Recent residential subdivision of nearby land has left very little indigenous vegetation within 500 m of the park except for scattered eucalypts. However, planted 'Australian natives' and indigenous plants in nearby gardens and streets help to augment the park's habitat for birds, bats, tree frogs and insects. On the other hand, many nearby gardens contain environmental weeds that spread into the park and runoff from some properties uphill introduces nutrients and other pollutants into the park.

The nearest areas of native vegetation of comparable size to Wombolano Park are Tintern Grammar School (Site 34, 620 m north-northwest), 'Uambi' (Site 32, 650 m southwest) and along the Belgrave Railway Line (Sites 29a–d, 750 m away). Gaps of those distances significantly limit the survival of most small native birds other than very sedentary or urban-adapted species such as White-browed Scrubwrens and Brown Thornbills.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Herb-rich Foothill Forest (EVC 23, **Vulnerable** in the bioregion)

Canopy trees: To over 20 m tall. Dominated by Messmate Stringybark (*Eucalyptus obliqua*) and White Stringybark (*E. globoidea*), followed by Narrow-leaved Peppermint (*E. radiata*). Mountain Grey Gum (*E. cypellocarpa*) is represented by a very large tree and probably two immature trees whose identity is less certain.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*), followed by Cherry Ballart (*Exocarpos cupressiformis*). Silver Wattle (*A. dealbata*) is scattered. Swamp Paperbark (*Melaleuca ericifolia*) is scarce, concentrated in and near the gullies.

Medium to large shrubs: Dominated by abundant Prickly Currant-bush (*Coprosma quadrifida*) and Burgan (*Kunzea* sp.). Common Cassinia (*Cassinia aculeata*) and Snowy Daisy-bush (*Olearia lirata*) are widespread and fairly abundant. Sweet Bursaria (*Bursaria spinosa*) forms localised, dense stands. Elderberry Panax (*Polyscias sambucifolia*) and Rough Bush-pea (*Pultenaea scabra*) are scattered, the latter comprising natural and planted individuals. Hop Goodenia (*Goodenia ovata*) is fairly abundant along the main gully.

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is very scarce.

Ferns: Common Ground-fern (*Calochlaena dubia*) is abundant and widespread. Austral Bracken (*Pteridium esculentum*) forms scattered patches. In the alluvium on the floors of the gullies, Harsh Ground-fern (*Hypolepis muelleri*) is fairly abundant, Mother Shield-fern (*Polystichum proliferum*) is scarce and there is at least one Rough Tree-fern (*Cyathea australis*).

Climbers: Mountain Clematis (*Clematis aristata*) is abundant. Twining Glycine (*Glycine clandestina*) is fairly abundant. Wonga Vine (*Pandorea pandorana*) was absent in previous flora surveys but is now scattered (and a potential environmental problem). Common Apple-berry (*Billardiera mutabilis*) is scarce.

Creepers: Kidney-weed (*Dichondra repens*) and the flat-pea, *Platylobium infecundum*, are abundant. Bidgee-widgee (*Acaena novae-zelandiae*) is abundant along the main gully. Ivy-leaf Violet (*Viola hederacea*) is scarce in 2019 but may be more abundant in good years.

Grasses, rushes and sedges: Notably, the total grass cover is probably exceeded by the cover of Tasman Flax-lily (*Dianella tasmanica*). Weeping Grass (*Microlaena stipoides*) is abundant, particularly in the former paddock and near paths. Thatch Saw-sedge (*Gahnia radula*) and Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) are fairly abundant throughout and Common Bog-rush (*Schoenus apogon*) is fairly abundant downstream of the pond. The following species are scattered: Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Soft Tussock-grass (*P. morrisii*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*) and Forest Wire-grass (*Tetrarrhena juncea*). Tall Sword-sedge (*Lepidosperma elatius*) is scarce, localised along the main gully.

Other groundcover: Tasman Flax-lily (*Dianella tasmanica*) dominates the groundcover. Mosses and the liverwort, Green Worms (*Chiloscyphus semiteres*), are also abundant. Slender Knotweed (*Persicaria decipiens*) is fairly abundant downhill from the pond. Other groundcover species are scarce, including Honey-pots (*Acrotriche serrulata*), Dainty Bird-orchid (*Chiloglottis trapeziformis*), Common Bird-orchid (*Chiloglottis valida*) and Nodding Greenhood (*Pterostylis nutans*).

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) and White Stringybark (*E. globoidea*) (as for the Herb-rich Foothill Forest), followed by Mealy Stringybark (*E. cephalocarpa*) and Bundy (*E. goniocalyx*).

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*), in combination with Golden Wattle (*Acacia pycnantha*) in localised stands. Black Wattle (*A. mearnsii*) is fairly abundant.

Medium to large shrubs: Patchily dense. Dominated by Sweet Bursaria (*Bursaria spinosa*) and Yarra Burgan (*Kunzea leptospermoides*). Hop Goodenia (*Goodenia ovata*) is fairly abundant.

Small shrubs: As is typical of Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant. Grey Parrot-pea (*Dillwynia cinerascens*) and Erect Guinea-flower (*Hibbertia riparia*) were present in previous flora surveys but not in 2019, quite possibly due to the much briefer survey in 2019.

Ferns: There are scattered patches of Austral Bracken (*Pteridium esculentum*).

Climbers: Common Apple-berry (*Billardiera mutabilis*) is fairly abundant. Small-leaf Clematis (*Clematis decipiens*) is scarce – a fairly recent arrival to the park. Purple Coral-pea (*Hardenbergia violacea*) is present but probably only due to planting, as it was not recorded in flora surveys prior to this one.

Creepers: Kidney-weed (*Dichondra repens*), Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel, *Oxalis exilis/perennans*, are the most abundant creepers.

Grasses, rushes and sedges: Abundant and rich in species. Weeping Grass (*Microlaena stipoides*) is dominant in some less natural areas and elsewhere, multiple species share dominance, the most

abundant being Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*) and Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*). Red-anther (or Silvertop) Wallaby-grass (*R. pallidum*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*) are fairly abundant.

Other groundcover: Black-anther Flax-lily (*Dianella revoluta*) is abundant. The small shrublets, Honey-pots (*Acrotriche serrulata*), Common Raspwort (*Gonocarpus tetragynus*) and Common Rice-flower (*Pimelea humilis*) are scattered.

Artificial wetland (no EVC or conservation status applicable) – the pond

Woody plants: absent.

Aquatic and semi-aquatic species: Dominated by rushes (particularly *Juncus gregiflorus*) and planted Tall Sedge (*Carex appressa*). Water Plantain (*Alisma plantago-aquatica*) and Slender Knotweed (*Persicaria decipiens*) are fairly abundant.

Significant plants

Globally endangered

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. It is abundant within an area of c. ½ ha in the northeast of Wombolano Park, with scattered individuals elsewhere in the park. Some have apparently been planted but some are part of the large, wild population recorded in 1996;

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Wombolano Park can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – a single plant overhangs a footpath, 20 m southwest of the playground, on a large *Eucalyptus cephalocarpa*;
- *Chiloglottis trapeziformis* (Dainty Bird-orchid) – a mixed colony of this species and *Chiloglottis valida* contains roughly 300 plants in total. The apportionment between the species could not be determined with any precision in the June 2019 field survey;
- *Calochlaena dubia* (Common Ground-fern) – widespread and abundant in the northern third of the park;
- *Correa reflexa* (Common Correa) – recorded in 1985 (when the species was common in Maroondah) but today's plants appear to be all hybrids and non-indigenous forms, most of them planted;
- *Eucalyptus cypellocarpa* (Mountain Grey Gum) – the only occurrence in Maroondah and probably the closest occurrence to Melbourne. There is one very large tree in the northwest of the park and at least two immature trees whose identity needs to be confirmed once fertile material becomes available;
- *Eucalyptus globoidea* (White Stringybark) – codominant with *E. obliqua* almost throughout. 93 were counted in an unexhaustive inspection of the park in 2019;
- *Eucalyptus macrorhyncha* (Red Stringybark) – recorded in two previous surveys (without an indication of abundance) but not in 2019, perhaps due to similarity with the dominant *E. globoidea*;
- *Hakea decurrens* (Bushy Needlewood) – recorded in 1985 but not in 1996–1997 or 2019, so presumed to have died out;
- *Hakea nodosa* (Yellow Hakea) – recorded in 1985 and 1986 but not in 1996–1997 or 2019, so presumed to have died out;
- *Hypolepis muelleri* (Harsh Ground-fern) – fairly abundant within c. 30 m up and down the gully from the pond;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – recorded in two previous surveys (without an indication of abundance) but not in 2019, which is understandable for such a tiny species in a quick site inspection;

- *Myriophyllum crispatum* (Upright Water-milfoil) – recorded in 1996 with an annotation that it may have been planted. Not detected in 2019, either due to the low intensity of the 2019 survey or because it was destroyed when extensive planting occurred in the pond some years ago;
- *Poa tenera* (Slender Tussock-grass) – recorded in 1996 (without an indication of abundance) but not in June 2019, which is understandable due to the time of year and the low intensity of the 2019 survey;
- *Polystichum proliferum* (Mother Shield-fern) – 2 or 3 were recorded in 1996 and 6 were recorded in 2019 – 4 next to the pond and 2 in the drainage line to the north (where they were in 1996);
- *Pultenaea scabra* (Rough Bush-pea) – 6 were recorded in 1996, compared with 12 in 2019 (some of which have been planted);
- *Senecio minimus* (Shrubby Fireweed) – in the brief survey in 2019, one plant was seen just north of Braewood Avenue and five between the pond and the car park. Numbers will vary greatly from year to year.

Large trees

Without trying hard, the author counted fifteen eucalypts with trunk diameters over 70 cm, which is the threshold to qualify as a 'large tree' under the state government's 'Vegetation Quality Assessment Manual'. One of those is the very large *Eucalyptus cypellocarpa* in the northwest corner of the park, mentioned above.

Fauna habitat

- The structure and composition of the forest represents suitable habitat for a modest range of forest birds, bats, possums and invertebrates, limited by the size of the park and the distance to comparable habitat;
- The park's large, old eucalypts are of high value as habitat trees;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- Nest boxes are attached to some trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The pond provides habitat for common pondlife and urban-adapted waterbirds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The park's vegetation shows a marked gradation in ecological condition from fairly natural in the north to fairly degraded in the south. The 2.3 ha at the southern end that was young regrowth scrub in 1945 has suffered a serious loss of eucalypts and substantial replacement of indigenous understorey plants by introduced groundcover. A similar problem has affected the park's western lobe. The park's northern third has rather minor occurrence of introduced plant species.

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the Herb-rich Foothill Forest mostly falls into rating 'B' (or good) and the Valley Heathy Forest is divided into approximately 10% 'B', 70% 'C' (fair) and 20% 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The flat-pea *Platylobium infecundum* is abundant in the northeast of Wombolano Park, with scattered plants further west. The species is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. Its global distribution is confined to Victoria. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance.

Many of the other species listed in the section above headed 'Significant plants' fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Regionally threatened Ecological Vegetation Classes

The Valley Heathy Forest in Wombolano Park easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of State significance (which does not override the National significance above).

Herb-rich Foothill Forest is listed by the state government as 'vulnerable' in the bioregion. Standard criterion 3.2.3 attributes State significance to a site containing a patch of a vulnerable EVC with a 'habitat score' of at least 0.3. The author is quite confident that the Herb-rich Foothill Forest in Wombolano Park meets that threshold, although no score has been calculated.

Ecological stepping-stone

As seen on the key map of Maroondah's sites of biological significance on p. 1, Wombolano Park is one of a series of forest patches along the Wicklow Hill Ridge. Some of the more mobile species of wildlife, such as Australian King Parrots, appear to use those sites as ecological 'stepping-stones'. The park therefore fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site. The nearest 'remnant habitat blocks' in this case include Sites 32, 33, 36, 37 and 38.

The park's overall 'National' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of *Platylobium infecundum*, which had not even been described as a species in 1997.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the park and living adjacent. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the gullies and pond helps to stabilise the soil and remove a small amount of water pollution emanating from the private properties uphill.

The natural ambience of the park is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors and those who pass through.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into surrounding streets and gardens.

Nearby Eastwood Primary School makes regular use of the park for activities such as environmental education and cross-country runs, heightening the park's importance for childhood development.

The park's natural ambience encourages people to get exercise by walking or running around the extensive network of paths.

While the members of the Friends of Wombolano Park provide ecological benefits to the bushland, the bushland reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The park's vegetation contributes substantially to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, the detectable change of native vegetation over that period comprises approximately:

- 400 m² of lost eucalypt canopy north and northwest of the playground; and
- 200 m² of lost eucalypt canopy in the western corner.

Change in the ecological condition of habitat

The assessment of the park's ecological condition in the 1997 report, *'Sites of Biological Significance in Maroondah'*, was consistent with the 2019 assessment given above in the section headed 'Ecological condition'.

Anecdotally, it appears that the declining health of the eucalypt canopy noted in a 1979 management plan stabilised at the time of a 1997 management plan (Lorimer 1997c) and subsequently resumed. A substantial number of eucalypts died during the Millennium Drought.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Displacement of indigenous plants by introduced plants (except that this threat has been brought well under control by the efforts of council staff and the Friends of Wombolano Park).

Strategic planning

The whole park is zoned 'Public Conservation and Resource Zone' and covered by the Vegetation Protection Overlay (VPO) and Schedule 3 of the Significant Landscape Overlay.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to replace the VPO with the proposed schedule ESO1.

Information sources

The analysis above draws on the following sources of information about the site:

- 3 hours 20 minutes of ecological survey for this study on 6/6/19 and 10/6/19, including: (a) compiling separate lists of the names and abundances of indigenous plant species in three parts of the park, for the purpose of characterising the vegetation; (b) documenting the details of rare or scarce plants; (c) mapping the vegetation and rare plants; and (d) collecting a specimen of the very large Mountain Grey Gum;
- A discussion with the Principal of Eastwood Primary School, Rukshana Verzijl, regarding the school's use of Wombolano Park;
- Maroondah City Council's records of planting in the reserve;
- Bird lists from members of Birds Australia on 16/4/88, 5/11/00, 27/7/14 and in most months from April 2015 to January 2019 – available from the online Atlas of Living Australia;
- Bird lists from eBird contributors Carol Edward on 8/2/17 and 'Emma B' on 27/7/14;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and the *'Wombolano Park Bushland Management Plan 1997'* (Lorimer 1997c). The documents involved approximately forty hours of fieldwork in the park by John C. Reid and the present author during February 1996 to September 1997, including a detailed flora survey, 20-minute bird census, frog call survey, mammal hair survey, spotlighting and incidental fauna observations;
- A pressed specimen of *Hypolepis muelleri* collected by the author on 29/2/96;
- Field data sheets from a brief survey of vascular flora by Randall Robinson on 8/12/86, including quadrat B18286 and species list T19543;
- A list of indigenous and introduced vascular plant species by Andrew Paget in June 1985;
- A 1979 management plan by Scott Furphy Engineers Pty Ltd titled *'Wombolano Park'*;
- A 1979 report (in the form of a letter within the previous document) by Dr Gretna Weste, concluding *Phytophthora cinnamomi* was probably absent in Wombolano Park;
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas other than duplications of a few of the information sources above.

Site 34. Tintern Grammar Sanctuary, Ringwood East

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundaries

The northern boundary and much of the western and southern boundaries follow fences. The rest of the boundary follows the edge of the contiguous native vegetation (including the tree canopy) and is therefore somewhat irregular in shape. As for all sites in this volume, the precise boundary is available in a shapefile for geographic information systems (GISs).

The boundary has contracted somewhat compared with the original version of the site in the 1997 report, *'Sites of Biological Significant in Maroondah'*. The change is mainly due to the greater precision that can now be achieved with a GIS and partly due to removal of vegetation for construction of the Senior College building.

The 1997 version of the site also included the southwest corner of the school property, which is excluded here for reasons discussed below.

Land use and tenure

The site was set aside in the 1950s as a 'wildflower sanctuary' within the grounds of the private school now known as Tintern Grammar.

General description

This site occupies 3.0 hectares of forest on a moderately steep slope facing east-southeast, separating classrooms from the school farm. There is a shallow drainage line along the southern boundary.

The slope is much steeper than land to the west or east, as is generally the case for sites on the eastern edge of the Wicklow Hill Ridge.

An aerial photograph from 1945 shows the sanctuary covered with young regrowth scrub punctuated by medium-sized pines. A track led diagonally down the slope. Today, the regrowth has grown to become a mature forest, the pines are large and the track has been paved to provide access to the farm. Many introduced plant species have joined the pines within the forest.

The site's history of past clearing, regrowth and incorporation of introduced plants is typical of native vegetation in the Melbourne Region (indeed, most of Victoria). The resulting loss of naturalness is continuing as introduced plants steadily replace the indigenous flora. Nevertheless, the forest still contained at least 75 indigenous plant species (some of them rare) at the time of the author's last inspections in 2010 and 2013.

Relationship to other land

Eucalypts in other parts of the school are the nearest indigenous vegetation to the sanctuary. There are hardly any indigenous trees (and few 'Australian natives') within 300 m. A tiny reserve on Walhalla Drive (340 m south) has a full canopy of remnant eucalypts with vestiges of indigenous understorey. There are some indigenous and 'Australian native' trees in the residential neighbourhood of Long View Road, 300–500 m to the northeast.

The closest areas of habitat with indigenous understorey are Cheong Wildflower Sanctuary (Site 36, 600 m to the north) and Wombolano Park (Site 33, 620 m to the south-southwest). Gaps of those distances significantly limit the survival of most small native birds other than very sedentary or urban-adapted species such as White-browed Scrubwrens and Brown Thornbills.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion), tending toward Herb-rich Foothill Forest (EVC 23)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*), followed by White Stringybark (*E. globoidea*), Red Stringybark (*E. macrorhyncha*) and Narrow-leaved Peppermint (*E. radiata*). Mealy Stringybark (*E. cephalocarpa*) is scarce.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*), followed by Cherry Ballart (*Exocarpos cupressiformis*) and Silver Wattle (*A. dealbata*).

Medium to large shrubs: Patchily dense. Dominated by Sweet Bursaria (*Bursaria spinosa*), followed by Myrtle Wattle (*Acacia myrtifolia*), Common Cassinia (*Cassinia aculeata*), Prickly Currant-bush (*Coprosma quadrifida*), Common Correa (*Correa reflexa*), Common Heath (*Epacris impressa*), Yarra Burgan (*Kunzea leptospermoides*) and Elderberry Panax (*Polyscias sambucifolia*).

Small shrubs: As is typical of Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) is abundant. Grey Parrot-pea (*Dillwynia cinerascens*) is fairly abundant. Silky Daisy-bush (*Olearia myrsinoides*) is scarce. The good environmental indicators, Erect Guinea-flower (*Hibbertia riparia*) and Common Beard-heath (*Leucopogon virgatus*), were present in the first flora survey, in 1956.

Ferns: Austral Bracken (*Pteridium esculentum*) is abundant. Screw Fern (*Lindsaea linearis*) was once present and is a good environmental indicator.

Climbers: The following species are fairly abundant: Common Apple-berry (*Billardiera mutabilis*), Mountain Clematis (*Clematis aristata*), Love Creeper (*Comesperma volubile*) and Twining Glycine (*Glycine clandestina*). Purple Coral-pea (*Hardenbergia violacea*) was previously present and may have been overlooked by the present author.

Creepers: Ivy-leaf Violet (*Viola hederacea*) is fairly abundant. Bidgee-widgee (*Acaena novae-zelandiae*), Kidney-weed (*Dichondra repens*) and Trailing Goodenia (*Goodenia lanata*) are scarce.

Grasses, rushes and sedges: Abundant and rich in species. Dominated by Thatch Saw-sedge (*Gahnia radula*) and Forest Wire-grass (*Tetrarrhena juncea*). Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) is also abundant. The following species are fairly abundant: Tall Spear-grass (*Austrostipa pubinodis*), Reed Bent-grass (*Deyeuxia quadriseta*), Soft Tussock-grass (*Poa morrisii*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Clustered Wallaby-grass (*Rytidosperma racemosum*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Kangaroo Grass (*Themeda triandra*). Small Grass-tree (*Xanthorrhoea minor*) is not abundant but serves as a good environmental indicator.

Other groundcover: The following species are fairly abundant: Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (*Gonocarpus tetragynus*) and Nodding Greenhood (*Pterostylis nutans*). Although less abundant, the following species are good environmental indicators: Common Rice-flower (*Pimelea humilis*), Candles (*Stackhousia monogyna*) and Yellow Rush-lily (*Tricoryne elatior*). Other good environmental indicators recorded prior to 2010 include Swamp Daisy (*Allittia cardiocarpa*), Tall Sundew (*Drosera auriculata*), Common Wedge-pea (*Gompholobium huegelii*), Brown-beaks (*Lyperanthus suaveolens*) and Cut-leaf Xanthosia (*Xanthosia dissecta*).

Significant plants

Critically endangered in Maroondah

The following plant species recorded in the sanctuary in the author's inspections in 2010 or 2013 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acianthus pusillus* (Small Mosquito Orchid) – a colony of at least fifteen individuals;
- *Amyema pendula* (Drooping Mistletoe) – a single, dead plant was seen in 2010;
- *Chrysocephalum semipapposum* (Clustered Everlasting) – 15 individuals;
- *Correa reflexa* (Common Correa) – scattered;
- *Eucalyptus globoidea* (White Stringybark) – scattered;
- *Eucalyptus macrorhyncha* (Red Stringybark) – scattered.

The following additional species were recorded in 1956 or 1997 without any details. Although they are in the 'critically endangered' category of dying out in Maroondah now, they would not have been at the time:

Allittia cardiocarpa (Swamp Daisy)
Calochilus paludosus (Red Beard-orchid)
Calochilus robertsonii (Purplish Beard-orchid)
Comesperma ericinum (Heath Milkwort)
Gompholobium huegelii (Common Wedge-pea)
Hakea decurrens (Bushy Needlewood)
Kennedia prostrata (Running Postman)
Lagenophora stipitata (Blue Bottle-daisy)
Ozothamnus obcordatus (Grey Everlasting)
Pauridia vaginata (Yellow Star)
Sphaerolobium minus (Globe-pea)
Thelymitra rubra (Salmon Sun-orchid)

Fauna habitat

- The structure and composition of the forest represents suitable habitat for a modest range of forest birds, bats, possums and invertebrates, limited by the size of the sanctuary and the distance to more substantial habitat;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The sanctuary's indigenous flora is being displaced by vigorous introduced plant species such as Sweet Pittosporum, Large-leafed Privet and Ivy.

Some trees in the south have been ringbarked, not all of them lethally.

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the most recent (2013) assessment rated approximately ½ hectare as 'B' (or good), 1½ hectare as 'C' (fair) and 1 hectare as 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Regionally threatened Ecological Vegetation Class

The Valley Heathy Forest in the sanctuary easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

Except for *Amyema pendula*, the species in the dot-points in the section above headed 'Significant plants' fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological stepping-stone

As seen on the key map of Maroondah's sites of biological significance on p. 1, the sanctuary is one of a series of forest patches along the Wicklow Hill Ridge. Some of the more mobile species of wildlife, such as Australian King Parrots, appear to use those sites as ecological 'stepping-stones'. The sanctuary therefore fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site. The nearest 'remnant habitat blocks' in this case include Sites 32, 33, 36, 37 and 38.

The sanctuary's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the 'endangered' conservation status of Valley Heathy Forest.

The original (1997) version of Site 34 included the eucalypt cover in the southwest of the school property. That area does not meet the standard criteria for a site of biological significance, and would not have done so in 1997 if the criteria had existed then.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people and farm animals within and close to the sanctuary. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the sanctuary is expected to contribute to the enjoyment, health, wellbeing and childhood development of the school community.

Those benefits are spread into the rest of the schoolgrounds and the neighbourhood by the movement of birds, butterflies and other animals as they move between the sanctuary and other areas of habitat.

Changes

Change in the extent of habitat

During the period from 1997 to 2018, the only significant change in the extent of vegetation in the sanctuary or the school as a whole is the removal of 0.2 hectares of forest for construction of the Senior College building. That loss has been somewhat compensated by the growth of tree crowns that have expanded over ground that previously had no native vegetation.

Change in the ecological condition of habitat

The 1997 report, *'Sites of Biological Significance in Maroondah'*, indicates a slightly better ecological condition than the 2013 assessment given above in the section headed 'Ecological condition'. However, neither assessment was done with high enough precision to allow a quantitative comparison.

Anecdotally, it appears that environmental weeds have increased at the expense of the indigenous flora and quite a few eucalypts died during the Millennium Drought.

Threats

This study has identified the following threats to the site's biodiversity:

- Displacement of indigenous plants by introduced plants such as Sweet Pittosporum, Large-leafed Privet and Ivy – by far the greatest threat;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The whole school is zoned 'Neighbourhood Residential – Zone 3' and covered by Schedule 3 of the Significant Landscape Overlay. The Vegetation Protection Overlay (VPO) applies to a somewhat larger area than the sanctuary, as well as to the southwest corner of the school property.

It is recommended to:

- Remove the VPO from the southwest corner of the school because that area does not qualify as a site of biological significance under the standard criteria of Amos (2004) – see above. This recommendation takes into account that the indigenous trees in that area would retain planning protection through the Significant Landscape Overlay and clause 52.17 of the Victoria Planning Provisions;
- Remove the VPO from the other part of the school where it currently applies, roughly corresponding to the sanctuary; and
- Cover Site 34, as delineated on the aerial photograph on p. 265, with the proposed schedule ESO1 discussed in Section 11.1.2 of Volume 1, as is appropriate for a site of State biological significance.

Information sources

The analysis above draws on the following sources of information about the site:

- A superficial inspection of the school from outside the fence on 10/6/19;
- Compilation of plant species lists on 15/5/10 and 27/4/13, including documentation of abundances;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork by John C. Reid on 18/1/96 that included mapping of the school's native vegetation and compilation of lists of species of vascular plants, birds and butterflies;
- A transcription of a plant species list (without abundances) for the school's wildflower sanctuary compiled by Ilma Dunn in spring 1956; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No data was available from eBird. No useful information could be found in the online Victorian Biodiversity Atlas other than an electronic version of the 1956 plant species list. Note that entries that were originally marked on the 1956 list as questionable have not been marked as such when entered into the Victorian Biodiversity Atlas.

Acknowledgement

Thanks to Tintern Schools for providing permission to inspect the bushland on their open days in 2010 and 2013.

Site 35. Cheong Park, Croydon

Biological Significance Level: *Local* due to the function as an ecological 'stepping-stone'



Boundaries, land use and tenure

The site is part of a municipal park managed for active and passive recreation and a playground. Buildings, car parks and active recreation areas are excluded from the site. The western, southern and eastern boundaries of the site coincide with those of the park. The site boundaries along Orchard Drive and in the northeast also follow the park boundary. The rest of the site boundary follows the edge of the canopy of indigenous eucalypts and is therefore rather irregular in shape. As with all sites in this volume, the precise site boundaries are available as a shapefile for geographic information systems.

The original version of the site included the whole park, for simplicity. The site delineated here is restricted to the areas of biological significance.

General description

Cheong Park has a slight slope (1:20) to the southeast and lies only 170 m from Tarralla Creek. The whole park has an area of 6.0 ha and Site 35 occupies 2.2 ha of it.

An aerial photograph from 1945 shows the current-day park was part of a paddock with strips of eucalypts along the Eastfield Road frontage and the park's western fringe. Pines were also present along the western fringe. Cheong Park was created in 1948 by a donation to the municipality from Rev. Cheok Hong Cheong.

The trees present today have nearly all germinated since 1945 but there remains at least one eucalypt visible on the 1945 aerial photograph and probably several of the pines. The pines are so large that they are competing strongly with the indigenous vegetation.

The park's history of past clearing and regrowth is typical of native vegetation in the Melbourne Region (indeed, most of Victoria). Despite that history, the site retains at least twenty naturally-occurring indigenous plant species.

The vegetation within Site 35 mostly comprises mature, naturally-occurring eucalypts growing over mown lawn. Much of the lawn has a high proportion of common native grasses, while a few other indigenous understorey plants are struggling to survive the mowing in the southeast corner of the park. The southwest corner retains islands of dense Spiny-headed Mat-rush (*Lomandra longiflora*) and Austral Bracken (*Pteridium esculentum*) surrounded by lawn. There are a few small areas of recent revegetation, with more planned in the northeast.

Relationship to other land

Small lizards and non-flying invertebrates would be capable of surviving entirely within Cheong Park. The rest of the park's native fauna need to move between the park and other areas of habitat. Fortunately, the park abuts habitat along Bayswater Road (Site 92, shown on the aerial photograph above) and is 170 m from the Tarralla Creek habitat corridor (Site 62). Those sites make it easier for flying fauna (and an occasional kangaroo) to travel between Cheong Park and superior habitat at Cheong Wildflower Sanctuary (Site 36, 330 m to the west), Eastfield Park (Site 61, 300 m to the east) and the Ruthven Way – Vasey Concourse Precinct (Site 37, 230 m to the northwest).

Scattered indigenous and Australian native trees on nearby nature strips and residential land further improve the permeability of the local landscape for birds and flying insects.

The central location of Cheong Park between Eastfield Park, Cheong Wildflower Sanctuary and the Ruthven Way – Vasey Concourse precinct makes Cheong Park strategically important for wildlife movement. The park is effectively an ecological 'stepping-stone' for wildlife movements through the area.

By encouraging those movements, Cheong Park helps bring birds and butterflies into the daily lives of surrounding residents.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Strongly dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) in most of the park but there are small areas dominated by Messmate Stringybark (*E. obliqua*) or Swamp Gum (*E. ovata*).

Lower trees: Sparse due to past clearing. Blackwood (*Acacia melanoxylon*) is scattered. Cherry Ballart (*Exocarpos cupressiformis*) is represented only by two adjacent, young stems beside Eastfield Road. Silver Wattle (*Acacia dealbata*) dominates the stratum of sub-canopy trees on the adjacent roadside of Bayswater Road.

Medium to large shrubs: Completely eliminated by past clearing but recent revegetation in two small areas is restoring a few species, particularly Yarra Burgan (*Kunzea leptospermoides*).

Small shrubs: Eliminated by past clearing. The locally rare Prickly Geebung (*Persoonia juniperinum*) was recorded in 1996 but was not found in 2019.

Ferns: There is a dense patch of Austral Bracken (*Pteridium esculentum*).

Climbers: The only remaining climbers are a small patch of about six Common Apple-berry (*Billardiera mutabilis*) near the park's southeast corner.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) occurs in one small patch.

Grasses, rushes and sedges: At least twelve indigenous species are present. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) dominates the groundcover in the southwest. In the lawns, Weeping Grass (*Microlaena stipoides*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are abundant. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Thatch Saw-sedge (*Gahnia radula*) are fairly abundant but localised. Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*) are scarce. The abundances of other species could not be reliably determined during the June 2019 site inspection due to mowing.

Other groundcover: There are localised patches of Pale Flax-lily (*Dianella longifolia*) and Black-anther Flax-lily (*Dianella revoluta*).

Significant plants

Critically endangered in Maroondah

Prickly Geebung (*Persoonia juniperinum*) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. At least one was recorded in 1996 but none were found in 2019.

Large trees

The author counted six eucalypts with trunk diameters over 70 cm, which is the threshold to qualify as a 'large tree' under the state government's 'Vegetation Quality Assessment Manual'. Such large trees have high value for amenity, natural heritage and wildlife habitat.

Fauna habitat

- The eucalypts (and particularly the large trees) provide suitable habitat for a modest range of forest birds, bats, possums and invertebrates, limited by the size of the park and the scarcity of understorey;
- The dense cover of mat-rushes in the park's southwest corner provide suitable cover for lizards.

Ecological condition

The ecological condition of the park's vegetation has been greatly diminished by the history of clearing, which has eliminated most indigenous plant species and left very few sub-canopy trees and shrubs. The resulting park-like landscape also encourages Noisy Miners, which tend to evict most other bird species. The eviction of small, insect-eating birds leaves the eucalypts at risk of excessive damage from insect pests.

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.1 ha in the park's southwest falls into rating 'C' (fair) and the remaining 2.1 ha of the site falls into rating 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Ecological stepping-stone

As discussed above in the section headed 'Relationship to other land', Cheong Park is regarded as an ecological 'stepping-stone' for fauna movements in the local area. The park therefore fits the following

description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site.

Regionally threatened Ecological Vegetation Class

Due to lack of understorey, the vegetation in Cheong Park does not meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Otherwise, the park would be of State significance under standard criterion 3.2.3 due to Valley Heathy Forest being listed by the state government as 'endangered' within the relevant bioregion. Revegetation could add the understorey required to lift the site's biological significance to the State level.

The park's 'Local' significance rating is unchanged from the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al*. 1997).

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the park and living adjacent. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The semi-natural ambience of the park is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of park visitors and those who pass through.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into surrounding streets and gardens.

The park's natural ambience, in combination with exercise equipment and playground equipment, encourages people to get exercise in the park.

The site's vegetation contributes substantially to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there has been no material change in the extent of native vegetation in the park.

Change in the ecological condition of habitat

The assessment of the park's ecological condition in the 1997 report, *'Sites of Biological Significance in Maroondah',* was consistent with the 2019 assessment given above in the section headed 'Ecological condition'.

Changes in the species present

Twenty-one naturally-occurring, indigenous plant species were detected in June 2019. Additional native grass species would almost certainly be detected in summer. By comparison, only fourteen species were recorded in December 1996. Only one species seen in 1996 (*Persoonia juniperina*) was not seen in 2019.

A few of the species seen in 2019 that were not detected in 1996 have almost certainly colonised in the interim. Mowing may have caused the remainder to be overlooked in 1996.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Debilitation of mature eucalypts east of the southern car park by recent dense planting of eucalypts beneath their crowns. The impact will be worst during droughts, which are predicted to worsen with climate change. See also Section 11.8.5 of Volume 1;
- Loss of plant species with low populations, due to mowing, slow attrition and poor reproductive success.

Strategic planning

The whole park is covered by:

- The 'Public Park and Recreation Zone';
- Schedule 2 of the Neighbourhood Character Overlay;
- Schedule 3 of the Significant Landscape Overlay (SLO3); and
- The Vegetation Protection Overlay (VPO).

Vegetation removal is regulated under SLO3, the VPO and clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the whole reserve and apply the proposed schedule ESO1 on Site 25 as delineated on the aerial photograph on p. 271. Vegetation in parts of the park outside Site 35 will continue to be subject to the planning provisions of clause 52.17 and SLO3.

Information sources

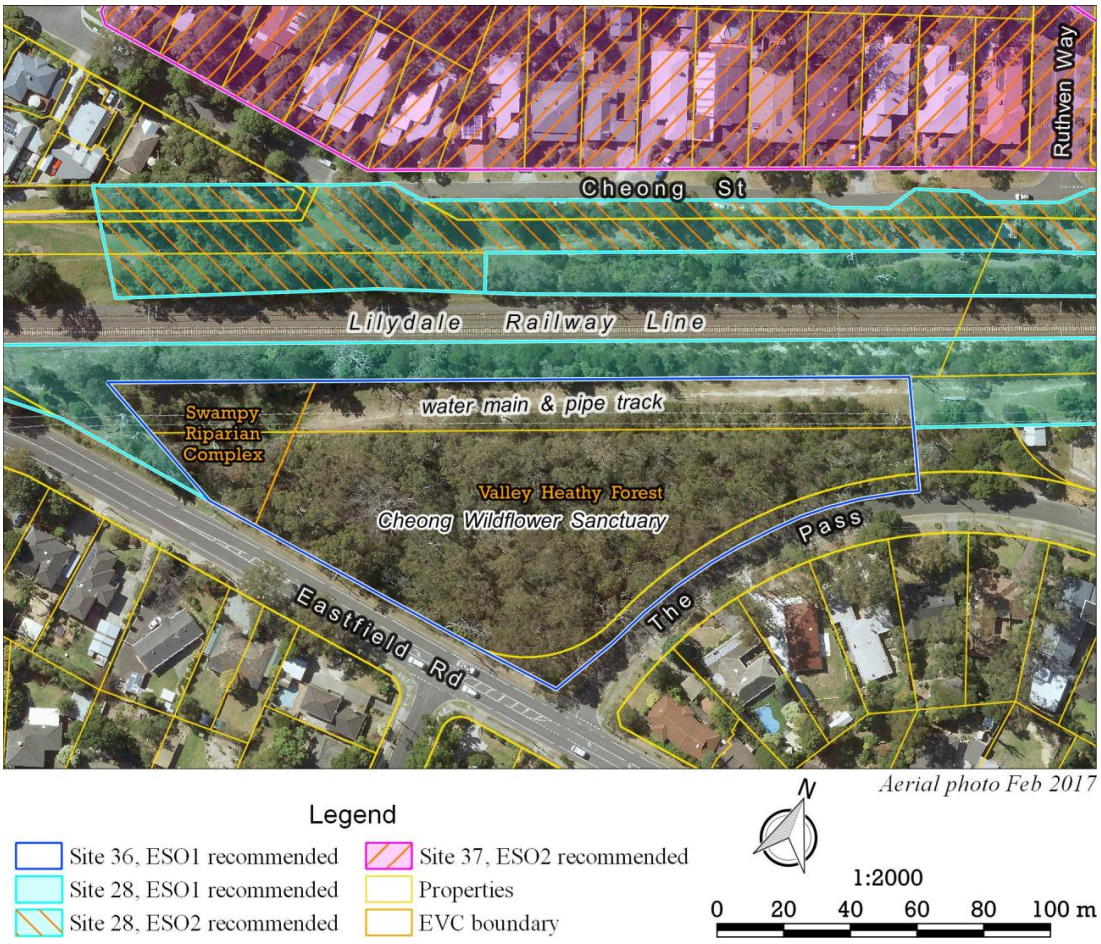
The analysis above draws on the following sources of information about the site:

- A flora survey on 11/6/19, including documentation of abundances of all indigenous plant species (excluding mosses and liverworts) and mapping of large eucalypts and scarce species;
- Bird lists from members of Birds Australia on 14/4/00, 6/11/09 and 5/2/10 – available from the online Atlas of Living Australia;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork by John C. Reid on 10/1/96 that included: (a) compilation of a list of species of vascular plants; (b) a 20-minute bird census; and (c) incidental records of birds and butterflies;
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in eBird or the online Victorian Biodiversity Atlas. Note that a plant list mapped in the Victorian Biodiversity Atlas as being from Cheong Park was actually from Cheong Wildflower Sanctuary (see below).

Site 36. Cheong Wildflower Sanctuary, Croydon

Biological Significance Level: *National* due to the presence of an endangered plant species



Boundaries, land use and tenure

The site comprises parts of two properties and a section of nature strip beside The Pass. A reserve for a water main abuts the reserve for the Lilydale Railway Line, separated by a 2-metre-high mesh fence. The other property is the wildflower sanctuary that gives the site its name. The site is truncated at the northeastern end by a vehicle track. The sanctuary is owned and managed for nature conservation by Maroondah City Council. The water main reserve is managed by Yarra Valley Water to maintain access to the buried pipe, without regard for nature conservation. Power lines along the water main reserve can be seen on the aerial photograph above.

General description

This site occupies 1.3 hectares situated on a gradual slope (1:13) to the west-southwest, with a south-flowing drain in the western corner. The drain would once have been a perennial creek but it has been reduced to a weedy, intermittent drain by repeated drainage works, pipelaying and residential development of the catchment.

Prior to those works, the original creek was lined with a vegetation type (Ecological Vegetation Class, or EVC) called Swampy Riparian Complex. Only vestiges remain. The rest of the site supports Valley Heathy Forest. The boundary between the two EVCs is marked on the aerial photograph above.

An aerial photograph from 1945 shows the site with scattered trees to 12 m crown diameter – somewhat smaller than a fully-grown eucalypt in Croydon. The sparsity and size of the trees indicates semi-mature regrowth that may have been grazed. Two or three of the trees in the photograph match the locations of the sanctuary's largest trees today – White Stringybarks. One of those trees carries a plaque and is covered by Heritage Overlay HO25 in the Maroondah Planning Scheme. It died during the Millennium Drought or soon after.

The water main running beside the railway line was laid in 1934 and the 1945 aerial photograph shows the pipe track to have been bare at that time. Cheong Wildflower Sanctuary was apparently created around 1948 through a donation to the municipality from Rev. Cheok Hong Cheong.

The site's history of past clearing and regrowth is typical of native vegetation in the Melbourne Region (indeed, most of Victoria). Despite that history, the site retains over seventy naturally-occurring, indigenous plant species, excluding mosses and liverworts. Eucalypts are now denser than in a natural forest, so not all of them can survive to maturity. Some of the plant species in the sanctuary are rare, notably including a population of the globally-endangered flat-pea, *Platylobium infecundum*. One rare grass species (*Austrostipa rudis* subsp. *australis*) extends from the sanctuary into the water main reserve.

Management of the water main reserve mostly involves regular mowing. The frequency of mowing appears to have increased recently and is adversely affecting the survival of many of the dozens of species of indigenous plants growing there, including the rare grass.

Maroondah City Council manages the sanctuary for nature conservation through weed control, planting of rare species and periodic brushcutting to simulate grazing by native animals. Lately, one or more kangaroos have taken up residence and negated the need for the brushcutting.

Relationship to other land

Of the fauna present in Site 36, all except small lizards and non-flying invertebrates would need to periodically travel to other areas of habitat to fulfil their habitat needs. Fortunately, as can be partly seen on the aerial photograph on p. 276, Site 36 is the southern edge of a much larger area of habitat that includes the Lilydale Railway Line reservation (Site 28, p. 200), the Ruthven Way – Vasey Concourse precinct (Site 37, p. 284) and the Mount Dandenong Road median strip (Site 38, p. 291). The railway line reservation provides rudimentary connectivity with Ringwood Lake Park (Site 26, p. 185) and Bedford Park (Site 27, p. 194), each nearly 2 km to the west.

The closest other habitat with understorey is at Cheong Park (Site 35, 330 m to the east) and the Tintern Grammar Sanctuary (Site 34, 600 m south).

Between those sites, the landscape is made more permeable for native birds and other flying fauna by the presence of indigenous eucalypts and 'Australian native' trees along some nature strips and in some gardens. There is also a tiny council reserve at 43 Eastfield Road (200 m to the east) with a sickly canopy of remnant eucalypts and a weedy understorey.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) and Red Stringybark (*E. macrorhyncha*). The other eucalypt species are White Stringybark (*E. globoidea*), Narrow-leaved

Peppermint (*E. radiata*) and Mealy Stringybark (*E. cephalocarpa*). Yellow Box (*E. melliodora*) and Bundy (*E. goniocalyx*) are very scarce or may have died out as they escaped detection in the brief site inspections in 2019.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Golden Wattle (*Acacia pycnantha*) is dense in localised stands. Black Wattle (*A. mearnsii*) is scattered thinly.

Medium to large shrubs: Patchily dense and diverse in species. Dominated variously by Sweet Bursaria (*Bursaria spinosa*), Yarra Burgan (*Kunzea leptospermoides*) or Manuka (*Leptospermum scoparium*). The following species are widely scattered or abundant in certain areas: Myrtle Wattle (*Acacia myrtifolia*), Hop Wattle (*A. stricta*), Shiny Cassinia (*Cassinia longifolia*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Common Heath (*Epacris impressa*) and Golden Bush-pea (*Pultenaea gunnii*). Common Correa (*Correa reflexa*) and Hop Goodenia (*Goodenia ovata*) are scarcer but ecologically informative.

Small shrubs: As is normal for Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant and Grey Parrot-pea (*Dillwynia cinerascens*) is present. Silky Daisy-bush (*Olearia myrsinoides*) is also fairly abundant.

Ferns: Austral Bracken (*Pteridium esculentum*) and Screw Fern (*Lindsaea linearis*) are both quite localised.

Climbers: Common Apple-berry (*Billardiera mutabilis*) and Downy Dodder-laurel (*Cassytha pubescens*) are fairly abundant. Love Creeper (*Comesperma volubile*) is scattered widely. Small-leafed Clematis (*Clematis decipiens*) is very scarce, being recorded in 2019 for the first time (as in many sites). Purple Coral-pea (*Hardenbergia violacea*) has been recorded but escaped detection in the brief 2019 site inspections.

Creepers: Trailing Goodenia (*Goodenia lanata*) and Ivy-leaf Violet (*Viola hederacea*) are scattered widely. There is a substantial patch of the endangered flat-pea *Platylobium infecundum* as well as at least one other plant. Centella (*Centella cordifolia*) is very scarce.

Grasses, rushes and sedges: Abundant and rich in species. Mostly dominated by Thatch Saw-sedge (*Gahnia radula*) and Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) but Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) becomes dominant along the interface with the Swampy Riparian Complex. Kangaroo Grass (*Themeda triandra*) and the common form of Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) are abundant. The following species are fairly abundant, at least in certain areas: Variable Sword-sedge (*Lepidosperma laterale*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Purplish Wallaby-grass (*R tenuius*), Forest Wire-grass (*Tetrarrhena juncea*), Small Grass-tree (*Xanthorrhoea minor*) and (along the pipe track) Smooth Wallaby-grass (*R. laeve*) and Common Love-grass (*Eragrostis brownii*).

Other groundcover: Rich in species, particularly lilies. Black-anther Flax-lily (*Dianella revoluta*) is abundant. The following species are fairly abundant: Honey-pots (*Acrotriche serrulata*), Milkmaids (*Burchardia umbellata*), Common Rice-flower (*Pimelea humilis*) and Yellow Rush-lily (*Tricoryne elatior*). Although less abundant, the following species are typical of Valley Heathy Forest: Chocolate Lily (*Arthropodium strictum*), Button Everlasting (*Coronidium scorpioides*), *Cryptostylis subulata* (Large Tongue-orchid), Tall Sundew (*Drosera auriculata*), Common Raspwort (*Gonocarpus tetragynus*), Common Hovea (*Hovea heterophylla*),Variable Stinkweed (*Opercularia varia*), Common Fringe-lily (*Thysanotus tuberosus*) and Cut-leaf Xanthosia (*Xanthosia dissecta*).

Swampy Riparian Complex (EVC 126, **Endangered** in the bioregion)

The original creek in the site's western tip has been heavily modified by pipelaying and drainage works, leaving only vestiges of the original vegetation. Weeds and revegetation now dominate. The following deals only with the vestiges.

Canopy trees: There are a few Mealy Stringybarks (*Eucalyptus cephalocarpa*).

Lower trees: Blackwood (*Acacia melanoxylon*) and Black Wattle (*A. mearnsii*) are scarce.

Shrubs: There are many Hop Goodenia (*Goodenia ovata*) but they have probably all been planted. Two Tree Everlastings (*Ozothamnus ferrugineus*) appear to be natural.

Ferns: Austral Bracken (*Pteridium esculentum*) forms a dense patch.

Climbers: none found.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is abundant.

Grasses, rushes and sedges: Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) dominates the groundcover at the interface with the Valley Heathy Forest. Thatch Saw-sedge (*Gahnia radula*) and Weeping Grass (*Microlaena stipoides*) are abundant in the less disturbed eastern fringe. In the drain, the cumbungi *Typha orientalis* dominates and there are a few Green Rush (*Juncus gregiflorus*) and Broom Rush (*J. sarophorus*).

Other groundcover: none found.

Significant plants

Globally endangered

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. Cheong Wildflower Sanctuary has a patch with an indeterminate number of individuals and at least one separate plant.

Rare (but not otherwise threatened) in Victoria

A subspecies of Veined Spear-grass (namely *Austrostipa rudis* subsp. *australis*) is moderately common on the pipe track property and the adjacent fringe of the Council reserve. The subspecies is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 36 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Astroloma humifusum* (Cranberry Heath) – not reported since 1971 so presumed to have died out;
- *Cheilanthes austrotenuifolia* (Green Rock Fern) – not reported since 1971 so presumed to have died out;
- *Comesperma ericinum* (Heath Milkwort) – reported since 1986 before dying out temporarily until a single plant regenerated following ecological brushcutting a few years ago;
- *Correa reflexa* (Common Correa) – there are a few that appear to be the local form but their offspring are likely to be hybrids with the many non-local forms and hybrids that have been planted;
- *Eucalyptus globoidea* (White Stringybark) – at least twenty individuals, including some large trees;
- *Eucalyptus macrorhyncha* (Red Stringybark) – a dominant species but suffering bad insect damage at the time of the 2019 inspection for this study;
- *Gompholobium huegelii* (Common Wedge-pea) – not reported since 1986 so presumed to have died out;
- *Goodenia humilis* (Swamp Goodenia) – not reported since 1971. Suitable habitat only ever occurred in the gully, which has been so modified by multiple drainage works that there is no chance of the species could have survived;
- *Hakea nodosa* (Yellow Hakea) – not reported since 1971 so presumed to have died out;
- *Hakea ulicina* (Furze Hakea) – over 20 grow in the sanctuary but it is uncertain whether any belong to the natural population reported in earlier flora surveys;
- *Hibbertia obtusifolia* (Grey Guinea-flower) – not reported since 1971 so presumed to have died out;
- *Kennedia prostrata* (Running Postman) – not reported since 1971 but there is a small chance that viable seeds remain in the soil;
- *Microseris walteri* (Murnong) – not reported since 1971 so presumed to have died out;
- *Pentapogon quadrifidus* (Five-awned Spear-grass) – not detected in the 2019 inspections due to the time of year and the brevity of the investigation but it is quite likely to persist;
- *Poa tenera* (Slender Tussock-grass) – not detected in the 2019 inspections due to the time of year and the brevity of the investigation but there is a chance that it persists in small numbers;
- *Polystichum proliferum* (Mother Shield-fern) – present in the gully in 1996 and subsequently destroyed by drainage works;
- *Pultenaea scabra* (Rough Bush-pea) – not reported since 1971 so presumed to have died out;

- *Rytidosperma procerum* (Tall Wallaby-grass) – has appeared in the sanctuary and on the pipe track on separate occasions after soil disturbance. However, the absence of seeds being set creates some misgivings that the plants may be sterile hybrids;
- Globe-pea (*Sphaerolobium minus*) – not reported since 1971. Suitable habitat only ever occurred in the gully, which has been so modified by multiple drainage works that there is no chance of the species could have survived.

Additional species that fall into the 'critically endangered' category of local extinction risk were listed in the report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). None of those species remain in Site 36. They were included in 1997 on the basis of a plant list appended to a 1991 report by Cecily Falkingham. However, some of the species listed in that report are implausible and the list apparently includes recollections from local residents of species that occurred near Site 36, not necessarily within it.

Significant fauna

At the time of writing (June 2019), one or more Eastern Grey Kangaroos have been resident in Site 36 for six weeks or more. Kangaroos disappeared from Ringwood Lake Park (Site 26) a few weeks earlier, so they may have travelled along the railway corridor from there to Site 36. Eastern Grey Kangaroos are historically rare in Maroondah but their population is increasing and dispersing more widely.

Sugar Gliders were recorded in the 1990s and may still persist. Sugar Gliders are quite uncommon in Maroondah.

A Koala was seen very close to Site 36 (on The Pass) in 1995 but that species is believed to have since died out in the whole municipality.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, possums and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The near-continuity of treed habitat that extends northward from Site 36 greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The gully in the site's western tip (where vestiges of Swampy Riparian Complex occur) is heavily modified by repeated drainage works and pipelaying. Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), that area comprises approximately 0.05 ha that rates 'C' (or fair) and 0.1 ha that rates 'D' (poor).

Of the Valley Heathy Forest, roughly 0.4 ha rates 'A' (excellent), 0.5 ha rates 'B' (good) and 0.3 ha rates 'C' (fair).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

Cheong Wildflower Sanctuary has a patch of the flat-pea *Platylobium infecundum* with an indeterminate number of individuals and at least one additional plant. The species is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. Its global distribution is confined to Victoria. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance.

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a substantial population in Site 36 that appears to be quite viable. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

The following plant species fall into the 'critically endangered' category of dying out in Maroondah and they have apparently viable populations in the sanctuary: *Eucalyptus globoidea*, *E. macrorhyncha* and *Hakea ulicina*. They fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating. The single plant of *Comesperma ericinum* also qualifies under the same criterion because the species only occurs at one other site in Maroondah, making Cheong Wildflower Sanctuary an 'important site'.

Regionally threatened Ecological Vegetation Classes

The Valley Heathy Forest in Site 36 easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. It contains Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that it meets standard criterion 3.2.3 for a site of State significance (which does not override the National significance above).

The site's overall 'National' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of *Platylobium infecundum*, which had not even been described as a species in 1997.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the site and living adjacent. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the drain helps to stabilise the soil and remove a small amount of water pollution.

The site's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into surrounding streets and gardens.

The sanctuary preserves something of the area's natural landscape. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there has been no detectable change in the extent of habitat in Site 36. However, the extent of understorey has been increased by council's planting of the nature strip of The Pass with indigenous shrubs and groundcovers, probably in the early part of this decade.

Change in the ecological condition of habitat

Compared with the 2019 assessment of ecological condition in the section headed 'Ecological condition' above, the 1997 report, *'Sites of Biological Significance in Maroondah'* reported much better ecological condition in the Swampy Riparian Complex and slightly better condition in the Valley Heathy Forest. The deterioration in the Swampy Riparian Complex was due to drainage works. The deterioration in the Valley Heathy Forest is due to disappearance of plant species, probably largely because the clearing in the first half of last century left conditions unsuitable for the long-term survival of sensitive species. The Millennium Drought accelerated the loss of species and debilitated the populations of some of the surviving species.

A strip of vegetation typically 2 m wide was cleared to install the fence abutting the railway reservation in c. 2012 and the regenerated vegetation appears to have poorer ecological condition and fewer indigenous species than previously. Notably, the Long Purple-flag (*Patersonia occidentalis*) appears to have died out from the whole site as a result.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss or decline of plant species (including the listed-rare *Austrostipa rudis* subsp. *australis*) due to excessive mowing of the pipe track;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. Some deaths are inevitable because of the unnaturally high density of eucalypts in the east of the sanctuary but deaths and disease are also leaving some other parts with an unnaturally low eucalypt density. Deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The nature strip of The Pass and a small area at the northeastern tip of the site are zoned 'Neighbourhood Residential – Schedule 1'. The rest of the sanctuary is zoned 'Public Conservation and Resource Zone' and the rest of the pipe track property is zoned 'Public Use – Service & Utility'.

Vegetation removal on the whole site is regulated by clause 52.17 of the Victoria Planning Provisions and Schedule 3 of the Significant Landscape Overlay. The 1997 report, *'Sites of Biological Significance in Maroondah'*, recommended that the whole of the site be covered by the Vegetation Protection Overlay (VPO) but a mapping error resulted in the western half of the water main reserve being excluded.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the site and abutting land, and apply the proposed schedule ESO1 to Site 36 as delineated on the aerial photograph on p. 276.

Information sources

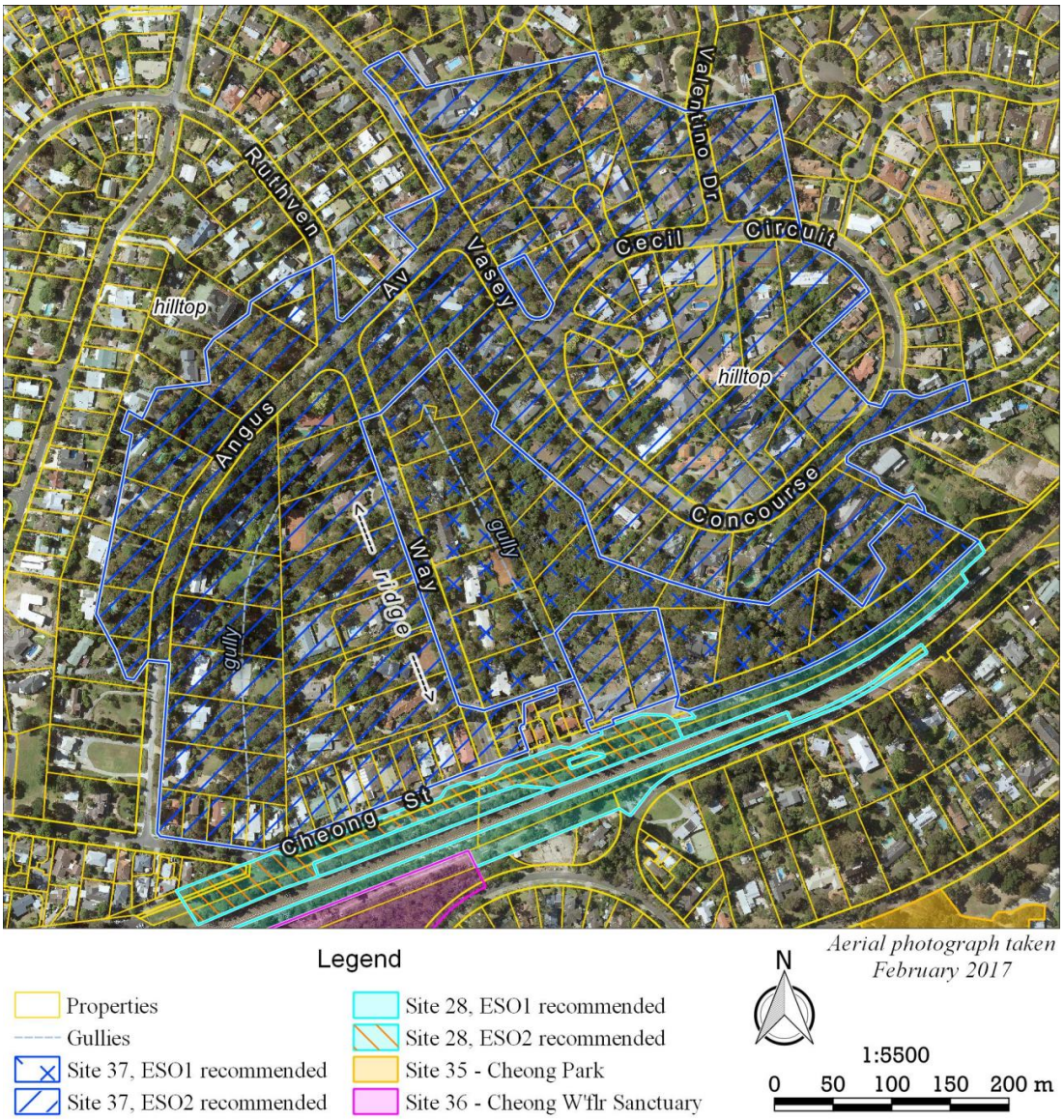
The analysis above draws on the following sources of information sources:

- Site inspections for this study on 5/3/18 (20 minutes) and 7/6/19 (1 hour 45 minutes), including: (a) compiling separate lists of dominant and character species of plants (excluding mosses and liverworts) for the site's two EVCs; (b) documenting the details of rare or scarce plants; and (c) mapping the vegetation and rare plants;
- Incidental records of significant plant species while training council bushland staff in October 2014;
- Pressed specimens of *Austrostipa rudis* subsp. *australis* (from 15/12/06) and *Rytidosperma procerum* (from 14/3/96 and 18/12/14). The first two of these specimens is kept at the National Herbarium of Victoria;
- Maroondah City Council's records of planting in the reserve;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork in March 1996, including a flora survey, frog call survey, mammal hair survey, spotlighting and incidental fauna observations;
- A 1997 management plan by Elizabeth Donoghue, Melissa Summerling and Rhys Jones titled *'The Management of Cheong Wildflower Sanctuary, Croydon'*;
- A 1995 observation of a Koala at The Pass, near the sanctuary, by Lynn Stevens;
- A 1993 record in the Victorian Biodiversity Atlas of a dead Southern Boobook at The Pass, near the sanctuary, by Ray Kendall;
- A few records of plant species observed by Helen Moss on 4/8/94, supplementary to the following;
- A 1991 report by Cecily Falkingham titled *'An Assessment of Cheong Wildflower Sanctuary, including its Flora and Fauna and Future Management'*, which includes lists of flora and fauna from in and near the sanctuary;
- Field data sheets from a brief survey of vascular flora by Randall Robinson on 8/12/86, including quadrat B18287 and species list T19544. The data from these sheets has been transcribed into the Victorian Biodiversity Atlas but the location of the list has been wrongly mapped at Cheong Park, not Cheong Wildflower Sanctuary;
- An October 1971 plant list (with a few errors) in 'Supplement to Circular No. 42' of the Ringwood Field Naturalists Club, compiled by F.J.C. Rogers and R.L. Cowling;
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in eBird and the only relevant information in the online Atlas of Living Australia was duplication of information from the Victorian Biodiversity Atlas and the author's herbarium specimens.

Site 37. Ruthven Way - Vasey Concourse Precinct

Biological Significance Level: *State* due to the presence of a threatened vegetation type or *National* if an endangered plant species remains present



Boundaries, land use and tenure

Site 37 contains residential properties, road reserves and a tiny (1,293 m²) bushland reserve at the corner of Vasey Concourse and Cecil Circuit. The aerial photograph shows the site with mid-blue markings. The site is divided into four parts according to the two planning controls recommended (ESO1 and ESO2 – see the section headed 'Strategic planning' on p. 289). Some of the boundaries follow property boundaries and the remainder trace lines of transition in vegetation.

The size of Site 37 delineated here is significantly smaller than the original version in the 1997 report, *'Sites of Biological Significance in Maroondah'*. Part of the reason is fragmentation of habitat around the

edges. The other reason is that the new boundary follows the edge of native habitat rather than being rounded out to whole properties.

General description

Site 37 occupies 31 hectares of mainly residential land straddling the boundary between Croydon and Ringwood East. As marked on the aerial photograph, it includes two hilltops, two gullies and a ridge. Water flows only intermittently in the gullies. At mid-slope on the hillsides, the gradient is mostly moderate (typically 1:10) but is steep (1:4) near the site's western extremity and uphill from the dead end of Cheong Street.

Native forest, complete with natural understorey, is found within the two areas marked on the aerial photograph as being recommended for planning overlay schedule ESO1. The rest of the site has a fragmented tree canopy with very little natural understorey. That canopy contains a mixture of remnant eucalypts, planted 'Australian natives' and species from overseas.

Forest birds are conspicuous in the site, which can be attributed to the substantial area of habitat (fragmented though it is) and the location within a sequence of habitat areas following the Wicklow Hill ridge between Heathmont and Croydon North.

The information below concerning vegetation composition and rare plants has been compiled without the benefit of entering private land during this study. Despite that limitation, no fewer than eighty-eight naturally-occurring, indigenous plant species were observed during this study. Additional information has been gleaned from aerial photography, previous flora surveys and what can be seen from the public realm.

Relationship to other land

As can be seen on the aerial photograph above, Site 37 abuts the Lilydale Railway Line reservation (Site 28, p. 200), which in turn abuts Cheong Wildflower Sanctuary (Site 36, p. 276). The three sites can be regarded as three parts of a single habitat area, although the railway line represents a barrier to non-flying fauna.

Cheong Park (Site 35, p. 271) lies only 180 m to the southeast but the more important areas of nearby habitat follow a sequence of sites along the Wicklow Hill ridge. That ridge runs north-northeast from Site 79 in Heathmont, through Site 37 to Hochkins Ridge Nature Conservation Reserve in Croydon North. The sequence of sites along the ridge can be seen on the key map on p. 1. It is expected (without direct observational evidence) that birds move along the ridge, using the sites as ecological stepping-stones.

Part of the reason for the ridge being a likely favoured route for bird movements is that the landscape between the sites is made more permeable for birds by the presence of indigenous eucalypts and 'Australian native' trees along some nature strips and in some gardens.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the more abundant or ecologically informative indigenous plant species that could be detected in this study. Swampy Riparian Complex occurred in the site until it was destroyed by the Woodford Close subdivision.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by various mixtures of White Stringybark (*Eucalyptus globoidea*), Bundy (*E. goniocalyx*), Red Stringybark (*E. macrorhyncha*), Messmate Stringybark (*E. obliqua*) and Narrow-leaved Peppermint (*E. radiata*). Mealy Stringybark (*E. cephalocarpa*) is less abundant.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Other species include Silver Wattle (*Acacia dealbata*), Blackwood (*A. melanoxylon*) and Black Wattle (*A. mearnsii*).

Medium to large shrubs: Dominated variously by Sweet Bursaria (*Bursaria spinosa*) or Yarra Burgan (*Kunzea leptospermoides*). Silver Banksia (*Banksia marginata*), Yellow Hakea (*Hakea nodosa*) and Furze Hakea (*Hakea ulicina*) were recorded prior to 1996 but may not have survived to 2019.

Small shrubs: As is normal for Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) is present. Six other small shrub species typical of Valley Heathy Forest have been recorded.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches. Common Maidenhair (*Adiantum aethiopicum*) and Rough Tree-fern (*Cyathea australis*) are apparently scarce. Other species recorded previously are Screw Fern (*Lindsaea linearis*) and Common Ground-fern (*Calochlaena dubia*).

Climbers: Common Apple-berry (*Billardiera mutabilis*) and Mountain Clematis (*Clematis aristata*) are most easily found. Other species recorded include Downy Dodder-laurel (*Cassytha pubescens*), Small-leafed Clematis (*Clematis decipiens*), Love Creeper (*Comesperma volubile*), Twining Glycine (*Glycine clandestina*) and Purple Coral-pea (*Hardenbergia violacea*).

Creepers: The most easily found species are Ivy-leaf Violet (*Viola hederacea*), Bidgee-widgee (*Acaena novae-zelandiae*), Kidney-weed (*Dichondra repens*) and Wood-sorrel (*Oxalis exilis/perennans*). Other species that have been recorded include Trailing Goodenia (*Goodenia lanata*) and, notably, the endangered flat-pea *Platylobium infecundum*.

Grasses, rushes and sedges: Abundant and rich in species. Mostly dominated by Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*) or Clustered Wallaby-grass (*Rytidosperma racemosum*). The following species are also readily found: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Purplish Wallaby-grass (*R tenuius*) and Forest Wire-grass (*Tetrarrhena juncea*). Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*) are apparently scarce. Numerous other species have been recorded.

Other groundcover: Once rich in species but the number of species remaining could not be determined without entering private land. Some species that are easily visible from the public realm include Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*) and Tasman Flax-lily (*D. tasmanica*).

Significant plants

Globally endangered

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. A small number of individuals were recorded in Site 37 until 1994. It is unknown whether they have survived.

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. The species was recorded (under the former name, *Acacia leprosa*) during a 2018 flora survey of species at 62–74 Vasey Concourse, by Ryder Arboriculture and Environment.

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* is also listed by the Victorian Government as 'Rare but not otherwise threatened'. The present author found it in the Woodford Close subdivision immediately before development commenced. It is certainly not there now but it may persist in neighbouring properties, as it does on the opposite side of the railway line.

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Those that were not seen during this study were recorded previously and still have a substantial likelihood of being present. Species that are likely to have died out are excluded:

- *Amyema pendula* (Drooping Mistletoe) – seen at 44–48 Vasey Concourse in 2000 and 60 Vasey Concourse in 1995;
- *Calochlaena dubia* (Common Ground-fern) – seen on several properties during 1996–2000 and probably still present;
- *Centrolepis strigosa* (Hairy Centrolepis) – seen at 60 Vasey Concourse in 1995;
- *Eucalyptus globoidea* (White Stringybark) – widespread in the site as one of the dominant canopy species, including some large specimens and a rare hybrid with *Eucalyptus macrorhyncha*;
- *Eucalyptus macrorhyncha* (Red Stringybark) – as for *E. globoidea*;
- *Hypericum japonicum* (Matted St John's Wort) – appears in a 2018 list of species at 62–74 Vasey Concourse;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – seen at 60 Vasey Concourse in 1995;
- *Poa tenera* (Slender Tussock-grass) – seen at several locations in 1995–1996.

Fauna habitat

- The structure and composition of the native vegetation in the more natural areas represents suitable habitat for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State or potentially National

Regionally threatened Ecological Vegetation Classes

Although it has not been possible to visit backyards for this study, a 2017 aerial photograph and views from Vasey Concourse indicate that the backyards of 38–60 Vasey Concourse contain vegetation that collectively meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the vegetation meets standard criterion 3.2.3 for a site of **State** significance. It is quite possible that some other backyards in the site also meet the definition of a 'patch', in which case they also give the site State significance.

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The flat-pea *Platylobium infecundum* is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. Its global distribution is confined to Victoria. It has been previously recorded in Site 37 without precise locations. It is unknown whether it has survived in the site. If it has, the relevant part of the site meets standard criterion 3.1.2 for a site of **National** significance.

The Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) was recorded at 62–74 Vasey Concourse in 2018. That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* may or may not still occur in Site 37. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. If the subspecies does still exist in the site, the attributes above meet standard criterion 3.1.2 for a site of Regional significance.

Two of Site 37's dominant eucalypt species – *Eucalyptus globoidea* and *E. macrorhyncha* – fall into the 'critically endangered' category of dying out in Maroondah. They fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 37 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' or 'National' significance ratings differ from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest, *Platylobium infecundum* and the Dandenong Range Cinnamon Wattle.

Note that not all parts of the site are so highly significant; indeed, some weedy areas detract from the site's significance. Most of the significance lies within the areas recommended for the proposed planning overlay ESO1. The ESO2 areas are mostly significant for their White Stringybarks and Red Stringybarks and their role as part of an ecological stepping-stone.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit all the site's residents as well as adjacent homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

Site 37's natural ambience is expected to be beneficial to the health, wellbeing, childhood development and quality of life of the residents. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals attracted to Site 37.

The site's vegetation contributes substantially to the 'green and leafy' character of Croydon and Ringwood East. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

The size of Site 37 delineated here is significantly smaller than the original (1997) version of the site in the report, *'Sites of Biological Significance in Maroondah'* due to vegetation removal and fragmentation of habitat. This is in marked contrast to another former 'Environmental Living Zone' in Warranwood (Site 16, p. 112), where hardly any vegetation has been lost.

The main cause of the loss in Site 37 has been residential subdivision and development. A secondary cause has been piecemeal removal of single trees or small groups of trees from gardens. The total loss of habitat from the area of the original Site 37 is approximately 1.5 ha. The loss in Site 16 was 0.1 ha.

The loss in both sites has been accompanied by a small, scarcely quantifiable increase in habitat extent due to tree crowns expanding over land that was bare in 1997.

Change in the ecological condition of habitat

As viewed from the public realm, the ecological condition of native vegetation in Site 37 has deteriorated markedly. Since 1997, eucalypt health has declined (as in Maroondah generally) and there have been many eucalypt deaths. Environmental weeds such as Sweet Pittosporum, Large-leafed Privet, Ivy and Asparagus Fern have grown and become much more prevalent, displacing indigenous flora and fauna. The formerly rich native understorey of some properties subdivided since 1997 has been destroyed to create lawns and gardens, leaving only the ailing tree canopy.

Without having access to the private land, the magnitude of the deterioration cannot be quantified, nor the loss of flora and fauna species determined. Those limitations do not affect the small reserve at the corner of Vasey Concourse and Cecil Circuit, which has lost approximately one-third of the indigenous plant species it had when assessed in 1996. Similar losses are likely on the site's private land.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Displacement of indigenous plants and their dependent fauna by introduced plant species such as those mentioned above. Some of those plants are being planted but most are proliferating by themselves;
- Residential subdivision. Twenty-four properties within the site are large enough to be subdivided in two without exceeding the 2,000m² minimum lot size that applies. Additional properties could be available for subdivision with realignment of lot boundaries;
- Construction of outbuildings and other property improvements;
- Continuing unpermitted removal of natural understorey to create lawns and gardens;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success, as reflected in the abovementioned loss of species in the small reserve. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The reserve at the corner of Vasey Concourse and Cecil Circuit is zoned 'Public Park and Recreation Zone'. The zoning of 11–13 Vasey Concourse and 28 Vasey Concourse is 'Neighbourhood Residential Zone – Schedule 3'. The rest of the site is zoned 'Neighbourhood Residential Zone – Schedule 1', which (among other things) limits lot sizes to at least 2,000 m².

The whole site is affected by Schedule 3 of the Significant Landscape Overlay (which controls vegetation removal) and Schedule 1 of the Design and Development Overlay. The road reserves and all properties larger than 0.4 ha are subject to the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. The Vegetation Protection Overlay (VPO) applies to the original version of Site 37 in the 1997 report, *'Sites of Biological Significance in Maroondah'*, which is larger than delineated here.

It is recommended here that the VPO should be removed from the original version of Site 37 and the new version of the site should be divided into areas covered by the two new overlay schedules ESO1 and ESO2

described in Section 11.1.2 of Volume 1. The areas to be affected by ESO1 and ESO2 are mapped on the aerial photograph on p. 284. ESO1 is for the more natural areas, mostly with some native understorey, where non-indigenous plants are either ecologically negative or benign. ESO2 is for areas with little more native vegetation than a fragmented canopy of remnant trees. Unlike ESO1, ESO2 would provide planning protection for 'Australian native' trees, which can partly compensate for the scarcity of indigenous trees.

Site 37 provides an interesting study into the effectiveness of planning controls for nature conservation. Until the 1990s, it was zoned as an 'Environmental Living Zone' with planning controls such as minimum lot sizes to conserve natural assets. The planning controls have changed over the years and the extent and condition of habitat has deteriorated markedly. This situation contrasts strongly with another former Environmental Living Zone – Site 16 (p. 112) in Warranwood. When they were assessed in 1997, the two sites had similar property sizes and were fairly similar in the extent and condition of habitat. The natural assets of Site 37 have deteriorated markedly whereas those of Site 16 have scarcely changed. It is outside the scope of this study to explain the reasons for the very different outcomes.

Information sources

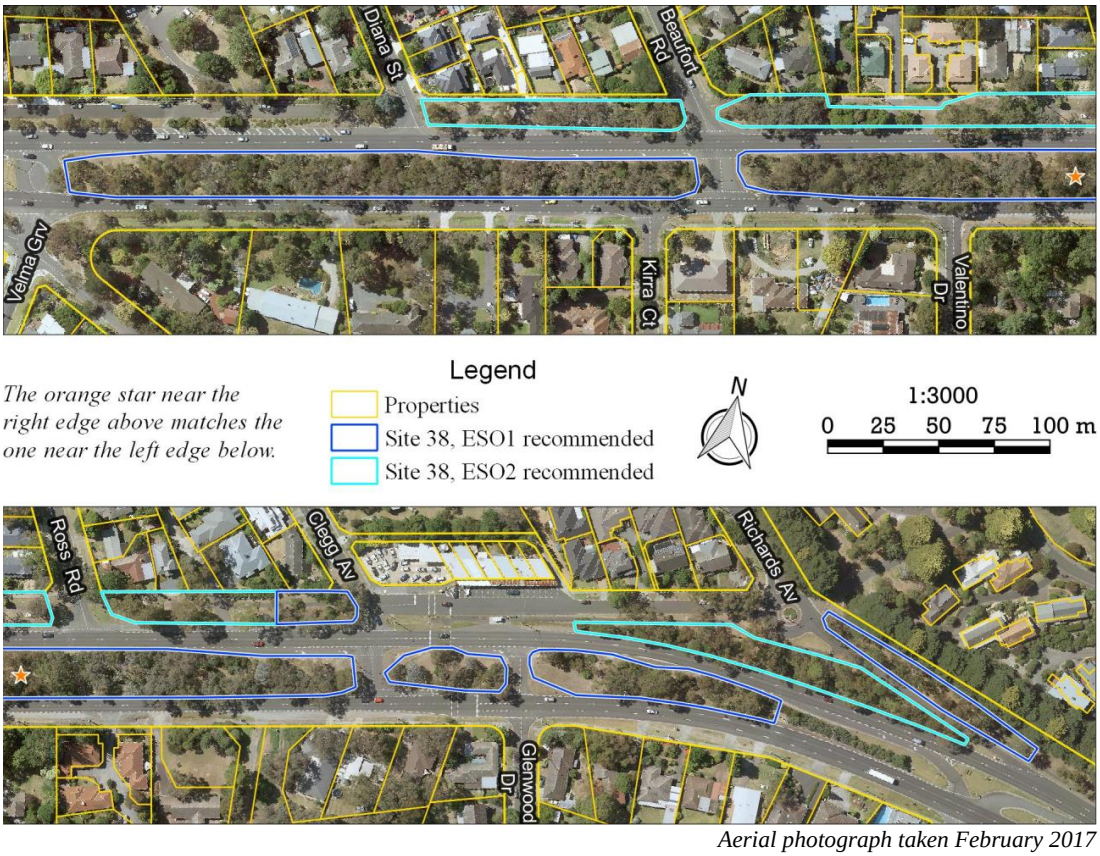
The analysis above draws on the following sources of information about the site:

- Site inspections for this study on 13/7/18, 7/5/19, 7/6/19 and 11/6/19, viewing every property while walking along the streets and along the extension of Cheong Street. Each property was assessed for its apparent cover of indigenous plants and 'Australian native' habitat trees. A full list of indigenous plants was compiled for the reserve within the site and observations were taken of the dominant tree species;
- A report dated 4/4/18 on the flora of 62–74 Vasey Concourse by Grant Harris and Tserin Wright (exhibited as part of a planning permit process). The report also maps Valley Heathy Forest on two properties to the west;
- A list of ten bird species from contributors to Birds Australia's 'Bathing Birds' project between 12/7/14 and 22/2/15;
- A detailed flora survey of 44–48 Vasey Concourse on 21/7/00 prior to residential development;
- A list of plant species and their abundances for a plot (quadrat E0413000) on 29 Angus Avenue, compiled by Sarah Bedggood, available online from the Victorian Biodiversity Atlas;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork in 1995–1996, including a flora survey, quadrat N04005, 20-minute bird census (by John C. Reid), frog call survey, mammal hair survey, spotlighting and incidental fauna observations;
- Specimens at the National Herbarium of Victoria of *Eucalyptus globoidea* (*G.S.Lorimer 1161*) and *Eucalyptus globoidea* × *macrorhyncha* (*G.S.Lorimer 1160*) from 3/2/96;
- A detailed flora survey of 60 & 60A Vasey Concourse on 13/6/95 prior to subdivision;
- Plant lists (indigenous species only) for the same land by Helen Moss on 6/9/93 and the Society for Growing Australian Plants (Maroondah Group) on 19/8/94;
- A list of indigenous plants dated 26/9/92 by Kath Deary for her property, 29–31 Ruthven Way;
- A list of indigenous plants dated from c. 1992 by Kath Deary for the area described as 'Angus Avenue – Vasey Concourse – Railway Line';
- Specimens at the National Herbarium of Victoria of *Juncus subsecundus* (*D.E.Albrecht 1443*) and *Isolepis marginata* (*D.E.Albrecht 1442*) from 25/11/84, with lists of associated species;
- The Victorian Government's Mapping of Ecological Vegetation Classes present in 2005 and 1750; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in eBird.

Site 38. Mount Dandenong Road, Croydon

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries

The site boundaries are outlined on the aerial photograph above with mid-blue for the parts recommended for the proposed new Schedule 1 of the Environmental Significance Overlay (ESO1) and cyan for the parts recommended for the proposed Schedule 2 of the same overlay (ESO2). The rationale for the recommended schedules is provided below. Most of the site boundaries follow property boundaries or the edges of road formations or paved footpaths. The remaining boundaries follow the edges of native vegetation, including the tree canopy. As for all sites in this volume, the precise boundaries are available in a shapefile for geographic information systems.

The parts of the site outlined in cyan are only biologically significant at the 'Local' level but their inclusion is important to supplement the core habitat in the rest of the site.

Land use and tenure

This site falls within the reservation of a main road managed by VicRoads. The median strip is effectively unused except for a pedestrian crossing. The rest of the site serves the usual functions of nature strips, along with some car parking.

General description

Site 38 occupies a total of 2.2 hectares of nature strip and median strip. Most of the land is gently undulating with slopes facing between northeast and northwest. The main exception is the easternmost 200 m, which

is on a saddle with a cutting and slopes that face in all directions. A minor gully crosses the site near Ross Road.

Native forest, complete with natural understorey, is found within the six segments of the site marked on the aerial photograph as being recommended for planning overlay schedule ESO1. The two largest segments contain a rich range of wild, indigenous plant species. The four smaller ESO1 segments have fewer indigenous plant species than the larger ones and most of their areas are regularly mowed. The mowed areas are mostly dominated by indigenous grass species. Among those grass species is a rare subspecies of spear-grass.

Roughly ten indigenous plant species were planted into the two largest ESO1 segments by Maroondah City Council in the first decade of this century. A handful of 'Australian native' species of trees and shrubs were planted into all the other segments of the site in the last few decades of the last century.

The four ESO2 segments are included in the site mainly for their indigenous trees and planted 'Australian native' shrubs and trees. Those plants provide native birds, bats and flying insects with habitat that supplements what is found in the ESO1 segments of the site. There are also at least six indigenous grass species in the lawns. Some areas also contain planted trees of foreign species, whose presence detracts from the habitat value.

Relationship to other land

Site 38 lies on the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, there is a sequence of sites of biological significance at intervals along the ridge. The sites closest to Site 38 are the Ruthven Way – Vasey Concourse precinct (Site 37, 130 m to the south) and the former Benedictine Monastery (Site 40, 200 m northeast). It is expected (without direct observational evidence) that birds move along the ridge, using the sites as ecological stepping-stones.

Part of the reason for the ridge being a likely favoured route for bird movements is that the landscape between the sites is made more permeable for birds by the presence of indigenous eucalypts and 'Australian native' trees along some nature strips and in some gardens.

Birds and perhaps kangaroos may also be encouraged to travel to and from Site 38 via the tree canopy and patches of understorey along Mount Dandenong Road (Site 90, 320 m to the west-southwest) or Old Lilydale Road (Site 89, 450 m west).

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the more abundant or ecologically informative indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*). Messmate Stringybark (*E. obliqua*) is co-dominant in some sections. The following species are also present: Bundy (*E. goniocalyx*), Red Stringybark (*E. macrorhyncha*) and Narrow-leaved Peppermint (*E. radiata*).

Lower trees: Dominated variously by Blackwood (*Acacia melanoxylon*) and/or Cherry Ballart (*Exocarpos cupressiformis*). Black Wattle (*A. mearnsii*) is also fairly abundant and Silver Wattle (*A. dealbata*) is becoming so as a result of planting.

Medium to large shrubs: Patchily dense. Dominated variously by Sweet Bursaria (*Bursaria spinosa*) or Yarra Burgan (*Kunzea leptospermoides*), followed by Sifton Bush (*Cassinia sifton*). Common Heath (*Epacris impressa*) is scattered widely.

Small shrubs: As is normal for Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) is abundant and Erect Guinea-flower (*Hibbertia riparia*) is fairly abundant. Grey Parrot-pea (*Dillwynia cinerascens*) is atypically absent.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is rather localised. Wonga Vine (*Pandorea pandorana*) and Small-leafed Clematis (*Clematis decipiens*) have arrived at the site in the last decade or so and can be expected to spread. No other climbers have been recorded.

Creepers: The wood-sorrel *Oxalis exilis/perennans* is fairly abundant. Bidgee-widgee (*Acaena novae-zelandiae*), Creeping Bossiaea (*Bossiaea prostrata*) and Trailing Goodenia (*Goodenia lanata*) are scattered sparsely in the site's two largest segments.

Grasses, rushes and sedges: Abundant and rich in species. Dominated variously by Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or (in mown areas) Clustered Wallaby-grass (*Rytidosperma racemosum*). The following species are also abundant: Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*), Kangaroo Grass (*Themeda triandra*), Small Grass-tree (*Xanthorrhoea minor*) and various species of wallaby-grass (*Rytidosperma*). Numerous other species have been recorded.

Other groundcover: Fairly rich in species, particularly lilies. Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*) and Common Raspwort (*Gonocarpus tetragynus*) are abundant. The presence in the site of Cut-leaf Xanthosia (*Xanthosia dissecta*) is a good indicator of Valley Heathy Forest.

Significant plants

Rare (but not otherwise threatened) in Victoria

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* is listed by the Victorian Government as 'Rare but not otherwise threatened'. The author has found it in the median strip between Beaufort Road and Ross Road every December for many years. The number of identifiable plants there varies between a few and a few dozen depending on the recency of slashing.

In 2018, *Austrostipa rudis* subsp. *australis* was also found immediately east of the Glenwood Drive cross-over. The population size could not be determined due to mowing of much of the potential habitat and the similarity of mown plants to *Austrostipa rudis* subsp. *rudis* (which is also present there).

The wallaby-grass, *Rytidosperma monticola*, is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. Site 38 is one of seven sites in Maroondah to support plants that are best regarded as an undocumented form of *R. monticola* with some characters tending toward the Hill Wallaby-grass (*R. erianthum*). In 2002, this species was recorded as 'numerous' in the more natural parts of the median strip between Velma Grove and Beaufort Road. The author has not kept records of its presence or population since 2002. It is likely to still be present.

The listed-rare species, Dandenong Range Cinnamon Wattle (*Acacia stictophylla*), is present in the median strip but only due to planting.

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Those that were not seen during this study were recorded previously and still have a substantial likelihood of being present. Species that are likely to have died out are excluded:

- *Amyema pendula* (Drooping Mistletoe) – At least five thriving plants grow west of Valentino Drive, plus at least one dead one;
- *Chrysocephalum semipapposum* (Clustered Everlasting) – a single plant grew in the median strip between Velma Grove and Diana Street in 2001;
- *Eucalyptus macrorhyncha* (Red Stringybark) – six were counted in a brief site inspection in 2019;
- *Pentapogon quadrifidus* (Five-awned Spear-grass) – in November 2000, three individuals were seen between Beaufort Road and Valentino Drive. No search has been conducted since. This annual species is a post-disturbance pioneer and can subsist for many years as seeds in the soil; and

- *Wahlenbergia multicaulis* (Tadgell's Bluebell) – a specimen was collected by Helen Moss in 2002 and identified by botanist David Albrecht. It has not been reported since but the species has a habitat of reappearing in response to soil disturbance after decades of absence above ground.

Fauna habitat

- The structure and composition of the forest in the site's two largest segments represents suitable habitat for a range of forest birds, bats and invertebrates. Kangaroos probably visit there from time to time but they are likely to be scared off fairly quickly by the traffic;
- The trees and shrubs in the other segments of the site provide somewhat inferior habitat to the two largest segments but can still be regarded as supplementary habitat;
- Tree hollows offer roost sites or nest sites for some animals;
- There are at least seven eucalypt trees whose trunk diameters exceed the threshold of 70 cm for them to be deemed a 'large tree' under the state government's 'Vegetation Quality Assessment' method. Such trees are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), about half of the vegetation in the two largest segments of median strip rates 'B' (or good) and the rest, 'C' (fair). The easternmost segment of median strip and the segment of nature strip next to the Clegg Avenue corner also rate 'C'. The smallest segment of median strip has a tiny patch that rates 'C' and the rest of it rates 'D' (poor). All other parts of the site rate 'D'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The two largest segments of median strip easily meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the vegetation meets standard criterion 3.2.3 for a site of **State** significance. The other segments of the site are too small to meet the definition of a 'patch' and are therefore not of State significance.

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a quite viable population in at least two segments of the median strip. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. These attributes meet standard criterion 3.1.2 for a site of Regional significance.

The western end of Site 38 is known habitat of the local form of *Rytidosperma monticola*, although the most recent information about its presence or absence comes from 2001. That species' range is not confined to Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened*

Plants in Victoria – 2014'. As for the Veined Spear-grass, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

The site's populations of *Amyema pendula* and *Eucalyptus macrorhyncha* (which fall into the 'critically endangered' category of dying out in Maroondah) fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Referring to the section above headed 'Relationship to other land', the whole of Site 38 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The presence of forest beside main roads may have psychological or practical benefits for road safety but such matters are outside the scope of this study.

As part of the 'urban forest', the trees help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation contributes substantially to the 'green and leafy' character of the area. It also preserves something of the area's natural landscape. It helps to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Most birds that travel to and from the site do so via the surrounding residential area, where they enrich the birdlife experienced by residents in their daily lives.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there was a very small net increase in the extent of native vegetation during that period due to the growth of tree crowns over areas with no prior native vegetation cover.

Change in the ecological condition of habitat

The level of detail in the flora survey for this study was inadequate to make a quantitative comparison of ecological condition with previous data. The author's perception is that the most natural areas improved in ecological condition during the first decade of the current century and have since deteriorated in the absence of active management. (VicRoads took over management from Maroondah City Council some years ago.) The less natural parts of the site appear to have improved in ecological condition over the past two decades as revegetation has matured.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Displacement of indigenous plants and their dependent fauna by introduced plant species such as Chilean Needle-grass and Gorse. This threat was reversed under former management by council but has resumed under the current, low level of maintenance. Chilean Needle-grass and Serrated Tussock are spreading fairly rapidly along the edges of the median strip due to the plants being mown while in seed;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continuing dumping of rubbish, particularly garden waste containing serious environmental weeds;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Acceleration of eucalypt decline and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The whole site is zoned 'Road Zone – Category 1'. Vegetation removal in the whole site is regulated under Schedule 3 of the Significant Landscape Overlay and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. The Vegetation Protection Overlay (VPO) was presumably meant to apply to the original version of Site 38 in the 1997 report, *'Sites of Biological Significance in Maroondah'*; however, it actually covers a substantial area of road pavement and only about one-third of the intended area.

It is recommended here that the VPO should be removed and the new version of the site should be covered by the two new overlay schedules ESO1 and ESO2 described in Section 11.1.2 of Volume 1. The areas to be affected by ESO1 and ESO2 are colour-coded on the aerial photograph on p. 291. ESO1 is for the more natural areas and also where non-indigenous plants are either ecologically negative or benign. ESO2 is for areas where 'Australian natives' make a substantial, positive contribution to the vegetation's habitat value. Unlike ESO1, ESO2 would provide planning protection for 'Australian native' trees.

Information sources

The author drives through this site multiple times each week. The analysis above draws on his incidental observations during those trips as well as the following sources of information about the site:

- Several site inspections for this study from November 2018 to June 2019 to check populations of rare species and confirm no significant change from the author's earlier flora surveys. The total time would be approximately two hours;
- Visits once or twice annually in spring and/or summer since c. 1996 to conduct superficial checks of the vegetation condition and remove environmental weeds, particularly Chilean Needle-grass, Serrated Tussock and Gorse;
- A specimen at the National Herbarium of Victoria of *Austrostipa rudis* subsp. *australis* (*G.S.Lorimer 2549*) collected on 2/12/15;
- *'Flora Management Plan for Mount Dandenong Road Median, Croydon & Ringwood East – 2002'* (Lorimer 2002), based on a detailed flora survey during November 2000 to March 2002;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which a flora survey of the site was done in 1996;
- A list of indigenous plants dated November 1992 for the median strip between Velma Grove and Beaufort Road, by Helen Moss of Croydon City Council; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Atlas of Living Australia or the Victorian Biodiversity Atlas.

Site 39. Former Sacred Heart Monastery, Croydon (Discontinued)

Biological Significance Level: *Not Significant*

Site 39 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was an unused part of the Sacred Heart Monastery in Croydon. The reasons for the site being recognised were the presence of approximately 1 ha of native vegetation containing at least forty indigenous plant species, including the locally rare *Acacia ulicifolia*. The vegetation type was the endangered Valley Heathy Forest, which would be regarded as being of State significance under the current criteria of Amos (2004).

Since 1997, the site was developed with home units as part of the Mingarra retirement village. The only surviving native vegetation is a group of three mature trees of Messmate Stringybark (*Eucalyptus obliqua*).

As a result, the site's biological significance under the standard criteria of Amos (2004) has descended from 'State' to 'Not Significant'.

Strategic planning

The whole of Site 39 is covered by the Vegetation Protection Overlay. As the site no longer qualifies as a site of biological significance, it is recommended to remove the overlay. The three surviving Messmate Stringybarks remain covered by Schedule 3 of the Significant Landscape Overlay and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions.

Site 40. Former Benedictine Monastery, Croydon

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries, land use and tenure

This site occupies part of 22–24 Murray Road, Croydon as well as land between that property and the footpaths along Webster Avenue and Columbia Avenue. The site boundary is outlined in blue above. Much of the site boundary follows the property boundary or the edge of footpaths. The rest traces the edge of native vegetation, including the crowns of large, indigenous trees. As for all sites in this volume, the precise boundaries are available in a shapefile for geographic information systems.

The property is owned by the Catholic Church. It has been vacant since c. 2000 and has been the subject of a failed subdivision permit application.

General description

Site 40 occupies 1.5 hectares. It is almost on the top of the Wicklow Hill ridge. It has a gentle (1:14) slope facing south.

A 1945 aerial photograph shows the site to have been part of an area that retained large eucalypts, which was rare in the Melbourne area. Some of those trees remain alive today, including at least six within Site 40. The 'Notable tree' marked on the aerial photograph above is one of them – a Bundy (*Eucalyptus goniocalyx*). It was already a large, old tree in 1945, with a crown diameter of approximately 19 m. Its age

was estimated in 1996 to have been 400 years old[*]. It is given specific planning protection under the Heritage Overlay of the Maroondah Planning Scheme.

The 2.7-hectare property on which Site 40 is mostly situated had a house on it in 1945 but that was demolished in c. 2002. It was the monastery of the Holy Spirit Benedictine Community until c. 2000. Ornamental trees and shrubs were planted and the grounds were regularly mown. Those activities suppressed the growth of the indigenous understorey but many indigenous species of groundcover and a few shrubs persisted. During the 1990s, the Sisters who lived at the monastery encouraged the indigenous flora to regenerate. They also planted some indigenous species and 'Australian natives'.

When development plans were devised for the property around 2000, the Sisters departed, mowing resumed and the native vegetation was left to deteriorate. The health of the eucalypts is now poor, attributable to possum damage and competition from Cedar Wattles and other environmental weeds. The indigenous groundcover is being suppressed as it was prior to the 1990s, but it persists nevertheless.

The suppression of indigenous groundcover also affects the land between the property boundary and the Webster Avenue footpath. A locally-rare Large Tongue-orchid was present there in 1996 but appears to have been destroyed by over-frequent mowing.

An embankment between the property and the Columbia Avenue footpath has not been subjected to mowing. It contains some indigenous groundcover species that are much scarcer or absent inside the property fence.

Prior flora surveys of the site were conducted in 1996, 2002, 2003 and 2007. Brief fauna surveys were done in 1996, 2002 and 2008. The present study inspected the site from the abutting public land in 2017 and 2018, detecting forty-one naturally-occurring, indigenous plant species.

Relationship to other land

Site 40 lies on the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, there is a sequence of sites of biological significance at intervals along the ridge. The sites closest to Site 40 are Grandfill Reserve (Site 42, 130 m north-northeast), Forest Court Reserve (Site 41, 180 m east-northeast) and the Mount Dandenong Road median strip (Site 38, 200 m south). It is expected (without direct observational evidence) that birds move along the ridge, using the sites as ecological stepping-stones.

Part of the reason for the ridge being a likely favoured route for bird movements is that the landscape between the sites is made more permeable for birds by the presence of indigenous eucalypts and 'Australian native' trees along some nature strips and in some gardens. Among those trees are some large, remnant Messmate Stringybarks across the road from Site 40 at 2–4 Webster Avenue and, over the fence from there, some planted eucalypts at the Mingarra residential aged care facility.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by White Stringybark (*Eucalyptus globoidea*). Messmate Stringybark (*E. obliqua*) is co-dominant in part of the site. Bundy (*E. goniocalyx*) is scattered thinly. Red Stringybark (*E. macrorhyncha*) and Narrow-leaved Peppermint (*E. radiata*) are scarce.

Lower trees: Indigenous species are depleted, replaced by *Acacia elata* and other introduced species. Cherry Ballart (*Exocarpos cupressiformis*) is the most widespread of the indigenous species, followed by Golden Wattle (*Acacia pycnantha*) and Blackwood (*Acacia melanoxylon*).

[*] See 'Tree 39' in *'Notable Trees of Maroondah'*, a report to Maroondah Council by H. Moss & G.S. Lorimer (1996).

Medium to large shrubs: Greatly depleted. Yarra Burgan (*Kunzea leptospermoides*) is scattered. Hop Wattle (*Acacia stricta*) is fairly abundant in the most natural area.

Small shrubs: As is typical of Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*), Erect Guinea-flower (*Hibbertia riparia*) and Grey Parrot-pea (*Dillwynia cinerascens*) are recorded. Silky Daisy-bush (*Olearia myrsinoides*) is also present.

Ferns: Austral Bracken (*Pteridium esculentum*) is scarce.

Climbers: Common Apple-berry (*Billardiera mutabilis*) and Purple Coral-pea (*Hardenbergia violacea*).

Creepers: Fairly abundant, the main species being the wood-sorrel *Oxalis exilis/perennans*, Kidney-weed (*Dichondra repens*) and Trailing Goodenia (*Goodenia lanata*).

Grasses, rushes and sedges: Abundant and very rich in species. Mown areas are dominated by Weeping Grass (*Microlaena stipoides*) and elsewhere, Thatch Saw-sedge (*Gahnia radula*) is most abundant. Kangaroo Grass (*Themeda triandra*), Soft Tussock-grass (*Poa morrisii*) and various wallaby-grass species (e.g *Rytidosperma geniculatum* and *R. tenuius*) are also abundant, followed by Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*). Numerous other species have been recorded.

Other groundcover: Fairly rich in species, with fairly abundant lilies and orchids. Common Raspwort (*Gonocarpus tetragynus*), Yellow Rush-lily (*Tricoryne elatior*) and sun-orchids (*Thelymitra* ?*peniculata)* are abundant and widespread. Scented Sundew (*Drosera aberrans*) and Nodding Greenhood (*Pterostylis nutans*) are quite dense over scattered patches of ~50 m². Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*) and Tall Sundew (*Drosera auriculata*) are fairly abundant. Cut-leaf Xanthosia (*Xanthosia dissecta*) is recorded as being in the site and it is a good diagnostic species of Valley Heathy Forest.

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. The species was recorded on the site in 1996 but not in subsequent flora surveys. As with many wattle species, the Dandenong Range Cinnamon Wattle often regenerates from seed many years after the species occurred above ground at the same site. It may therefore reappear at the former monastery.

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Those that were not seen during this study were recorded previously and still have a substantial likelihood of being present. Species that are likely to have died out are excluded:

- *Centrolepis strigosa* (Hairy Centrolepis) – recorded in the 2002–2003 flora survey as being abundant in one quadrat and scarce in another. This is a tiny annual species that does not emerge every year and is easily overlooked. It is quite likely to persist;
- *Eucalyptus globoidea* (White Stringybark) – the site's dominant eucalypt species, with ~20 individuals. Some of them are large, old trees but most are in poor health, with foliage heavily eaten by possums and insects;
- *Eucalyptus macrorhyncha* (Red Stringybark) – only one could be confidently identified from outside the property fence;
- *Kennedia prostrata* (Running Postman) – recorded in the 1996 and 2002–2003 flora surveys. This species often reappears from soil-borne seed many years after it disappears above-ground;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – recorded only in the 1996 flora survey. It may have died out but alleviation of mowing might allow regeneration;
- *Microtis arenaria* (Sand Onion-orchid) – recorded by Geoff Carr as being abundant in 2003. This species is extremely difficult to detect and identify except during its brief flowering season, so it is understandable that it was not recorded in other flora surveys. It may still grow in the site;

- *Senecio* ?*minimus* (Shrubby Fireweed) – not recorded since the 1996 flora survey but this species tends to reappear in suitable habitat in years with suitable conditions.

Significant fauna

Seven species of insectivorous bats were detected on the property in 2002, which is probably exceptional in Maroondah. (Too little survey work has been done in Maroondah to be sure.) To have such a large number of species is probably due to the availability of flying insects in the forest and suitable roost sites in the large eucalypts.

The Eastern Yellow Robin was on the only other fauna list found for the property, which was compiled by Katrina Sofo in 2008. Although not an uncommon species in larger areas of forests in Victoria, its presence on this property indicates that the habitat is suitable and sufficiently close to other suitable habitat to overcome the drawback of Site 40's small size.

Fauna habitat

- The structure and composition of the forest represents suitable habitat for a range of forest birds, bats and invertebrates. The value of that habitat is diminished by the small area but somewhat compensated by the proximity to other habitat, as discussed above in the section headed 'Relationship to other land';
- Tree hollows offer roost sites or nest sites for some animals;
- At least six ancient eucalypts remain alive in Site 40 and there are also dead ones. Such trees are of high value as habitat;
- The native vegetation, logs and forest litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds. Of special note are the large logs from an ancient tree that died a few years ago and can be seen lying on the ground in the aerial photograph on p. 299.;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

As mentioned above, the site's eucalypts are largely in poor health, with heavy loss of foliage from possums and insects. Non-indigenous 'Australian native' trees, particularly Cedar Wattle (*Acacia elata*) and Sweet Pittosporum (*Pittosporum undulatum*), are competing with the indigenous trees and exacerbating their decline.

The shrub layer is dominated by non-indigenous 'Australian natives', particularly Sallow Wattle (*A. longifolia* subsp. *longifolia*). The non-indigenous species are displacing the diminished ranks of the indigenous shrubs.

The groundcover varies from rich in indigenous species (but biased toward species tolerant of mowing) to largely introduced species.

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.3–0.4 ha of the site rates 'B' (good) and 1.1–1.2 ha rates 'C' (fair).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

Most of the vegetation in Site 40 meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the vegetation meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) was recorded at 62–74 Vasey Concourse in 2018. That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

Eucalyptus globoidea falls into the 'critically endangered' category of dying out in Maroondah and it is the dominant species in Site 40, including some large, ancient individuals. The site's population of the species therefore fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Referring to the section above headed 'Relationship to other land', the whole of Site 40 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation contributes substantially to the 'green and leafy' character of the neighbourhood. It also preserves something of the area's natural landscape. It, and the associated birdlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Birds that travel to and from the site do so via the surrounding residential area, thereby enriching the birdlife experienced by residents in their daily lives.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, non-indigenous trees (particularly Cedar Wattles) have greatly increased in cover during that time. Some of the space beneath those trees has been transformed from native vegetation to bare ground or introduced plants, but the total area of lost habitat is probably only a very small fraction of the whole site.

Some mature eucalypts that have died during the same period have left little if any indigenous flora beneath them, particularly in the site's southern corner. This has probably led to a loss of a few hundred square metres of native vegetation.

The aerial photographs do not reveal any material gains in the extent of native vegetation.

Change in the ecological condition of habitat

Since the 1996 flora survey, eucalypt health has declined markedly and indigenous shrubs have reduced in numbers of individuals and perhaps species. Comparing the condition ratings in the section above headed 'Ecological condition' with corresponding information from the 1997 report, *'Sites of Biological Significance in Maroondah'*, there appears to have been a decline in the ecological condition of the groundcover. That can be attributed to an increase in the amount of mowing.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Residential subdivision, which has already been attempted at least once. The property is over 31 times the minimum lot size of 864m²;
- Displacement of indigenous plants and their dependent fauna by introduced plant species, particularly Cedar Wattle, Sallow Wattle, Sweet Pittosporum and conifers;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The whole site is zoned 'Neighbourhood Residential – Schedule 2' and covered by Schedule 2 to the Design and Development Overlay. Vegetation removal in the whole site is regulated under Schedule 3 to the Significant Landscape Overlay and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. Heritage Overlay HO46 protects the 'Notable tree' marked on the aerial photograph on p. 299. The Vegetation Protection Overlay (VPO) applies to the original version of Site 40 in the 1997 report, *'Sites of Biological Significance in Maroondah'*, which is a simplified approximation to the site outlined in blue on the aerial photograph on p. 299.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 to the area delineated in blue on the aerial photograph on p. 299. The 'Notable tree' receives adequate planning protection from the Heritage Overlay and other existing planning controls without any need to apply ESO1 to it.

Information sources

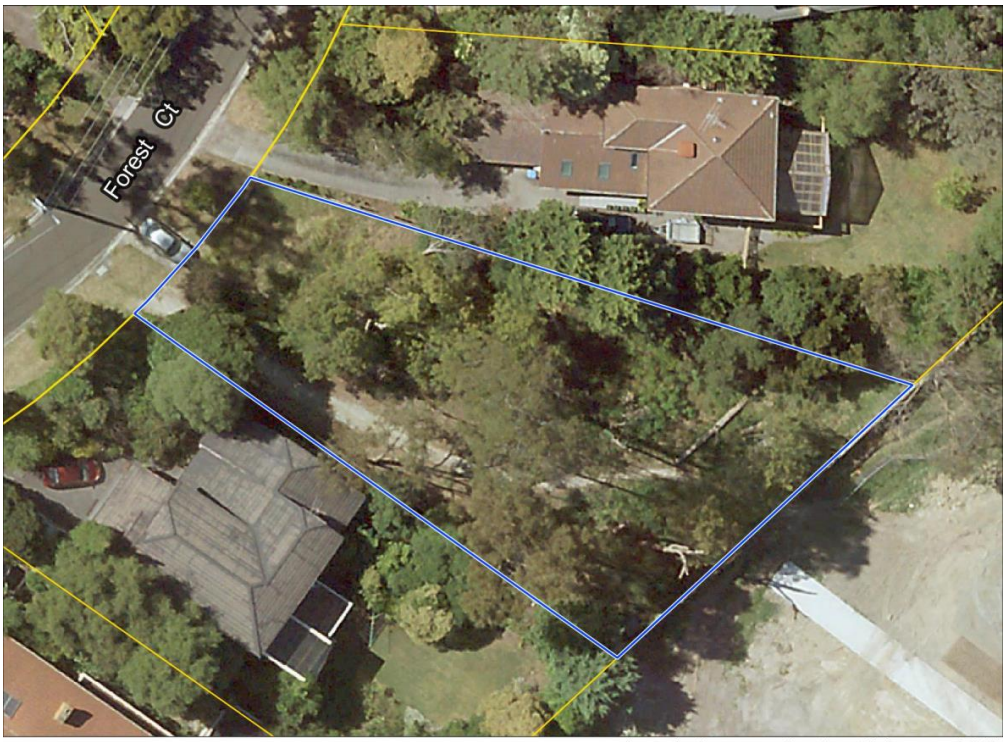
The analysis above draws on the following sources of information about the site:

- The author's site inspections from outside the property in January to June 2019 to check for changes from earlier flora surveys;
- A list of birds (and Garden Skink) observed by Katrina Sofo on 12/2/08;
- A list of plant species detected by Catherine Costello and Nicky Schnittler in November 2007, available from the online Victorian Biodiversity Atlas (VBA);
- A flora survey by the author on 30/9/03, including compilation of a list of plant species and a 'Vegetation Quality Assessment' according to the state government's method;
- A detailed flora survey by Geoff Carr during 2002–2003, including 13 quadrats, a general species list and a 'Vegetation Quality Assessment';
- Witness statements and spoken evidence at the Victorian Civil and Administrative Tribunal, given by the author and Mr Carr during October to December 2003 regarding their findings from the two flora surveys just mentioned;
- A list of seven microbat species and corresponding numbers of individuals from a bat detector survey conducted by Sarah Way on 9/4/02;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which a flora survey of the site was done in March and September 1996 by Helen Moss and the present author; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird and the Atlas of Living Australia. Note that the state government's vegetation mapping wrongly shows the site to support both Grassy Forest and Valley Heathy Forest. The vegetation type was considered in the evidence mentioned above and both botanists agreed that only Valley Heathy Forest occurs on the property.

Site 41. Forest Court Reserve, Croydon

Biological Significance Level: *Local* due to the presence of locally threatened plant species



Aerial photograph taken February 2017

Boundaries, land use and tenure

This site coincides with the reserve at 8 Forest Court, Croydon, as outlined in blue above. It is a council reserve, managed for amenity and pedestrian thoroughfare via a concrete footpath.

General description

Forest Court Reserve occupies 976 m². It is on the southern slope of Wicklow Hill at the break of slope, with a gradient of 1:3 (steep) next to Forest Court and 1:8 (moderate) at the southeastern fence. The slope faces south to southeast. The other properties on Forest Court have one house each. The land to the southeast is occupied by retirement units that were under construction at the time of the aerial photograph above.

The reserve is not actively managed for nature conservation.

Seventeen naturally-occurring, indigenous plant species were observed in the reserve during this study.

Relationship to other land

Grandfill Reserve (Site 42) lies 100 m north of Forest Court Reserve. The former is much larger and its habitat is more natural. The two reserves are separated by two residential properties with a moderate cover of indigenous and Australian native trees. That habitat connection means Forest Court Reserve receives greater visitation by indigenous forest birds and insects than would otherwise occur.

That degree of visitation is further boosted by Forest Court Reserve's location on the escarpment of the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, there is a sequence of sites of biological significance at intervals along the ridge. It is expected (without direct observational evidence) that birds move along the ridge, using the sites as ecological stepping-stones. Forest Court Reserve may represent a minor stepping-stone.

Bioregion: on the boundary between the Gippsland Plain and Highlands - Southern Fall

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Grassy Forest (Ecological Vegetation Class no. 128, **Endangered** in the Gippsland Plain bioregion, **Vulnerable** in the Highlands - Southern Fall)

Canopy trees: Dominated by Bundy (*Eucalyptus goniocalyx*), followed by Red Stringybark (*E. macrorhyncha*). There is also one White Stringybark (*E. globoidea*) and one Narrow-leaved Peppermint (*E. radiata*).

Lower trees: The only indigenous species of sub-canopy tree is Cherry Ballart (*Exocarpos cupressiformis*), which is quite prominent.

Medium to large shrubs: Reduced to one Hop Wattle (*Acacia stricta*) and one Prickly Currant-bush (*Coprosma quadrifida*). In 1996, the following additional species were recorded: Juniper Wattle (*Acacia ulicifolia*), Common Cassinia (*Cassinia aculeata*), Sifton Bush (*Cassinia sifton*), Common Heath (*Epacris impressa*), Tree Everlasting (*Ozothamnus ferrugineus*), Elderberry Panax (*Polyscias sambucifolia*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: Absent, now and in 1996.

Ferns: Austral Bracken (*Pteridium esculentum*) is quite conspicuous and there is a trace of Common Ground-fern (*Calochlaena dubia*).

Climbers: Absent, now and in 1996.

Creepers: Absent, now and in 1996.

Grasses, rushes and sedges: Thatch Saw-sedge (*Gahnia radula*) is abundant. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Forest Wire-grass (*Tetrarrhena juncea*) are moderately abundant. A few Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) are present and one Tall Rush (*Juncus procerus*). In 1996, the following species were also present: Reed Bent-grass (*Deyeuxia quadriseta*), Hollow Rush (*Juncus amabilis*), Pale Rush (*Juncus pallidus*) and Broom Rush (*Juncus sarophorus*).

Other groundcover: There are approximately 125 leaf-rosettes of Autumn Bird-orchid (*Chiloglottis reflexa*) and substantial patches of Tasman Flax-lily (*Dianella tasmanica*). The only other indigenous groundcovers found in 2018 were three individuals of Pale Flax-lily (*Dianella longifolia*). In 1996, Common Raspwort (*Gonocarpus tetragynus*) and Variable Stinkweed (*Opercularia varia*) were seen.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Calochlaena dubia* (Common Ground-fern) – a small patch slightly east of the reserve's centre;
- *Chiloglottis reflexa* (Autumn Bird-orchid) – approximately 125 leaf-rosettes spread over a distance of approximately ten metres, many of them affected by slashing and trampling;
- *Eucalyptus globoidea* (White Stringybark) – a single, large tree (over 70 cm trunk diameter) in moderately good health;
- *Eucalyptus macrorhyncha* (Red Stringybark) – several, in poor health.

Fauna habitat

- The canopy of eucalypts and Cherry Ballart represents suitable habitat for common forest birds but the value of that habitat is diminished by the small area and sparse shrub layer;
- The reserve's White Stringybark is so large that it provides greater habitat value than most trees;
- Logs provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds.

Ecological condition

The vegetation's ecological is in poor to fair ecological condition, held back by the fragmented eucalypt canopy and the near-absence of shrubs.

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the vegetation falls into categories 'C' (fair) and 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The reserve's vegetation is too small to meet the definition of a 'patch' of native vegetation adopted by the standard criteria. Therefore, it is accorded no significance level on the basis of the presence of a threatened Ecological Vegetation Class.

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

There is only one other colony (plus one individual leaf-rosette) of *Chiloglottis reflexa* in Maroondah, so Forest Court Reserve is clearly an important site for the species in Maroondah. The reserve therefore fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating. There are only six other sites with *Calochlaena dubia*, so the small patch at Forest Court Reserve might qualify as Local significance, too.

The site's 'Local' significance rating is equivalent to the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997).

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation contributes to the 'green and leafy' character of the neighbourhood. It also preserves something of the area's natural landscape. It, and the associated birdlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community, though not as much as Sites 40 and 42.

Birds that travel to and from the site do so via the surrounding residential area, thereby enriching the birdlife experienced by residents in their daily lives.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017 does not reveal any material change in the extent of native vegetation between those years.

Change in the ecological condition of habitat

Since the 1996 flora survey, a substantial fraction of the reserve's indigenous flora species died out (see the section headed 'Habitat type' above). The 'C' and 'D' ratings of ecological condition in the section above headed 'Ecological condition' compare poorly with rating 'B' (good) the 1997 report, *'Sites of Biological Significance in Maroondah'*. These pieces of information indicate there has been a decline in the ecological condition of the vegetation. That can be attributed to mowing, the Millennium Drought and the long-lasting effects of habitat fragmentation.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Mowing in areas of indigenous groundcover (including the rare Autumn Bird-orchids); and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The whole site is zoned 'Neighbourhood Residential – Schedule 2' and covered by Schedule 2 to the Design and Development Overlay. Tree removal is regulated under Schedule 3 to the Significant Landscape Overlay.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the whole reserve.

Information sources

The analysis above draws on the following sources of information about the site:

- A botanical survey by the author on 14/6/17 and 23/1/18, including compilation of a list of indigenous and introduced plant species;

- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which Helen Moss did a flora survey of the reserve on 22/3/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 42. Grandfill Reserve, Croydon

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Legend
Properties
Site 42

N

1:1500
0 10 20 30 40 50 m

Boundaries, land use and tenure

The site coincides with the single property that comprises Grandfill Reserve (50–60 Webster Avenue, Croydon). It is a council bushland reserve with a picnic table and small lawn, which can be seen on the aerial photograph above.

General description

Grandfill Reserve occupies 1.5 hectares on the upper and middle slopes of Wicklow Hill, facing south to west-southwest. There are no drainage lines. The summit of Wicklow Hill (207 m elevation) is marked on the aerial photograph above. South of the summit, the reserve's slope is quite steep, with a gradient of 1:2.8. The reserve's shallowest slope is 1:7, where the lawn is located. The average slope over the reserve is 1:4.

The steep, south-facing parts of the reserve have a tall forest very similar to the 'Grassy Forest' Ecological Vegetation Class (EVC) of the Dandenong Ranges, with ferny undergrowth. The rest of the reserve, with its southwest to west-southwesterly aspect, is less ferny and supports more wildflowers, tending toward the 'Valley Heathy Forest' EVC. The regionally-rare species, White Stringybark (*Eucalyptus globoidea*), is one of the dominant eucalypts. However, it can be seen on the aerial photograph that many eucalypts have died. Heavy possum browsing is evident on many of the surviving eucalypts.

A 1945 aerial photograph shows that 0.2 ha of the south-facing slope was treeless and the largest trees on the land had crown diameters of 9–10 m, little more than half the size of the largest crowns today. Therefore, the whole reserve must have been cleared in the first half of the 20th Century.

By the latter part of the 20th Century, eucalypts had grown and proliferated markedly over most of the reserve. The part of the reserve that lies within 75 m of the eastern corner was densely covered with garden plants and their offspring. There were also extensive, small excavations through that area. Among the garden plants were Cedar Wattles (*Acacia elata*) and Sweet Pittosporums (*Pittosporum undulatum*), which have proliferated and displaced the indigenous flora. Maroondah City Council has been progressively removing the non-indigenous plants but quite a few remain, including the Cedar Wattles whose yellow-green crowns can be seen on the aerial photograph above.

Despite the reserve's chequered history, 113 naturally-occurring, indigenous plant species were observed there during this study.

Relationship to other land

Being 1.5 ha in size, Grandfill Reserve is too small to provide the full habitat needs for most bird species but adequate for many reptiles and invertebrates. Birds within the reserve therefore need to move around the landscape to fulfil their needs.

The reserve lies on the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, there is a sequence of sites of biological significance at intervals along the ridge. The sites closest to Grandfill Reserve are tiny Forest Court Reserve (Site 41, 100 m southeast), the former Benedictine Monastery (Site 40, 130 m south-southwest), and Alto Reserve (Site 43, 250 m north). It is expected (without direct observational evidence) that birds move along the ridge, using the sites as ecological stepping-stones.

Part of the reason for the ridge being a likely favoured route for bird movements is that the landscape between the sites is made more permeable for birds by the presence of indigenous eucalypts and 'Australian native' trees along some nature strips and in some gardens. Three residences abutting Grandfill Reserve's southern boundary retain such vegetation, but otherwise, the gardens and street trees in the neighbourhood comprise mostly exotic plants and provide poor habitat.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species.

Grassy Forest (Ecological Vegetation Class no. 128, **Endangered** in the bioregion), tending toward Valley Heathy Forest (EVC 127, Endangered) in the lower, less steep areas.

Canopy trees: Dominated by similar numbers of White Stringybark (*Eucalyptus globoidea*), Messmate Stringybark (*E. obliqua*) and Red Stringybark (*E. macrorhyncha*). Bundy (*E. goniocalyx*) and Narrow-leaved Peppermint (*E. radiata*) are less abundant.

Lower trees: Cherry Ballart (*Exocarpos cupressiformis*) is fairly abundant throughout. Golden Wattle (*Acacia pycnantha*) is also fairly abundant but more localised. Black Wattle (*Acacia mearnsii*) is scarce. There are moderate numbers of Blackwood (*Acacia melanoxylon*) and a single Silver Wattle (*A. dealbata*) but both species are probably present only due to planting, as none were recorded in any prior flora survey (1986–1998).

Medium to large shrubs: Rich in species and patchily dense, dominated in different areas by Burgan (*Kunzea leptospermoides*) or Manuka (*Leptospermum scoparium*). Other species that are fairly abundant include Hedge Wattle (*Acacia paradoxa*), Hop Wattle (*Acacia stricta*), Common Cassinia (*Cassinia aculeata*), Shiny Cassinia (*Cassinia longifolia*), Sifton Bush (*Cassinia sifton*), Common Correa (*Correa reflexa*), Common Heath (*Epacris impressa*) and Golden Bush-pea (*Pultenaea gunnii*). Sweet Bursaria (*Bursaria spinosa*) is also present but apparently only due to planting. The

remaining five wild species in this size range are scarce, but Prickly Currant-bush (*Coprosma quadrifida*) is a good ecological indicator.

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) and Pink-bells (*Tetratheca ciliata*) are moderately abundant. Grey Parrot-pea (*Dillwynia cinerascens*), Silky Daisy-bush (*Olearia myrsinoides*) and Prickly Geebung (*Persoonia juniperina*) are scarce.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*S. quadridentatus*) are fairly abundant.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over substantial areas. Screw Fern (*Lindsaea linearis*) is very scarce. Common Ground-fern (*Calochlaena dubia*) was reported in 1986 but not in subsequent flora surveys.

Climbers: Common Apple-berry (*Billardiera scandens*) and Small-leafed Clematis (*Clematis decipiens*) are fairly abundant. Other climbers are scarce, notably including the good ecological indicators, Mountain Clematis (*Clematis aristata*) and Twining Glycine (*Glycine clandestina*).

Creepers: Ivy-leaf Violet (*Viola hederacea*) is abundant in colonies. A crane's-bill (*Geranium* ?*potentilloides*) and the wood-sorrel *Oxalis exilis/perennans* are scattered fairly widely. Other creepers are scarce and localised, notably including the ecological indicator species, Thin-leaf Wattle (*Acacia aculeatissima*) and Trailing Goodenia (*Goodenia lanata*).

Grasses, rushes and sedges: Dense and rich in species. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) forms dense patches. Other abundant species include Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Clustered Wallaby-grass (*R. racemosum*), Purplish Wallaby-grass (*R. tenuius*) and Forest Wire-grass (*Tetrarrhena juncea*). Of the many other grassy species, the most ecologically informative are Soft Tussock-grass (*Poa morrisii*), Red-anther Wallaby-grass (*R. pallidum*), Slender Tussock-grass (*Poa tenera*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Fairly abundant and rich in species. Lilies and orchids are well represented. Mosses are also abundant, notably including many patches of *Dicranoloma billarderi*. The following other species are abundant: Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*), Tall Sundew (*Drosera auriculata*), Nodding Greenhood (*Pterostylis nutans*) and Trim Sun-orchid (*Thelymitra* ?*peniculata*). There are numerous other species. The past presence of Cut-leaf Xanthosia (*Xanthosia dissecta*) reflects a tendency toward Valley Heathy Forest in lower parts of the reserve.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Grandfill Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Caladenia carnea/transitoria* (Eastern Bronze Caladenia) – the slender leaves and year-old stems of four adjacent plants were discovered in August 2017. The slender leaves and short capsules suggest either *C. carnea* or *C. transitoria*, both of which are critically endangered in Maroondah;
- *Correa reflexa* (Common Correa) – the number of genuinely indigenous plants is hard to determine due to a proliferation of very vigorous hybrid correas and Rock Correas, which are acting as serious environmental weeds. The indigenous species will very likely be completely replaced by hybrids;
- *Eucalyptus globoidea* (White Stringybark) – one of the dominant species in the reserve, some of them large. Their health varies with season but is typically fair;
- *Eucalyptus macrorhyncha* (Red Stringybark) – another of the dominant species, many of them in poor health and showing extensive possum bite-marks in their depleted foliage;
- *Muellerina eucalyptoides* (Creeping Mistletoe) – the solitary plant mapped in 1998 has died, leaving no successor;
- *Persoonia juniperina* (Prickly Geebung) – one plant c. 35 m south of the uphill corner and another 65 m west of the reserve's eastern corner;

- *Poa tenera* (Slender Tussock-grass) – seen in 1998; unable to be found in this study but possibly overlooked in the reserve's south;
- *Pultenaea forsythiana* (Eastern Prickly Bush-pea) – three adjacent plants (perhaps suckering) near the southern fence are believed to be wild, according to Council officer, Craig Mauger; and
- *Pterostylis nana* (Dwarf Greenhood) – 13 were seen on the edge of a path, where they are very vulnerable to visitors trampling them, or dogs digging or urinating.

Fauna habitat

- The structure and composition of the forest represents suitable habitat for a range of forest birds, bats, possums and invertebrates, limited by the size of the reserve;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997):

- Rating 'A' (excellent) applies to roughly 0.2 ha, almost half of which is near the southwest corner and the remainder extends uphill from the reserve's centre;
- Rating 'B' (good) applies to roughly 0.3 ha surrounding the 'A' areas and extending along the southern fringe;
- Rating 'D' (poor) applies to 0.2 ha in the eastern corner as well as the lawn (0.1 ha); and
- Rating 'C' (fair) applies to the remaining 0.7 ha.

Other information about the reserve's ecological condition appears in the section above headed 'General description' and the section below headed 'Threats'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The Grassy Forest in Grandfill Reserve easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Grassy Forest is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of State significance.

Threatened plant species

The section above headed 'Significant plants' provides details of plant species that fall into the 'critically endangered' category of risk of dying out in Maroondah. Of those, *Eucalyptus globoidea* and *E. macrorhyncha* are significant for their substantial numbers, while *Caladenia carnea/transitoria*, *Persoonia juniperina*, *Pterostylis nana* and *Pultenaea forsythiana* are important because there are very few other populations of them in Maroondah. The populations of all these species fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with

suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological stepping-stone

As seen on the key map of Maroondah's sites of biological significance on p. 1, and as discussed above in the section headed 'Relationship to other land', Grandfill Reserve is one of a series of forest patches along the Wicklow Hill Ridge. Some of the more mobile species of wildlife, such as Australian King Parrots, appear to use those sites as ecological 'stepping-stones'. The reserve therefore fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Grassy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the reserve and living within roughly 100 m. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the reserve is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into surrounding streets and gardens.

While the members of the Grandfill Flora Reserve Committee of Management provide ecological benefits to the forest, the forest reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The reserve's vegetation contributes substantially to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, no clear change is discernible in the extent of habitat.

Change in the plant species present

A few plant species recorded from the reserve in previous studies were not found in this study. However, those omissions were more than counterbalanced by new discoveries. Seventeen more naturally-occurring, indigenous plant species were detected in the reserve during this study than have been recorded in all previous flora surveys combined. Orchids were the main group with newly detected species. A small part of the differences could be due to differences in the seasons and survey effort.

Change in the ecological condition of habitat

Comparing the information in the section above headed 'Ecological condition' with equivalent information in the reserve's 1998 bushland management plan (Lorimer 1998e), it appears that the condition of at least 0.1 ha has improved from rating 'B' to 'A' (uphill from the reserve's centre) and the area in rating 'C' has grown at the expense of the area in rating 'D'. These changes represent a significant improvement. However, the health of the eucalypt canopy has declined and many eucalypts died during the Millennium Drought.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change. Excessive possum browsing was noted during this study;
- Displacement of indigenous plants and their dependent fauna by hybrid correas, which are forming dense thickets of increasing size;
- Displacement of indigenous plants and their dependent fauna by introduced plants in the eastern and northern corners; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The reserve is a single property divided into two parcels by a line parallel to Penhyrn Avenue. Anomalously, the northern parcel is zoned 'Public Park and Recreation Zone' and the southern parcel is zoned 'Neighbourhood Residential Zone – Schedule 2' (like the surrounding area). The southern parcel (but not the northern parcel) is covered by Schedule 2 of the Design and Development Overlay.

As the reserve is managed as a single entity and there is no apparent difference in Council's plans for the two parcels, it is recommended that Council unify the zoning and overlay treatment across the whole property.

Vegetation removal over the whole reserve is covered by the Vegetation Protection Overlay (VPO), Schedule 3 of the Significant Landscape Overlay and the state-wide native vegetation regulations of clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to replace the VPO with the proposed schedule ESO1.

Information sources

The analysis above draws on the following sources of information about the site:

- 6½ hours of ecological survey for this study by Graeme Lorimer and Leigh Kett on 31/8/17, as well as 2¼ hours by Lorimer on 23/1/18 and 20 minutes by Lorimer on 19/6/18. The survey included: (a) compiling a list of the names and abundances of indigenous and introduced plant species, distinguishing between plants that are wild, planted or of uncertain origin; (b) documenting the details of rare or scarce plants; (c) mapping the vegetation and rare plants; and (d) compiling a list of fauna observed incidentally;
- Maroondah City Council's records of planting in the reserve;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and the *'Grandfill Reserve Management Plan 1998'* (Lorimer 1998e). The documents' assessments of the site were based on a

total of approximately fifteen hours of fieldwork by the present author over the period July 1996 to June 1998, including a detailed flora survey and incidental fauna observations;

- A bird list from Graham Bower provided to the author in March 1998;
- A list of indigenous vascular plant species compiled by Helen Moss on 12/7/93;
- Information in the report, *'Botanical Significance and Management Strategies for the Webster Avenue Flora Reserve, Croydon'*, by G. Pergl, R. Adams and D. Simmons of Victoria College; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Site 43. Alto Reserve, Croydon

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Legend
Properties
Site 43

N

1:1200
0 10 20 30 40 50 m

Boundaries, land use and tenure

The site coincides with the single property that comprises Alto Reserve (78–86 Alto Avenue, Croydon). It is a council reserve managed for amenity and nature conservation.

General description

Alto Reserve occupies 1.0 hectares at the top of a hill on the Wicklow Hill Ridge. There are no drainage lines. The highest part of the land (194 m elevation) is the former location of a water supply reservoir, now occupied by a lawn (marked on the aerial photograph) with two planted eucalypts growing in it. The rest of the reserve has a typical gradient of 1:7, which is a moderate slope. The aspect is mostly northwest to northeast.

Old vehicle tracks, excavations and planted Monterey Pines (*Pinus radiata*) remain from the land's former use for water supply. The vegetation is quite variable in nature, age and condition due to the land's history. The area marked on the aerial photograph above as 'core habitat' has all strata of indigenous plants, mostly

naturally-occurring. The rest of the reserve has varying densities of planted indigenous species and occasional natural regrowth.

Maroondah City Council and its predecessor, Croydon City council, have made a concerted effort to restore the vegetation in most of the reserve to a more natural condition since the land became a council reserve in 1974. The Friends of Alto Reserve Bushland have assisted. An unusual feature of the vegetation's development is that two orchid species – Nodding Greenhood (*Pterostylis nutans*) and the sun-orchid *Thelymitra* ?*peniculata* – have become abundant and widespread through the core habitat area despite being very scarce or absent in the 1990s.

A total of fifty-three naturally-occurring, indigenous plant species were observed in the reserve during this study.

Relationship to other land

With less than 1 ha of habitat, Alto Reserve is too small to satisfy the full habitat needs of most bird species. Birds within the reserve therefore need to move around the landscape to fulfil their needs.

Fortunately, the reserve lies on the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, there is a sequence of sites of biological significance at intervals along the ridge. The closest sites larger than 1 ha to Alto Reserve are Grandfill Reserve (Site 41, 250 m south), the former Benedictine Monastery (Site 40, 520 m south-southwest), Croydon Primary School (Site 55, 550 m east) and the former Croydon High School (Site 44, 580 m east-northeast). It is expected (without direct observational evidence) that birds move along the ridge, using the sites as ecological stepping-stones.

Part of the reason for the ridge being a likely favoured route for bird movements is that the landscape between the sites is made more permeable for birds by the presence of indigenous eucalypts and 'Australian native' trees along some nature strips and in some gardens. However, the vegetation in the neighbourhood around Alto Reserve comprises mostly exotic plants and provides poor habitat.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by White Stringybark (*Eucalyptus globoidea*) and Red Stringybark (*E. macrorhyncha*). Bundy (*E. goniocalyx*) is also present. The reserve's single Messmate Stringybark (*E. obliqua*) may be natural or may have been planted long ago.

Lower trees: Strongly dominated by Cherry Ballart (*Exocarpos cupressiformis*). There are also scattered Black Wattle (*Acacia mearnsii*) and Golden Wattle (*A. pycnantha*). Blackwood (*Acacia melanoxylon*) is scarce and may have been planted.

Medium to large shrubs: Patchily dense and rich in species. Dominated by Yarra Burgan (*Kunzea leptospermoides*). The following species are also fairly abundant or widespread: Hedge Wattle (*Acacia paradoxa*), Hop Wattle (*Acacia stricta*) and Shiny Cassinia (*Cassinia longifolia*). Other shrub species are scarce except Juniper Wattle (*Acacia ulicifolia*), all of which may have been planted.

Small shrubs: As is normal for Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) and Grey Parrot-pea (*Dillwynia cinerascens*) are abundant and Erect Guinea-flower (*Hibbertia riparia*) is present (if scarce).

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*S. quadridentatus*) are both fairly abundant.

Ferns: Austral Bracken (*Pteridium esculentum*) was recorded in previous flora surveys but not in this study.

Climbers: Purple Coral-pea (*Hardenbergia violacea*) is fairly abundant, mostly creeping rather than climbing. The questionably-indigenous Small-leafed Clematis (*Clematis decipiens*) arrived in recent years and has become fairly abundant. Common Apple-berry (*Billardiera mutabilis*) and Love Creeper (*Comesperma volubile*) are scarce.

Creepers: Depleted, represented mainly by patches of Kidney-weed (*Dichondra repens*). Ivy-leaf Violet (*Viola hederacea*) and a crane's-bill (*Geranium* species) were recorded in previous flora surveys.

Grasses, rushes and sedges: Dense and rich in species. Dominated variously by Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) or Red-anther Wallaby-grass (*Rytidosperma pallidum*). Weeping Grass (*Microlaena stipoides*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are abundant in the lawn and open areas. The following species are also fairly abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Finger Rush (*Juncus subsecundus*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Purplish Wallaby-grass (*R. tenuius*) and Small Grass-tree (*Xanthorrhoea minor*). Other grassy species are either scarce or could not be reliably identified in the winter flora surveys of this study.

Other groundcover: Mosses are rather dense and fairy rich in species, the most abundant being Common Hypnum (*Hypnum cupressiforme*) and Broody Swan-neck Moss (*Campylopus clavatus*). The liverwort, Green Worms (*Chiloscyphus semiteres*), is also fairly abundant. The vascular groundcover species are abundant but depleted in species. Lilies and orchids are well represented. Chocolate Lily (*Arthropodium strictum*) is so abundant as to be the dominant groundcover species over substantial areas in winter-spring. Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (Gonocarpus tetragynus) and Nodding Greenhood (*Pterostylis nutans*) are also abundant. Honeypots (*Acrotriche serrulata*) is moderately abundant. Other groundcover species were scarce during this study's winter flora surveys.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Alto Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Correa reflexa* var. *reflexa* (Common Correa) – a few were seen in 2019, one of them abnormally tall for the local form and looking like a possible hybrid with a garden variety;
- *Eucalyptus globoidea* (White Stringybark) – one of the two dominant species in the reserve, with roughly 20 living individuals are a number of dead ones. Their health varies between very poor and good; and
- *Eucalyptus macrorhyncha* (Red Stringybark) – the other dominant species, roughly 30 individuals, many of them in poor health.

Fauna habitat

- The structure and composition of the forest represents suitable habitat for common forest birds, bats, possums and invertebrates, limited by the small area of habitat;
- The native vegetation and its litter provide food and cover for invertebrates, some of which then become food for vertebrates such as lizards, bats and birds. The presence of nests of two species of bullants is a positive sign for invertebrate diversity;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997):

- Rating 'B' (good) applies to 0.13 ha to the centre and southwest of the area labelled 'core habitat' on the aerial photograph on p. 318;

- Rating 'C' (fair) applies to the remaining 0.3 ha of the 'core habitat'; and
- Rating 'D' (poor) applies to 0.4 ha.

The lawn and the northern corner of the reserve have negligible native vegetation and are excluded from the classifications above.

The eucalypt canopy is in generally poor to fair health, with few eucalypts in good health. The cause is unclear.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The Valley Heathy Forest in the area labelled 'core habitat' on the aerial photograph on p. 318 meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of State significance.

Threatened plant species

The section above headed 'Significant plants' provides details of plant species that fall into the 'critically endangered' category of risk of dying out in Maroondah. Of those, *Eucalyptus globoidea* and *E. macrorhyncha* are significant for their substantial numbers. The populations of these species fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological stepping-stone

As seen on the key map of Maroondah's sites of biological significance on p. 1, and as discussed above in the section headed 'Relationship to other land', Alto Reserve is one of a series of forest patches along the Wicklow Hill Ridge. Some of the more mobile species of wildlife, such as Australian King Parrots, appear to use those sites as ecological 'stepping-stones'. The reserve therefore fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the reserve and living in adjacent homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the reserve is expected to contribute in a small way to the enjoyment, health, wellbeing, childhood development and quality of life of visitors.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into surrounding streets and gardens.

While the members of the Friends of Alto Reserve Bushland provide ecological benefits to the forest, the forest reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The reserve's vegetation contributes to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, no clear change is discernible in the extent of habitat.

Change in the plant species present

Differences in the naturally-occurring, indigenous plant species recorded in this study and flora surveys in the 1990s are generally minor, particularly considering the winter timing of this study's survey. However, there is one notable change: the two orchid species *Pterostylis nutans* and *Thelymitra* ?*peniculata* have become abundant despite being scarce or absent in the 1990s.

Planting has brought about an increase in the total number of indigenous species present, though some planted species are likely to die out.

Change in the ecological condition of habitat

Comparing the information in the section above headed 'Ecological condition' with equivalent information in the reserve's 1998 bushland management plan (Lorimer 1998a), it appears that:

- The area in condition rating 'B' has expanded by about one-third to the northeast due to improvement from rating 'C' (fair);
- The remaining area in condition rating 'C' has expanded greatly in the eastern half of the area labelled 'core habitat' on the aerial photograph on p. 318 due to weeding, planting and natural colonisation by indigenous species (particularly Chocolate Lilies); and
- The area in rating 'D' has diminished because some of it has risen to rating 'C'.

These changes represent a significant improvement. However, the health of the eucalypt canopy has declined and many eucalypts died during the Millennium Drought (as can be seen by comparing aerial photographs from 2001 and 2011).

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change. Excessive possum browsing was noted during this study; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The reserve is zoned 'Public Park and Recreation Zone'. Tree removal is covered by Schedule 1 of the Neighbourhood Character Overlay and Schedule 3 of the Significant Landscape Overlay (SLO3). Native vegetation (trees or otherwise) is protected by the Vegetation Protection Overlay (VPO) and the state-wide native vegetation regulations of clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to replace the VPO with the proposed schedule ESO1.

Information sources

The analysis above draws on the following sources of information about the site:

- Two hours of ecological survey for this study by the author on 22/7/18 and 24/7/19. The survey included: (a) compiling a list of the names and abundances of indigenous plant species, distinguishing between plants that are wild, planted or of uncertain origin; (b) documenting the details of rare or scarce plants; and (c) mapping the vegetation's condition;
- Maroondah City Council's records of planting in the reserve;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and the *'Alto Reserve Management Plan 1998'* (Lorimer 1998a). The documents' assessments of the site were based on a total of approximately ten person-hours of fieldwork by John C. Reid and the present author over the period December 1995 to May 1998, including a detailed flora survey and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Site 44. Former Croydon High School

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries, land use and tenure

Until 2018, this site was part of a state secondary school. Its future is currently unknown.

The site comprises two polygons. Where the site boundaries do not coincide with the former school's boundary, they follow the edge of the significant vegetation. As with all sites in this volume, the precise boundary is available as a shapefile for geographic information systems.

The boundaries above have changed significantly since the original version of Site 44 in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). A triangle in the western corner of the property has been deleted because hardly any indigenous flora remains there and 'environmental weeds' make the triangle more an environmental liability than an asset. The southern polygon has been extended eastward to include vegetation that has been restored to a more natural state through planting and removal of introduced plants. The northern polygon has been added because it contains large White Stringybarks (*Eucalyptus globoidea*), which are regionally rare, and several species that are locally threatened and absent from the other polygon.

General description

Site 44's southern polygon measures 0.95 ha and has a moderately steep slope (1:6) facing northeast to north-northeast. The northern polygon measures 0.31 ha and has a moderate (1:8) slope to the south-southeast. The site lies on the lower part of the escarpment of the Wicklow Hill Ridge.

A substantial fraction of the northern polygon is mown. North of the driveway from Tynong St, the lawn mostly comprises indigenous species of grass, particularly Slender Wallaby-grass (*Rytidosperma penicillatum*) and Mat Grass (*Hemarthria uncinata*). Where the ground is uneven and the mowing is less frequent, wildflowers grow, including several lily species and forty Grass Trigger-plants (*Stylidium armeria*). The part of the northern polygon that lies south of the driveway has a healthy canopy of mature eucalypts, including an unusually large White Stringybark.

The most natural vegetation in the southern polygon is south and southwest of the playing field, with many wildflowers. Much of the rest of the polygon shows clear signs of wear and tear from decades of use by students. The main sign is the abundance of introduced grasses, particularly Large Quaking-grass (*Briza maxima*). Gosford Wattle (*Acacia prominens*) and Cedar Wattle (*A. elata*) were planted decades ago and have proliferated, displacing the indigenous vegetation and its dependent wildlife. The shrub layer is quite depleted in most of the area, for reasons unknown.

Eighty-six naturally-occurring, indigenous plant species were observed in the site during this study.

Relationship to other land

With less than 1.3 ha of habitat, Site 44 is too small to satisfy the full habitat needs of most bird species. Birds within the site therefore need to move around the landscape to fulfil their needs.

The rest of the schoolgrounds contains patches of trees that would help birds and indigenous flying insects meet their habitat needs. The mature trees along Croydon Road also help. However, additional habitat is still needed for most birds.

Fortunately, the site lies on the lower slopes of the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, there is a sequence of sites of biological significance at intervals along the ridge. The closest sites larger than 1 ha to Site 44 are Croydon Primary School (Site 55, 270 m south), Alto Reserve (Site 43, 580 m west-southwest), Grandfill Reserve (Site 41, 800 m southwest) and the Birt Hill area (Sites 45, 46 and 104, 400 m north). It is expected (without direct observational evidence) that birds move along the ridge, using the sites as ecological stepping-stones.

Part of the reason for the ridge being a likely favoured route for bird movements is that the landscape between the sites is made more permeable for birds by the presence of indigenous eucalypts and 'Australian native' trees along some nature strips and in some gardens. Aerial photograph shows many mature eucalypts in the residential neighbourhood around Site 44.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*), followed by White Stringybark (*E. globoidea*), Bundy (*E. goniocalyx*), Red Stringybark (*E. macrorhyncha*) and Narrow-leaved Peppermint (*E. radiata*). There are also four Swamp Gums (*E. ovata*) and a rare hybrid *E. cephalocarpa* × *obliqua* in the southern polygon.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Blackwood (*Acacia melanoxylon*) is scattered. Black Wattle (*A. mearnsii*) and Black Sheoak (*Allocasuarina littoralis*) are scarce and quite possibly present only due to planting, as they were absent in the 1995 flora survey.

Medium to large shrubs: Quite patchy and depleted in species. The only species that are not scarce are Sweet Bursaria (*Bursaria spinosa*) and Yarra Burgan (*Kunzea leptospermoides*).

Small shrubs: As is normal for Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) and Grey Parrot-pea (*Dillwynia cinerascens*) are present (though the latter is scarce). The locally rare Prickly Geebung (*Persoonia juniperina*) is represented by a single individual.

Ferns: Austral Bracken (*Pteridium esculentum*) was present in 1995 but not detected in this study.

Climbers: Twining Glycine (*Glycine clandestina*) is fairly abundant. About ten Twining Fringe-lilies (*Thysanotus patersonii*) are scattered widely. There are also four Common Apple-berry (*Billardiera mutabilis*), four Purple Coral-pea (*Hardenbergia violacea*) and one Mountain Clematis (*Clematis aristata*).

Creepers: Ivy-leaf Violet (*Viola hederacea*) is abundant (though numbers will vary from year to year). Kidney-weed (*Dichondra repens*) is fairly abundant. Bidgee-widgee (*Acaena novae-zelandiae*) and the wood-sorrel *Oxalis exilis/perennans* are scarce. The locally-rare Lanky Goodenia (*Goodenia elongata*) was present in the 1995 flora survey but not detected in this study.

Grasses, rushes and sedges: Abundant and rich in species. Dominated variously by Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*), Slender Wallaby-grass (*Rytidosperma penicillatum*) or Purplish Wallaby-grass (*R. tenuius*). The following species are also abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Red-anther Wallaby-grass (*Rytidosperma pallidum*) or (in lawn in the northern polygon) Mat Grass (*Hemarthria uncinata*). Other species with substantial populations include Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or (in mown areas), Velvet Wallaby-grass (*R. pilosum*), Clustered Wallaby-grass (*R. racemosum*), Bristly Wallaby-grass (*R. setaceum*), Common Bog-rush (*Schoenus apogon*) and Kangaroo Grass (*Themeda triandra*). Among the less abundant species, Soft Tussock-grass (*Poa morrisii*) and Small Grass-tree (*Xanthorrhoea minor*) are good ecological indicators.

Other groundcover: Fairly rich in species (22 vascular species recorded), particularly lilies. Milkmaids (*Burchardia umbellata*) and Yellow Rush-lily (*Tricoryne elatior*) are abundant. The following species are fairly abundant: Pale Grass-lily (*Caesia parviflora*), Pale Flax-lily (*Dianella longifolia*), Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (Gonocarpus tetragynus), Small Poranthera (*Poranthera microphylla*) and Grass Trigger-plant (*Stylidium armeria*). Among the scarcer species, the following are good ecological indicators: Honey-pots (*Acrotriche serrulata*), Tasman Flax-lily (*Dianella tasmanica*), Common Rice-flower (*Pimelea humilis*), Variable Plantain (*Plantago varia*), a sun-orchid (*Thelymitra* ?*peniculata*) and Cut-leaf Xanthosia (*Xanthosia dissecta*).

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 44 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acianthus pusillus* (Small Mosquito Orchid) – a colony of twenty and a colony of seventeen were discovered in the southern polygon by Maroondah City Council staff on 30/8/19;
- *Correa reflexa* var. *reflexa* (Common Correa) – confined to the southern polygon, where it is scarce but no count was taken. At least some of the offspring are hybrids with garden correas;
- *Eucalyptus globoidea* (White Stringybark) – fairly abundant, with a particularly large specimen beside the driveway from Tynong Street;
- *Eucalyptus macrorhyncha* (Red Stringybark) – fairly abundant in the southern polygon;
- *Goodenia elongata* (Lanky Goodenia) – recorded in the 1995 flora survey but not in December 2017, perhaps due to the drought conditions;
- *Persoonia juniperina* (Prickly Geebung) – two adjacent plants grow c. 18 m south of the southwest corner of the playing field. Another plant grows 35m south of the middle of the southern edge of the playing field;

- *Pterostylis concinna* (Trim Greenhood) – colonies containing twenty, fifteen, eleven and five rosettes were discovered in the southern polygon by Maroondah City Council staff on 30/8/19;
- *Pterostylis nana* (Dwarf Greenhood) – a solitary plant and four colonies containing five rosettes were discovered in the southern polygon by Maroondah City Council staff in spring 2019.

There is also a rare hybrid *Eucalyptus cephalocarpa* × *obliqua*. Under international criteria, hybrids of any kind are excluded from consideration as threatened because they can theoretically arise spontaneously from the two parent species.

Significant fauna

- A Sugar Glider was found dead in September 2019, indicating the likely presence of other Sugar Gliders. The species is uncommon in Maroondah and urban Melbourne generally.

Fauna habitat

- The structure and composition of the forest represents suitable habitat for common forest birds, bats, possums and invertebrates, limited by the small area of habitat and depleted shrubs layer;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The native vegetation and its litter provide food and cover for invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The following approximate areas fall into the A–D categories of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997):

- Rating 'B' (good) applies to 0.3 ha uphill (southwest) of the playing field;
- Rating 'C' (fair) applies to 0.4 ha; and
- Rating 'D' (poor) applies to 0.5 ha.

The health of the eucalypt canopy is generally poor in the site's southern polygon and fair to very good in the northern polygon.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The Valley Heathy Forest in the site's southern polygon easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of State significance.

The northern polygon is slightly too small to qualify as a 'patch' and therefore does not qualify for significance under standard criterion 3.2.3.

Locally threatened species

The section above headed 'Significant plants' provides details of plant species that fall into the 'critically endangered' category of risk of dying out in Maroondah. Of those, *Acianthus pusillus*, *Correa*

reflexa, *Eucalyptus globoidea*, *E. macrorhyncha*, *Pterostylis concinna* and *P. nana* have viable populations, while the three plants of *Persoonia juniperina* are important because there are very few other populations of the species in Maroondah. The populations of all these species fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Sugar Gliders are so uncommon in Maroondah that the discovery of one in 2019 (presumably part of a population) meets standard condition 3.1.5 for Local significance in the same way that the abovementioned plants do.

Ecological stepping-stone

As seen on the key map of Maroondah's sites of biological significance on p. 1, and as discussed above in the section headed 'Relationship to other land', Site 44 is one of a series of forest patches along the Wicklow Hill Ridge. Some of the more mobile species of wildlife, such as Australian King Parrots, appear to use those sites as ecological 'stepping-stones'. The reserve therefore fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people within the site or living in neighbouring homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

While the site was part of a school, its natural ambience probably contributed to the enjoyment, health, wellbeing, childhood development and quality of life of the school community. It is hoped that those benefits will be continued when the property's future is decided.

The benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into surrounding streets and gardens.

The site's vegetation contributes to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, the only discernible change in the extent of habitat is the addition of approximately 0.08 ha (800 m²) at the eastern end of the site's southern polygon. The expansion was due to revegetation and removal of non-indigenous plants.

Change in the plant species present

More naturally-occurring, indigenous plant species were detected in this study than in 1995. That might be explained by a difference in survey effort. The only conclusion that can be drawn with confidence is that there has not been any significant reduction in the number of indigenous species.

Change in the ecological condition of habitat

The information in the section above headed 'Ecological condition' suggests an overall improvement in ecological condition of the vegetation compared with the 1997 *'Sites of Biological Significance in Maroondah'* report (based on fieldwork in December 1995). The 1997 report indicated that the (smaller) site at that time was 10% in condition 'C' (fair) and 90% 'D' (poor), compared with this study's assessment of approximately 25% 'B', 35% 'C' and 40% 'D'.

However, the health of the eucalypt canopy has deteriorated, as evidenced by aerial photographs from 2001 and 2017. A 2011 aerial photograph shows that most of the tree deaths occurred between 2001 and 2011, attributable to the Millennium Drought.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- The site's unknown future;
- Displacement of indigenous plants and their dependent fauna by introduced plants, particularly Large Quaking-grass, Bulbil Watsonia, Cedar Wattle and Gosford Wattle;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change. Excessive possum browsing was noted during this study; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The school is zoned 'Public Use Zone – Education'. Throughout the school, tree removal is covered by Schedule 3 of the Significant Landscape Overlay (SLO3) and native vegetation (trees or otherwise) is protected by the state-wide native vegetation regulations of clause 52.17 of the Victoria Planning Provisions. Within the original (rather different) version of Site 44 from 1997, native vegetation is further protected by the Vegetation Protection Overlay (VPO).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to replace the VPO with the proposed schedule ESO1.

Site 44's 'State' significance means that its future conservation should be part of considerations about the former school's future.

Information sources

The analysis above draws on the following sources of information about the site:

- 3½ hours of ecological survey for this study by the author on 20–21/12/17 plus 55 minutes with Maroondah City Council bushland management staff on 4/9/19. The survey included: (a) compiling a list of indigenous and introduced plant species (including mosses and liverworts) and their abundances in each of the site's two polygons; (b) documenting the details of rare or scarce plants; and (c) mapping the vegetation and rare plants;

- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on a flora survey by Lynlee Tozer on 30/12/95; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird. The state government's mapping of bioregional boundaries is imprecise in this vicinity, with the boundary between the Gippsland Plain and the Highlands - Southern Fall being placed a few hundred metres too far west. That has resulted in Site 44 being wrongly mapped as being in the latter bioregion rather than the former.

Acknowledgement

Thanks to Mr Terry Bennett, the Principal of Melba College, for permission to conduct the December 2017 flora survey. (Melba College occupied the property at the time.) Thanks also to Daniel Flaim, Craig Mauger and Manu Thomas of Maroondah City Council for providing information about plant populations.

Site 45. Birts Hill Reserve, Croydon North

Biological Significance Level: *State* due to the presence of a threatened vegetation type and the rare Dandenong Range Cinnamon Wattle



Aerial photograph taken February 2017

Boundaries, land use and tenure

Site 45 coincides exactly with the Crown land reserve at 7–15 Alice Street, Croydon North. The reserve has been managed for nature conservation by Maroondah City Council and its predecessor (Croydon City Council) since 1970.

General description

Birts Hill Reserve occupies 1.2 hectares on the mid-slope of Birt Hill (see Site 46 on p. 338). It has a fairly steep slope (1:4 to 1:5) facing east-southeast.

Relationship to other land

Of the fauna present in Birts Hill Reserve, all except small lizards and non-flying invertebrates would need to periodically travel elsewhere to fulfil their habitat needs. As seen on the aerial photograph above, the

abutting Site 46 and nearby Site 104 provide some additional habitat. Warrien Reserve (360 m northeast) provides a substantial area of high-quality habitat.

Birts Hill Reserve lies on the eastern slope of the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, the reserve and the abutting Sites 46 and 104 form one of the largest areas of habitat in a sequence of sites of biological significance distributed along the ridge. It is expected (without direct observational evidence) that birds move along the ridge, using the sites as ecological stepping-stones.

The habitat between the sites of biological significance is augmented by remnant eucalypts or Australian native trees in quite a few residences and on nature strips.

Bioregion: at the interface between Gippsland Plain and Highlands - Southern Fall

Habitat type

The state government's mapping of Ecological Vegetation Classes (EVCs) and bioregional boundaries is inaccurate in this vicinity. Grassy Dry Forest is implausibly shown as occurring throughout Birts Hill Reserve, extending to the adjacent steep, shady, southeast-facing slope and across the creek at the base of the slope.

Because the reserve is at the interface between two bioregions, the vegetation community is intermediate between the Valley Heathy Forest EVC of the Gippsland Plain bioregion and the Grassy Forest EVC of the Highlands - Southern Fall bioregion.

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Intermediate between Valley Heathy Forest (EVC 127, **Endangered** in the Gippsland Plain) and Grassy Forest (EVC 128, **Vulnerable** in the Highlands - Southern Fall). 110 naturally-occurring, indigenous plant species were observed during this study.

Canopy trees: Dominated by Red Stringybark (*Eucalyptus macrorhyncha*), which is generally in poor health. The following species are also fairly abundant: White Stringybark (*E. globoidea*), Bundy (*E. goniocalyx*), Messmate Stringybark (*E. obliqua*) and Narrow-leaved Peppermint (*E. radiata*). There are two Swamp Gums (*E. ovata*) but they may be present only due to planting.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*) and Black Wattle (*Acacia mearnsii*). Silver Wattle (*A. dealbata*) is fairly abundant. Blackwood (*A. melanoxylon*) and Golden Wattle (*Acacia pycnantha*) are scarce.

Medium to large shrubs: Patchily dense and diverse in species. Dominated variously by Shiny Cassinia (*Cassinia longifolia*), Yarra Burgan (*Kunzea leptospermoides*) or Manuka (*Leptospermum scoparium*). The following species are widely scattered or abundant in certain areas: Dandenong Range Cinnamon Wattle (*Acacia stictophylla*), Hop Wattle (*A. stricta*), Juniper Wattle (*A. ulicifolia*), Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*), Common Correa (*Correa reflexa*), Common Heath (*Epacris impressa*), Hop Goodenia (*Goodenia ovata*), Austral Indigo (*Indigofera australis*), Snowy Daisy-bush (*Olearia lirata*), Eastern Prickly Bush-pea (*Pultenaea forsythiana*), Golden Bush-pea (*P. gunnii*) and Large Kangaroo Apple (*Solanum laciniatum*). Of the less abundant shrubs species, the most ecologically informative are Myrtle Wattle (*Acacia myrtifolia*), Prickly Currant-bush (*Coprosma quadrifida*) and Snowy Daisy-bush (*Olearia lirata*).

Small shrubs: Fairly abundant. As is normal for Valley Heathy Forest, Grey Parrot-pea (*Dillwynia cinerascens*) and Common Flat-pea (*Platylobium obtusangulum*) are fairly abundant, as are Silky Daisy-bush (*Olearia myrsinoides*) and Pink-bells (*Tetratheca ciliata*). Although represented by just one individual, Prickly Geebung (*Persoonia juniperina*) is a good ecological indicator.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*S. quadridentatus*) are both fairly abundant.

Ferns: Austral Bracken (*Pteridium esculentum*) is abundant. Tall Tree-fern (*Cyathea australis*) was present in 1998 but died out during the Millennium Drought.

Climbers: Wonga Vine (*Pandorea pandorana*) was scarce in 1998 but has become so dense in some areas as to be displacing other plants by smothering them. Common Apple-berry (*Billardiera mutabilis*), Downy Dodder-laurel (*Cassytha pubescens*), Mountain Clematis (*Clematis aristata*) and Love Creeper (*Comesperma volubile*) are fairly abundant. Twining Glycine (*Glycine clandestina*) and Purple Coral-pea (*Hardenbergia violacea*) are scarce.

Creepers: Kidney-weed (*Dichondra repens*) is dense in some areas. Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel, *Oxalis exilis/perennans*, are fairly abundant. Trailing Goodenia (*Goodenia lanata*) is scarce.

Grasses, rushes and sedges: Abundant and represented by at least 33 species. Mostly dominated by Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*) or Clustered Wallaby-grass (*Rytidosperma racemosum*). Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*) and Common Bog-rush (*Schoenus apogon*) are also abundant. Of the many other species, the most ecologically informative are Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Soft Tussock-grass (*P. morrisii*), Slender Tussock-grass (*P. tenera*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Forest Wire-grass (*Tetrarrhena juncea*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Forbs are abundant and rich in species, particularly lilies. Uncommonly, Grass Trigger-plant (*Stylidium armeria*) is so abundant as to dominate the groundcover in some areas. Other abundant species include Chocolate Lily (*Arthropodium strictum*), Milkmaids (*Burchardia umbellata*), Common Raspwort (*Gonocarpus tetragynus*) and Small Poranthera (*Poranthera microphylla*). There are numerous other species.

Significant plants

Rare (but not otherwise threatened)

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. Birts Hill Reserve has a substantial and apparently quite viable population of the species.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 36 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acianthus pusillus* (Small Mosquito Orchid) – eight plants were observed in this study but others could easily have escaped detection;
- *Correa reflexa* var. *reflexa* (Common Correa) – a substantial population;
- *Eucalyptus globoidea* (White Stringybark) – one of the dominant species but mostly in ill-health;
- *Eucalyptus macrorhyncha* (Red Stringybark) – as above;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – one small colony was detected in this study;
- *Persoonia juniperina* (Prickly Geebung) – one individual was detected in this study;
- *Poa tenera* (Slender Tussock-grass) – only one individual was detected in this study but the species was previously more abundant; and
- *Pultenaea forsythiana* (Eastern Prickly Bush-pea) – forty stems were counted in this study but some are almost certain to share a common root system.

Significant fauna

One individual of each of the following locally-rare species was observed at Birts Hill Reserve during this study:

- Fan-tailed Cuckoo;
- Shining Bronze-Cuckoo; and
- Olive-backed Oriole.

The reserve's vegetation is well suited to these species and there is enough area of habitat for them because of native vegetation in the abutting Site 46, as well as nearby in Warrien Reserve (Site 47) and beside the Maroondah Highway (Site 104).

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, possums and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of additional habitat in the abutting Site 46 and nearby greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), approximately 0.1 ha rates 'A' (excellent), 0.5 ha rates 'B' (good), 0.5 ha rates 'C' (fair) and 0.1 ha rates 'D' (poor).

The health of the eucalypt canopy is poor, with large gaps left by the deaths of trees.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The vegetation in Birts Hill Reserve easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. It contains vegetation intermediate between an endangered EVC and a vulnerable EVC (see above). Either way, because the 'habitat score' is clearly at least 0.3, it follows that the vegetation has a 'conservation significance' rating of 'high' or 'very high' under the Native Vegetation Framework (NRE 2002). Consequently, the reserve meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The reserve has an apparently quite viable population of Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

The following plant species that fall into the 'critically endangered' category of dying out in Maroondah have apparently viable populations in the reserve: *Acianthus pusillus, Correa reflexa, Eucalyptus globoidea, E. macrorhyncha* and *Pultenaea forsythiana*. They fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under

consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating. The single colony of *Lagenophora stipitata* and the single plant of *Persoonia juniperina* also qualify under the same criterion because those species occurs at very few other sites in Maroondah, making Birts Hill Reserve an 'important site'.

Ecological corridor

The section above headed 'Relationship to other land' describes how Birts Hill Reserve and the abutting Sites 46 and 104 together form a large node in a sequence of sites of biological significance along the Wicklow Hill ridge. The aggregate of those sites fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the reserve or living in neighbouring homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The reserve's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the reserve into surrounding streets and gardens.

The park preserves something of the area's natural landscape. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there has been no detectable change in the extent of habitat in Birts Hill Reserve.

Change in the plant species present

Seven wild, indigenous plant species that were recorded from Birts Hill Reserve in flora surveys in the 1980s and 1990s were not detected in this study. They included three species of rush (*Juncus*) and the Rough Tree-fern (*Cyathea australis*), all of which grew in a depression at the uphill end of the reserve. That area has been too dry for those species over the past two decades.

Conversely, this study found 24 wild, indigenous plant species that were not detected in the previous flora surveys.

Change in the ecological condition of habitat

There is no material difference between the ecological condition ratings in the section headed 'Ecological condition' above (for 2017) and the equivalent assessment in the *'Birts Hill Reserve Management Plan 1998'* (Lorimer 1998b).

However, aerial photographs from 2001, 2011 and 2017 show that many eucalypts died between 2001 and 2011, attributable to the Millennium Drought. The surviving eucalypt canopy is in poor health (Figure 2 of Volume 1), much more so than is evident in the 2001 aerial photograph. The resources of sunlight, nutrients and soil moisture that have been freed up by the tree deaths have allowed groundcovers to thrive or regenerate (Figure 3 of Volume 1). Regeneration prompted by the eucalypt deaths is one reason for the increase in indigenous plant species noted above.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. Deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Displacement of indigenous flora and their dependent fauna by rampant growth of hybrid correas or Wonga Vine (*Pandorea pandorana*); and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The reserve is zoned 'Public Conservation and Resource Zone'. Tree removal is controlled by Schedule 3 of the Significant Landscape Overlay. Removal of native vegetation (trees or otherwise) comes under the state-wide controls of clause 52.17 of the Victoria Planning Provisions as well as the Vegetation Protection Overlay (VPO).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to replace the VPO with the proposed schedule ESO1.

Native vegetation on the nature strip is protected under the abovementioned clause 52.17.

Information sources

The analysis above draws on the following sources of information about the site, from the author's work except where otherwise noted:

- A total of 8 hours of fieldwork for this study on 11/10/17, 29/10/17, 20/11/17 and 20/12/17, including: (a) compiling a list of plant species (including mosses and liverworts) and their abundances; (b) documenting the details of rare or scarce plants; (c) mapping the vegetation and rare plants; and (d) recording fauna observed incidentally (26 species);
- Lists of indigenous, vascular plant species observed by local resident, Ken Whitney, in 2002, 2004, 2006, 2007, 2009, 2012 and 2016. Mr Whitney also showed the author the locations of some uncommon plant species;
- Maroondah City Council's records of planting in the reserve;
- The *'Birts Hill Reserve Management Plan 1998'* (Lorimer 1998b)., which was based on an intensive flora survey in June 1998 as well as the following information;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose information about Birts Hill Reserve was based on fieldwork in 1994 as a contribution to the booklet, *'Trees and Wildflowers of Croydon 1995'* by the Croydon Conservation Society;

- The 1987 *'Birts Hill Reserve Management Plan'* by Andrew Paget for the Croydon Conservation Society;
- A specimen at the National Herbarium of Victoria of *Correa reflexa* var. *reflexa* (*G.S.Lorimer 1313*; MEL 2328518A) from 23/6/98;
- A specimen at the Melbourne University Herbarium of *Eucalyptus globoidea* (*P.Y.Ladiges 1394*) from 12/9/90;
- A specimen at the National Herbarium of Victoria of *Acacia stricta* × *stictophylla* (*A.N.Paget s.n.*; MEL 0258487A) from 20/8/86; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Acknowledgement

Thanks to Mr Ken Whitney for showing the author several uncommon plant species and providing records of the reserve's plants over the years.

Site 46. Birt Hill, Croydon North

Biological Significance Level: *State* due to the presence of threatened plants and EVCs



Boundaries

The aerial photograph on the previous page has been overlaid with Site 46 outlined in dashed, mid-blue lines and marked internally to show the recommended planning overlays – ESO1 with blue crosses and ESO2 with diagonal blue lines. (Overlays are discussed in the section headed 'Strategic planning' below.) The gaps between the blue dashes expose yellow lines where the site boundaries and property boundaries coincide. Where the site boundaries do not coincide with property boundaries, they trace the edges of native vegetation. As for all sites in this volume, the precise boundaries are available in a shapefile of geographic information systems.

The boundary of Site 46 delineated here is significantly different from the original version in the 1997 report, *'Sites of Biological Significance in Maroondah'*. Tadji Close Reserve has been added to the northern tip because its revegetation has matured and it now significantly reduces habitat fragmentation along the Wicklow Hill ridge. Some properties have been excised from the original site due to clearing, residential subdivision and development. Some properties (or parts thereof) have been added due to maturation of trees or to control further habitat fragmentation. The original version of the site avoided inclusion of fractions of properties because the mapping and aerial photography at the time were not conducive.

Land use and tenure

Most of the land in Site 46 covers residential properties and their abutting roads. The property sizes are between 748 m² and 8,138 m². As shown on the aerial photograph on the previous page, the site also contains a narrow water supply reserve in the south and two municipal reserves: Tadji Close Reserve and a nearby unnamed reserve at the eastern end of San Martin Drive.

General description

Site 46 occupies 13.5 hectares. It has a greater range of elevations than any other site in this volume. At its highest, it almost reaches the summit of Birt Hill (206 m elevation), the highest point in Melbourne's suburbs. The location of the summit is labelled on the aerial photograph on the previous page. The lowest point is the southeastern corner of Tadji Close Reserve, at 122 m elevation. A creek flows eastward to that point through the reserve at the end of San Martin Drive. That creek's valley has steep lower slopes (up to 1:2 gradient), supporting the Ecological Vegetation Classes (EVCs) Herb-rich Foothill Forest to the north and Valley Grassy Forest to the south.

The upper north- and northwest-facing slopes from 68 to 110 Richardson Road support vestiges of the EVC, Grassy Dry Forest.

The properties on Richardson Road with street numbers less than about 65 are on moderately- to quite steep slopes (up to 1:2.5) with southerly or easterly components to their aspect. There are remnants of vegetation that is intermediate between the Ecological Vegetation Classes (EVCs) Valley Heathy Forest and Grassy Forest. The southeastern edge of the site is at an elevation of 140 m next to a non-perennial creek, which flows northeast through the abutting Site 104.

The type and ecological condition of the site's habitat for indigenous flora and fauna is extremely variable, mainly depending on the gardening practices and lot size of each property and its nature strip.

Tadji Close Reserve has few naturally-occurring indigenous plants but has been heavily revegetated to provide a habitat link in a chain of sites of biological significance (see the key map of sites on p. 1).

The slope immediately southwest of Tadji Close Reserve has a canopy dominated by large, old trees of the regionally rare species, White Stringybark (*Eucalyptus globoidea*). Introduced sub-canopy trees (Sweet Pittosporum and Cedar Wattle) have proliferated to become so dense that the understorey has few indigenous species left. Surprisingly, the most abundant indigenous understorey species is Common Ground-fern (*Calochlaena dubia*), whose risk of dying out in Maroondah is in the 'critically endangered' category.

Further southwest, the reserve at the eastern end of San Martin Drive has possibly the most natural understorey in the whole site, complete with rare species. However, its overstorey is young regrowth from clearing that occurred sometime between 2001 and 2010.

The other contender for the most natural vegetation in the site is at its eastern extremity, in the eastern (downhill) halves of 44 and 48 Richardson Road. However, both these sites have lost indigenous plants over the past decade or two, mainly through clearing and eucalypt deaths.

Many other properties in the site, and most of the nature strips, support remnant indigenous trees in varying density and ages. Eucalypts and Cherry Ballart (*Exocarpos cupressiformis*) are the most common tree species. Some of the eucalypts support mistletoes, which have become so rare in Maroondah that they fall into the 'critically endangered' category of risk of dying out. Small patches of indigenous understorey plants are scattered thinly.

Across the whole site, forty-seven naturally-occurring, indigenous plant species were observed during this study.

Many properties in the site support planted Australian native trees that augment the wildlife habitat of the site's remnant native vegetation; e.g. Spotted Gums, wattles or paperbarks.

However, two particular Australian native trees - Sweet Pittosporum and Cedar Wattle – have gone wild and become large, rampant and widespread on the larger properties. As a result, they have displaced a substantial fraction of the native vegetation that was recorded in a 1996 flora survey of the site. The canopy of these 'environmental weed' species is particularly dense on 96 Richardson Road and 100 Richardson Road. It is not possible to see much of the understorey from the nature strip of those properties, so this study was unable to determine how much native understorey persists.

Broadly, the site's habitat for indigenous flora and fauna falls into two categories: (a) areas with remnant understorey and overstorey; and (b) areas that have remnant indigenous trees and/or Australian native trees that provide wildlife habitat but little if any understorey habitat. The former are shown on the aerial photograph on p. 338 as 'ESO1' and the latter as 'ESO2', corresponding to the different planning overlays that are recommended. For more information about the overlays, see the section below headed 'Strategic planning'.

Relationship to other land

Birt Hill is the highest point on the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, Site 46 is one of the largest of a sequence of sites of biological significance distributed along the ridge. Site 46's location, high elevation, habitat diversity and large size give it a considerable degree of strategic importance for biodiversity conservation in Maroondah.

Birts Hill Reserve (Site 45, p. 331) is nestled into the southeast of Site 46. Birds move freely between the two sites. Insects no doubt do likewise. These movements allow the fauna to better fulfil their habitat needs. They no doubt also spread pollen and seeds, thereby improving the reproduction and genetic diversity of indigenous flora. Unfortunately, they also spread seeds of some environmental weeds, particularly Sweet Pittosporum.

At the foot of the Wicklow Hill ridge, Warrien Reserve (Site 47) lies scarcely 300 m east of Site 46. Most birds and flying insects are quite capable of moving between the two sites to expand and diversify the habitat available to them, incidentally spreading pollen and seeds.

Bioregion: at the broad interface between Gippsland Plain and Highlands - Southern Fall

Habitat types

The state government's mapping of Ecological Vegetation Classes (EVCs) and bioregional boundaries is quite inaccurate around Birt Hill. Grassy Dry Forest is implausibly shown as covering the steep, shady, south- and southeast-facing slopes of the hill and across the creek in the abutting Site 104.

The descriptions of EVCs below include only the more abundant or ecologically informative, indigenous plant species.

Grassy Dry Forest (EVC 22, 'Least concern' in the Highlands - Southern Fall bioregion) on the upper slopes where the aspect is northerly or northwesterly

Canopy trees: Dominated by Red Stringybark (*Eucalyptus macrorhyncha*). Bundy (*E. goniocalyx*) is also abundant.

Lower trees: Strongly dominated by Cherry Ballart (*Exocarpos cupressiformis*). Black Wattle (*Acacia mearnsii*), Blackwood (*A. melanoxylon*) and Golden Wattle (*A. pycnantha*) are all scarce.

Medium to large shrubs: Yarra Burgan (*Kunzea leptospermoides*) is abundant but not throughout. Shiny Cassinia (*Cassinia longifolia*) is fairly common and Sweet Bursaria (*Bursaria spinosa*) is scarce.

Small shrubs: None seen.

Shrubby herb: Cotton Fireweed (*Senecio quadridentatus*) is fairly abundant.

Ferns: None seen.

Climbers: Small-leafed Clematis (*Clematis decipiens*) and Downy Dodder-laurel (*Cassytha pubescens*) are scarce.

Creepers: None seen.

Grasses, rushes and sedges: very patchy in distribution. Clustered Wallaby-grass (*Rytidosperma racemosum*) is abundant in some areas. Other species with substantial numbers include Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*) and Purplish Wallaby-grass (*R. tenuius*). Veined Spear-grass (*Austrostipa rudis*), Short-stem Sedge (*Carex breviculmis*) and Small Grass-tree (*Xanthorrhoea minor*) are scarce.

Other groundcover: Very depleted. The only species observed in substantial numbers were Black-anther Flax-lily (*Dianella revoluta*) and Tasman Flax-lily (*D. tasmanica*, on the boundary with Valley Heathy Forest).

Herb-rich Foothill Forest (EVC 23, 'Least concern' in the bioregion) on the south-facing slope along the southwest edge of Tadji Close Reserve and in the northern parts of 66A Richardson Road and the reserve at the eastern end of San Martino Drive

Canopy trees: Strongly dominated by White Stringybark (*Eucalyptus globoidea*). One of them has a Creeping Mistletoe (*Muellerina eucalyptoides*).

Lower trees: Silver Wattle (*Acacia dealbata*) is scarce. Other indigenous subcanopy trees have been displaced by dense Cedar Wattle (*A. elata*) and Sweet Pittosporum (*Pittosporum undulatum*).

Shrubs: Absent, again due to Cedar Wattles and Sweet Pittosporums.

Ferns: Common Ground-fern (*Calochlaena dubia*) is fairly abundant. Austral Bracken (*Pteridium esculentum*) is scarce.

Climbers: Wonga Vine (*Pandorea pandorana*) is fairly abundant.

Scrambler: Small-leaf Bramble (*Rubus parvifolius*) is scarce.

Creepers: None seen.

Grasses, rushes and sedges: Sparse. Weeping Grass (*Microlaena stipoides*) is the only species seen that has significant numbers. Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) is scarce.

Other groundcover: None seen, but there may be some on the private land.

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion) on

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*), followed by Red Stringybark (*E. macrorhyncha*), then Bundy (*E. goniocalyx*).

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*), followed by Black Wattle (*Acacia mearnsii*).

Medium to large shrubs: The main species on the slope are Shiny Cassinia (*Cassinia longifolia*), Yarra Burgan (*Kunzea leptospermoides*) and a colony of Hedge Wattle (*Acacia paradoxa*). There are also a few Sifton Bush (*C. sifton*) and seedlings of Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). On the creek adjacent to the Herb-rich Foothill Forest, there is a dense cluster of Shrubby Fireweed (*Senecio minimus*) and many Dandenong Range Cinnamon Wattle and Hop Goodenia (*Goodenia lanata*); however, the Goodenia have probably been planted or descended from planted parents.

Small shrubs: none encountered.

Ferns: Austral Bracken (*Pteridium esculentum*) is scattered thinly. Common Maidenhair (*Adiantum aethiopicum*) forms drifts on the lower slopes.

Climbers: Mountain Clematis (*Clematis aristata*) and Wonga Vine (*Pandorea pandorana*) are fairly abundant.

Creepers: Fairly abundant, the most common species encountered being Bidgee-widgee (*Acaena novae-zelandiae*), a crane's-bill (*Geranium*) species and the wood-sorrel *Oxalis exilis / perennans*.

Grasses, rushes and sedges: Abundant and dense. The most abundant species on the slope are Weeping Grass (*Microlaena stipoides*), Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Thatch Saw-sedge (*Gahnia radula*), followed by Wattle Mat-rush (*Lomandra longifolia* subsp. *longifolia*). The slope also has smaller numbers of Cluster-headed Mat-rush (*L. longifolia* subsp. *exilis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Forest Wire-grass (*Tetrarrhena juncea*). On the creek adjacent to the Herb-rich Foothill Forest, Tall Sedge (*Carex appressa*) and a robust form of Variable Sword-sedge (*Lepidosperma laterale*) are dominant. Hollow Rush (*Juncus amabilis*) is scarce.

Other groundcover: Severely depleted. Only Pale Flax-lily (*Dianella longifolia*) and Black-anther Flax-lily (*Dianella revoluta*) were seen.

Intermediate between Valley Heathy Forest (EVC 127, **Endangered** in the Gippsland Plain) and Grassy Forest (EVC 128, **Vulnerable** in the Highlands - Southern Fall) in the south and east of the site, where the aspect has a southerly or easterly component. The vegetation is intermediate between EVCs because it lies at the interface between two bioregions. The following description has been hampered by lack of access to the most natural areas, which are on private land.

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*), Bundy (*E. goniocalyx*) and (on lower slopes) White Stringybark (*E. globoidea*). Red Stringybark (*E. macrorhyncha*) is also fairly abundant and Narrow-leaved Peppermint (*E. radiata*) is scarce.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Black Wattle (*Acacia mearnsii*) is sparse.

Shrubs: The only shrub species observed from the public realm was Yarra Burgan (*Kunzea leptospermoides*), sometimes in thickets.

Ferns: Austral Bracken (*Pteridium esculentum*).

Climbers: Wonga Vine (*Pandorea pandorana*).

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is the only species observed.

Grasses, rushes and sedges: Clustered Wallaby-grass (*Rytidosperma racemosum*) is abundant in some open areas. Thatch Saw-sedge (*Gahnia radula*) is fairly abundant, Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) is localised and Forest Wire-grass (*Tetrarrhena juncea*) is scarce.

Other groundcover: unable to be detected from the public realm.

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong

Ranges. The species is abundant in the gully of the reserve at the eastern end of San Martin Drive. In 1996, it was recorded as present on many private properties that were not surveyed in this study.

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Population sizes may be understated and some species may have gone undetected due to lack of access to private land:

- *Amyema pendula* (Drooping Mistletoe) – three grow on a hybrid eucalypt at 59 Richardson Road;
- *Calochlaena dubia* (Common Ground-fern) – abundant in the Herb-rich Foothill Forest on the steep, south-facing slope between the eastern end of San Martin Drive and Tadji Close Reserve;
- *Eucalyptus globoidea* (White Stringybark) – widespread on the site's south- to east-facing slopes as one of the dominant canopy species, including some large specimens;
- *Eucalyptus macrorhyncha* (Red Stringybark) – the most abundant canopy species in the site, with over 100 counted in this study;
- *Gompholobium huegelii* (Common Wedge-pea) – recorded in 1996; perhaps not seen in this study for want of access to private land;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – as above;
- *Muellerina eucalyptoides* (Creeping Mistletoe) – one grows on a large *Eucalyptus globoidea* on 66A Richardson Road, a few metres from Tadji Close reserve; and
- *Senecio minimus* (Shrubby Fireweed) – a cluster of over ten young plants was seen beside the creek in the reserve at the eastern end of San Martin Drive.

The abovementioned tree on which the three *Amyema pendula* grow appears to be a hybrid eucalypt, *Eucalyptus macrorhyncha* × *obliqua* (also named *Eucalyptus* × *brevirostris*). Although *Eucalyptus* × *brevirostris* is listed by the state government as 'Rare' in Victoria, that status was conferred in the mistaken belief that the name refers to a hybrid between *Eucalyptus macrorhyncha* and *Eucalyptus muelleriana*.

Significant fauna

During this study, a mob of approximately 15 Eastern Grey Kangaroos were resident in and near Site 46. Although it is still uncommon for kangaroos to live in suburban Maroondah in such numbers, there is a strong trend toward increasing occurrences.

Fauna habitat

- The structure and composition of the native vegetation in the more natural areas represents suitable habitat for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The site's role as an ecological 'stepping-stone' on the Wicklow Hill ridge greatly amplifies the habitat values above;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State at the reserve on San Martino Drive and on two private properties; Local elsewhere

Regionally threatened Ecological Vegetation Classes

The Valley Grassy Forest on and abutting the reserve at 25–29 San Martino Drive meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The present author is confident that the vegetation has a habitat score of at least 0.3. Such a habitat score, in combination with the 'Vulnerable' status of Valley Grassy Forest, leads to a conservation significance rating of 'High' under the 'Native Vegetation Framework'. Standard criterion 3.2.3 then leads to a rating of **State** significance.

The same factors appear to apply to the Grassy Forest in the eastern halves of 44 and 48 Richardson Road, so that area also gives the site **State** significance.

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is abundant in the reserve at the eastern end of San Martin Drive. In 1996, it was also recorded widely on private land that was not visited in this study. The species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

The site's populations of *Calochlaena dubia*, *Eucalyptus globoidea* and *E. macrorhyncha* are large. Those species fall into the 'critically endangered' category of dying out in Maroondah. They therefore fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The populations of *Amyema pendula* and *Muellerina eucalyptoides* appear (from the public realm) to be small but they can be regarded as 'important populations' for the municipality because so few individuals are left. They therefore fit the criterion just quoted and give the site Local significance.

The cluster of *Senecio minimus* in the gully near the eastern end of San Martin Drive appears to be a viable population (though its numbers will rise and fall, as is usual for the species). The population therefore fits the same criterion as above for a site of Local significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', the whole of Site 46 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' significance ratings differ from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of the EVCs and the Dandenong Range Cinnamon Wattle.

Note that not all parts of the site are so highly significant. Most of the significance lies within the areas recommended for the proposed planning overlay ESO1. The ESO2 areas are mostly significant for their White Stringybarks and Red Stringybarks and their role as part of an ecological stepping-stone.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit all the site's residents as well as others living on and near Birt Hill. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

However, the amount of tree cover within the site has reduced significantly over the past twenty years, so the amount of climate benefit from the trees has also reduced.

The natural ambience of the more treed parts of the site is expected to be beneficial to the health, wellbeing, childhood development and quality of life of the residents. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals attracted to the site.

The site's vegetation contributes substantially to the 'green and leafy' character of the area. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

As discussed on p. 339, Site 46 as delineated here is significantly different than the original (1997) version of the site in the report, *'Sites of Biological Significance in Maroondah'*. The addition of Tadji Close Reserve is because the revegetation there was young in 1997 and it is now maturing. Comparison of aerial photographs from 2001 and 2017 has revealed a reduction of tree cover elsewhere in the site. An estimated total of 1.0 ha of tree cover has been cleared, mostly on 1, 32, 44, 48, 66A & 86–92 Richardson Road and 21, 22 & 24 San Martin Drive.

Change in the ecological condition of habitat

The ecological condition of native vegetation in Site 46 has deteriorated markedly over the past two decades.

It seems fairly clear that the main cause of that deterioration has been the proliferation of introduced Cedar Wattles (*Acacia elata*) and Sweet Pittosporums (*Pittosporum undulatum*). Those species now form dense canopies on many of the larger properties, particularly 66A, 74, 96 & 100 Richardson Road. Little sunlight penetrates those canopies, causing the natural understorey to dwindle and die. Shade-tolerant introduced plants such as Blackberry, Wandering Trad, Ivy and Large-leafed Privet have colonised the affected areas and displaced most of the surviving indigenous flora and fauna.

However, removal of the canopy of introduced plants would probably allow indigenous plants to regenerate from seeds in the soil.

Another reason for ecological decline in Site 46 is because eucalypt health has declined (as in Maroondah generally) and there have been many eucalypt deaths. Comparison of aerial photographs from 2001, 2011 and 2017 indicates that most eucalypt deaths occurred between 2001 and 2011, attributable to the Millennium Drought.

Without having access to the private land, the magnitude of the site's ecological deterioration cannot be quantified, nor the loss of flora and fauna species determined.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Residential subdivision;
- Displacement of indigenous plants and their dependent fauna by introduced plant species, particularly those mentioned above;

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Further eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Construction of outbuildings and other property improvements;
- Continuing unpermitted removal of native vegetation; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Most of Site 46 is zoned 'Neighbourhood Residential Zone – Schedule 1', which (among other things) limits lot sizes to at least 2,000 m². The parts of the site with different zoning are as follows:

- Tadji Close Reserve and 6, 8 & 12 Rustic Rise are zoned 'Neighbourhood Residential Zone – Schedule 3'; and
- The narrow water supply reserve is zoned 'Public Use Zone – Service and Utility'.

All of the site except Tadji Close Reserve is covered by the Design and Development Overlay.

The road reserves and all properties larger than 0.4 ha are subject to the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. The Vegetation Protection Overlay (VPO) further controls removal of native vegetation within the original version of Site 46 in the 1997 report, *'Sites of Biological Significance in Maroondah'*. Removal of trees (native or not) is controlled throughout the site by Schedule 3 of the Significant Landscape Overlay.

It is recommended here that the VPO should be removed from the original version of Site 46 and the new version of the site should be divided into areas covered by the two new overlay schedules ESO1 and ESO2 described in Section 11.1.2 of Volume 1. The areas to be affected by ESO1 and ESO2 are mapped on the aerial photograph on p. 338. ESO1 is mainly for the more natural areas that retain some native understorey, where non-indigenous plants are either ecologically negative or benign. ESO2 is for areas with little more native vegetation than a fragmented canopy of remnant trees. Unlike ESO1, ESO2 would provide planning protection for 'Australian native' trees, which can partly compensate for the scarcity of indigenous trees.

The proposal to apply ESO1 rather than ESO2 to 96–98 Richardson Road and 100–102 Richardson Road is made without the benefit of entering the properties. From the road and from aerial photographs, the land appears to contain no non-indigenous plants that provide suitable habitat for wildlife. It may well have some native understorey or at least the potential for natural regeneration. Ideally, a site inspection would be conducted to make a more confident determination. Otherwise, ESO1 is the safer option and involves less change to the current VPO.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately six hours of fieldwork for this study on 27–28 June 2019, viewing every property while walking along the streets and through each of the reserves. Each property was assessed for its cover of indigenous plants and 'Australian native' habitat trees, with the aid of binoculars where appropriate. A moderately thorough list of wild, indigenous plant species and their abundances was compiled for each of five parts of the site: (a) each of the two EVCs at the reserve on San Martin Drive; (b) Herb-rich Foothill Forest in Tadji Close Reserve and abutting private land; (c) Grassy Dry Forest areas; and (d) the area of Valley Heathy Forest / Grassy Forest. The most ecologically detrimental introduced species were included in those lists. Locations of significant plant species were mapped;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was largely based on fieldwork in April 1996 by Helen Moss and the present author, including separate

flora surveys of 36–38 Richardson Rd, 48–52 Richardson Rd, 62–78 Richardson Rd and the rest of the site; and

- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in eBird, the Victorian Biodiversity Atlas or the Atlas of Living Australia.

Site 47. Warrien Reserve, Croydon North

Biological Significance Level: *State* due to the presence of endangered vegetation types



Boundaries, land use and tenure

Site 47 occupies almost all the municipal reserve at 18–52 Warrien Road, Croydon North. The omitted part of the reserve is the walkway in the northeast corner, where two straight segments of the boundary have been drawn to exclude the lawn and footpath. The reserve has multiple functions: nature conservation, drainage, recreation and pedestrian passage between streets. Facilities include two picnic shelters, picnic tables, a playground and a toilet block. Management is undertaken by the Warrien Reserve Special Committee of Council (formerly called a Committee of Management).

General description

Warrien Reserve occupies 6.45 hectares, of which, 6.35 hectares is included in Site 47. It is largely occupied by a natural basin where five minor creeks or drainage lines converge, receiving deposits of silt

washed down by the creeks (alluvium) and soil eroded from the surrounding slopes (colluvium). Consequently, much of the reserve has a very shallow gradient (typically 1:20) and is seasonally sodden and prone to flooding. However, the northeast corner and the western edge are steeper, with gradients up to 1:10. The highest elevation is 107 m in the southwest corner. The lowest elevation is 93 m where the waters of the creek system exit the reserve near the northeast corner.

The topography has been modified by excavations for construction of Warrien Road and the creation and subsequent destruction of a dam in the reserve's south[*].

The winter-sodden soil in much of the reserve has resulted in three endangered Ecological Vegetation Classes (EVCs): Swampy Woodland, Swampy Riparian Complex and Swampy Riparian Woodland – as shown on the aerial photograph above. Unfortunately, the low drainage rate in those areas has led to extensive excavations and pipelaying. That has caused extensive ecological disruption and the loss of many plant species. As a result, the boundary between Swampy Riparian Woodland and Swampy Riparian Complex is not distinguishable.

The more freely-draining slopes in the northern half of the reserve support two other endangered EVCs: Valley Heathy Forest and (in the northeast corner) Valley Grassy Forest. Those two EVCs represent two different 'bioregions': the 'Gippsland Plain' and the 'Highlands - Southern Fall', respectively. (State government mapping of EVCs and bioregions is inaccurate in this area.)

0.4 hectares of the Valley Heathy Forest was fenced in 1951 and named the 'Everard Memorial Park', now signposted as the 'Everard Wildflower Sanctuary'[*]. Following an ecological burn in 2015, the fence was removed and a new fence (shown in white on the aerial photograph above) was erected to encompass a slightly larger area.

In the reserve's south, a line of Sugar Gums (*Eucalyptus cladocalyx*, from South Australia) marks a former property boundary. There are lawns and picnic facilities each side of it. Most of the lawn area is heavily dominated by the locally uncommon Kneed Wallaby-grass (*Rytidosperma geniculatum*) and, in season, the indigenous herbs, Spreading Crassula (*Crassula decumbens*) and Common Cotula (*Cotula australis*). Surprisingly, the lawn also includes a colony of the Trim Greenhood (*Pterostylis concinna*), which falls into the 'critically endangered' category of dying out in Maroondah.

Altogether, 117 naturally-occurring, indigenous plant species were observed in the reserve during this study.

There has been extensive revegetation in the reserve. The densest areas of surviving revegetation are in the reserve's southwest, southeast and northeast.

Relationship to other land

Of the fauna present in Warrien Reserve, all except frogs, small lizards and non-flying invertebrates would need to periodically travel elsewhere to fulfil their habitat needs. The observed seasonal presence of species such as the Grey Fantail demonstrates that forest birds are attracted to Warrien Reserve from other forested areas.

With few exceptions, properties and nature strips in the immediate neighbourhood are not at all suitable as habitat. Therefore, Warrien Reserve's fauna are restricted to species that can either live entirely within the reserve or are capable of moving through or over the largely inhospitable neighbourhood to reach habitat beyond. As seen on the key map of sites of biological significance on p. 1, the nearest sites are Site 49 (Palmer Avenue Reserve and adjacent land, 240 m northwest), Sites 50a and 50b (Exeter Ridge, 300 m northwest), Site 48 (Mulgrave Way Reserve, 400 m west-northwest), Site 46 (Birt Hill, 315 m west) and Site 45 (Birts Hill Reserve, 360 m southwest).

The few remnant indigenous trees and planted Australian native trees between those sites are presumed to make the landscape more permeable for birds and flying insects.

[*] According to the document, 'A History of Warrien Reserve' by the Warrien Reserve Committee of Management in 2012, available online.

Some of those fauna are also likely to carry pollen or seeds, thereby helping to maintain plant populations and their genetic viability.

Bioregion: Gippsland Plain except the Valley Grassy Forest in the northeast, which is in the Highlands - Southern Fall

As noted above, the state government's mapping of Ecological Vegetation Classes (EVCs) and bioregional boundaries is inaccurate in this vicinity.

Habitat types

The descriptions of vegetation below include only the most ecologically informative, naturally-occurring, indigenous plant species. Species that were detected in 1995–1997 but not this study are indicated with asterisks. *'EVC' means 'Ecological Vegetation Class'.*

Valley Grassy Forest (EVC 47, **Vulnerable** in the Highlands - Southern Fall bioregion) – 0.1 ha in the reserve's northeast.

Canopy trees: This EVC stands out because it is strongly dominated by Yellow Box (*Eucalyptus melliodora*), which is absent elsewhere in the reserve.

Lower trees: Black Wattle (*Acacia mearnsii*).

Other species: The understorey of this area has been so modified and planted with so many indigenous species that it has not been possible for many years to be confident about the natural understorey composition.

Valley Heathy Forest (EVC 127, **Endangered** in the Gippsland Plain bioregion) – 1.4 ha on the east-facing slope.

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*), Messmate Stringybark (*E. obliqua*) and Narrow-leaved Peppermint (*E. radiata*). Red Stringybark (*E. macrorhyncha*) is scattered but the number of dead trees of the species suggest that it was once more abundant.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*) and Black Wattle (*Acacia mearnsii*). Silver Wattle (*A. dealbata*) and Blackwood (*A. melanoxylon*) are fairly abundant.

Medium to large shrubs: Patchily dense and diverse in species. Large shrubs are dominated variously by Sweet Bursaria (*Bursaria spinosa*) or Common Cassinia (*Cassinia aculeata*). Medium shrubs are dominated by Hop Goodenia (*Goodenia ovata*) followed by Common Correa (*Correa reflexa*). The following species are widely scattered or abundant in certain areas: Prickly Currant-bush (*Coprosma quadrifida*), Common Heath (*Epacris impressa*), Snowy Daisy-bush (*Olearia lirata*), Tree Everlasting (*Ozothamnus ferrugineus*), Golden Bush-pea (*P. gunnii*) and Kangaroo Apple (*Solanum aviculare*). Of the less abundant shrubs species, the most ecologically informative are Myrtle Wattle (*Acacia myrtifolia*), Dandenong Range Cinnamon Wattle (*Acacia stictophylla*), Silver Banksia (*Banksia marginata*), Bushy Needlewood (*Hakea decurrens*), Yellow Hakea (*H. nodosa*), Manuka (*Leptospermum scoparium*) and Elderberry Panax (*Polyscias sambucifolia*).

Small shrubs: Depleted. As is normal for Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant, but Grey Parrot-pea (*Dillwynia cinerascens*) appears to have died out (perhaps temporarily). Common Beard-heath (*Leucopogon virgatus*) is a less common component of Valley Heathy Forest and also appears to have died out.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*S. quadridentatus*) are both fairly abundant.

Ferns: Austral Bracken (*Pteridium esculentum*) is abundant. Screw Fern (*Lindsaea linearis*) is scattered and Common Maidenhair (*Adiantum aethiopicum*) is scarce.

Climbers: Following the recent ecological burn, Downy Dodder-laurel (*Cassytha pubescens*) has become so dense in some areas as to represent a significant concern for the survival of many other species that it is smothering and parasitising. Common Apple-berry (*Billardiera mutabilis*), Twining Glycine (*Glycine clandestina*) and Purple Coral-pea (*Hardenbergia violacea*) are fairly abundant. Mountain Clematis (*Clematis aristata*), Small-leafed Clematis (*C. decipiens*) and Love Creeper (*Comesperma volubile*) are scarce.

Creepers: Ivy-leaf Violet (*Viola hederacea*) is abundant. Bidgee-widgee (*Acaena novae-zelandiae*), Trailing Goodenia (*Goodenia lanata*) and the wood-sorrel, *Oxalis exilis/perennans*, are fairly abundant.

Grasses, rushes and sedges: Abundant and fairly rich in species. Variously dominated by Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*) or Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*). Clustered Wallaby-grass (*R. racemosum*) is abundant in open areas. and Common Bog-rush (*Schoenus apogon*) are also abundant. Of the many other species, the most ecologically informative are Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Soft Tussock-grass (*P. morrisii*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Forest Wire-grass (*Tetrarrhena juncea*, recorded in 1995) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: The shrublets, Honeypots (*Acrotriche serrulata*) and Common Rice-flower (*Pimelea humilis*), are scarce. Forbs (essentially, non-woody wildflowers) are abundant and rich in species, particularly lilies. Among the forbs, the most ecologically informative species include Pale Grass-lily (*Caesia parviflora*), Blue Stars (*Chamaescilla corymbosa*), Large Tongue-orchid (*Cryptostylis subulata*), Common Wedge-pea (*Gompholobium huegelii*), Nodding Greenhood (*Pterostylis nutans*), Grass Trigger-plant (*Stylidium armeria*), Twining Fringe-lily (*Thysanotus patersonii*), Common Fringe-lily (*T. tuberosus*) and Cut-leaf Xanthosia (*Xanthosia dissecta*).

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion) – approximately 1 ha.

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Swamp Gum (*E. ovata*), with minor occurrence of Narrow-leaved Peppermint (*E. radiata*).

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*) and Swamp Paperbark (*Melaleuca ericifolia*).

Medium to large shrubs: Largely sparse but with some denser patches. Hop Goodenia (*Goodenia ovata*) is the densest and most widespread shrub. Other species includes Prickly Moses (*Acacia verticillata*), Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*), Yarra Burgan (*Kunzea leptospermoides*) and Manuka (*Leptospermum scoparium*). Yellow Hakea (*Hakea nodosa*) and Tree Everlasting (*Ozothamnus ferrugineus*) have been present in the past.

Small shrubs: None recorded.

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) is present in numbers likely to fluctuate from year to year.

Ferns: Austral Bracken (*Pteridium esculentum*) is localised. Swamp Selaginella (*Selaginella uliginosa*) was scarce in 1995–1997 and appears to have died out.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is scarce.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) and Ivy-leaf Violet (*Viola hederacea*) are fairly abundant. Centella (*Centella cordifolia*), Lanky Goodenia (*Goodenia elongata*) and Angled Lobelia (*Lobelia anceps*) were scarce in 1995–1997 but could not be found in this study's brief search for them.

Grasses, rushes and sedges: Abundant, dominated variously by Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or Thatch Saw-sedge (*Gahnia radula*). Ecologically-informative species include Pale Twig-rush* (*Baumea acuta*), Red-fruit Saw-sedge (*G. sieberiana*), club-rushes* (*Isolepis hookeriana, I. platycarpa*), rushes* (*Juncus pallidus, J. planifolius*), Tall Sword-sedge (*Lepidosperma elatius*), Sword (or Purple-sheathed) Tussock-grass* (*Poa ensiformis*), Slender Tussock-grass* (*P. tenera*), Smooth Wallaby-grass (*Rytidosperma laeve*), Slender Wallaby-grass (*R. penicillatum*), Tasmanian Wallaby-grass* (*R. semiannulare*), Common Bog-rush (*Schoenus apogon*) and Slender Bog-rush* (*Schoenus lepidosperma*).

Other groundcover: Depleted due to past drainage works and revegetation. The only surviving species observed in the brief search of this study was Tasman Flax-lily (*Dianella tasmanica*). Ecologically informative species that were recorded previously include Swamp Daisy (*Allittia cardiocarpa*), Large Tongue-orchid (*Cryptostylis subulata*), Long Purple-flag (*Patersonia occidentalis*) and the globe-pea, *Sphaerolobium minus*.

Swampy Riparian Woodland (EVC 83, **Endangered** in the Gippsland Plain bioregion),
Swampy Riparian Complex (EVC 126, **Endangered** in the Gippsland Plain bioregion) and
Stream channel (no EVC number or conservation status available)
– c. ½ ha total along the creeks.

Dominant canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*). Mealy Stringybark (*Eucalyptus cephalocarpa*) and Messmate Stringybark (*Eucalyptus obliqua*) are also present.

Lower trees: Dominated in different areas by Blackwood (*Acacia melanoxylon*) or Swamp Paperbark (*Melaleuca ericifolia*). Silver Wattle (*A. dealbata*) and Black Wattle (*Acacia mearnsii*) are also fairly abundant. Cherry Ballart (*Exocarpos cupressiformis*) is scarce.

Medium to large shrubs: Dominated variously by Prickly Currant-bush (*Coprosma quadrifida*) or Elderberry Panax (*Polyscias sambucifolia*). Hop Goodenia (*Goodenia ovata*) is also abundant. Other species that are fairly abundant include Prickly Moses (*Acacia verticillata*), Common Cassinia (*Cassinia aculeata*), Yarra Burgan (*Kunzea leptospermoides*), Snowy Daisy-bush (*Olearia lirata*), Tree Everlasting (*Ozothamnus ferrugineus*) and Kangaroo Apple (*Solanum aviculare*).

Small shrub: None recorded.

Ferns: Austral Bracken (*Pteridium esculentum*) forms extensive, dense patches.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is scarce.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is abundant.

Grasses, rushes and sedges: Abundant. The most abundant species are Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Green Rush (*Juncus gregiflorus*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) and (in open areas) Clustered Wallaby-grass (*Rytidosperma racemosum*). The following species are fairly abundant or widespread: Australian Sweet-grass (*Glyceria australis*), Pale Rush (*Juncus pallidus*), Tall Rush (*J. procerus*), Tall Sword-sedge (*Lepidosperma elatius*) and Weeping Grass (*Microlaena stipoides*). Other ecologically-informative species include Tall Sedge (*Carex appressa*), Common Spike-rush* (*Eleocharis acuta*), Hollow Rush (*Juncus amabilis*), Loose-flower Rush (*J. pauciflorus*), Broad-leaf Rush* (*J. planifolius*), Broom Rush (*J. sarophorus*), Common Blown Grass (*Lachnagrostis filiformis*), Common Reed* (*Phragmites australis*) and Slender Tussock-grass* (*P. tenera*).

Aquatic or semi-aquatic herbs: Lesser Joyweed (*Alternanthera denticulata*) and Slender Knotweed (*Persicaria decipiens*) are abundant. Water Plantain (*Alisma plantago*-aquatica) was present in 1995–1997 but not detected in this study.

Other groundcover: Depleted due to past drainage works and revegetation. Tasman Flax-lily (*Dianella tasmanica*) is dominant in some areas and Hairy Willow-herb (*Epilobium hirtigerum*) is abundant. Common Cudweed (*Euchiton involucratus*) is scarce. At least ten other indigenous forbs were recorded in 1995–1997 but not in this study. They included Pale Grass-lily (*Caesia parviflora*), Pale Flax-lily (*Dianella longifolia*) and Streaked Arrow-grass (*Triglochin striatum*).

Significant plants

Rare (but not otherwise threatened)

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. Warrien Reserve has small numbers of the species in the Valley Heathy Forest, having regenerated following an ecological burn in 2015. It is possible that those plants may be offspring of planted plants, as the species had not been recorded as growing naturally in the reserve in plant lists before this study.

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* is listed by the Victorian Government as 'Rare but not otherwise threatened'. It was recorded in the Swampy Woodland in 1997 without an indication of population size. This study only detected the common *Austrostipa rudis* subsp. *rudis* but the rare subsp. *australis* could have escaped detection due to the times of year of the surveys.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Warrien Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Allittia cardiocarpa* (Swamp Daisy) – two plants were detected in 1995–1997 but not in this study; probably died out;
- *Banksia marginata* (Silver Banksia) – eleven seedlings or suckers were detected in the sanctuary during this study within the area of the 2015 ecological burn;
- *Baumea acuta* (Pale Twig-rush) – two patches were detected in 1995–1997 but could not be found in this study's brief search. The habitat still seems suitable;
- *Caladenia carnea* (Pink Fingers) – recorded by Llywellyn Staiff in the sanctuary in 2014 and/or 2015, numbers unknown;
- *Correa reflexa* var. *reflexa* (Common Correa) – abundant in the Valley Heathy Forest, having regenerated well following the 2015 ecological burn. There are also hybrids with garden correas, which pose a serious threat to the survival of the indigenous population;
- *Eucalyptus macrorhyncha* (Red Stringybark) – scattered in the Valley Heathy Forest, plus quite a few dead individuals;
- *Gompholobium huegelii* (Common Wedge-pea) – 'a few plants' were reported in a 1997 management plan (Lorimer & Moss 1997). They have probably died out;
- *Goodenia elongata* (Lanky Goodenia) – one patch was found in the Swampy Woodland in 1995–1997, unable to be found in this study's brief search;
- *Hakea decurrens* (Bushy Needlewood) – over a dozen plants were seen in the sanctuary during this study, following the 2015 ecological burn. The parents were planted by Llywellyn Staiff, having been raised from seeds collected at Bungalook Conservation Reserve, Kilsyth South (Site 66);
- *Hakea nodosa* (Yellow Hakea) – one wild seedling and a number of planted plants were detected during this study;
- *Poa tenera* (Slender Tussock-grass) – recorded in 1995–1997 but not detected in this study;
- *Pterostylis concinna* (Trim Greenhood) – a pot of plants of this species was planted northeast of the toilets beneath the Sugar Gums roughly ten years ago by Llywellyn Staiff and they have increased to approximately 50 plants;
- *Schoenus lepidosperma* (Slender Bog-rush) – 'a few clumps' were recorded on the downhill edge of the sanctuary in 1995–1997 but none were detected in this study;
- *Selaginella uliginosa* (Swamp Selaginella) – a patch measuring 0.3 m × 1 m was recorded in 1995–1997 but the species was not detected in this study and it has probably died out;
- *Senecio minimus* (Shrubby Fireweed) – abundant in much of the reserve;
- *Solanum aviculare* (Kangaroo Apple) – fairly abundant in much of the reserve;
- *Sphaerolobium minus* (Globe-pea) – recorded at the northern end of the Swampy Woodland in 1995–1997 it has but probably died out since;
- *Wahlenbergia gymnoclada* (Naked Bluebell) – recorded in the sanctuary in 1995–1997, possibly overlooked in this study.

Significant fauna

The following locally-rare species were observed at Warrien Reserve during this study:

- White-browed Scrubwren – one bird seen and heard;
- Grey Fantail – two birds seen and heard.

There is also a substantial population of an unidentified, dark-coloured skink that is probably locally rare. It was observed along the creek near the northern picnic shelter. A targeted survey is recommended.

Kangaroos are intermittently present, which would have been regarded as significant a few years ago but has since become fairly common through most of Maroondah.

Other locally significant fauna may easily have escaped detection during this study.

Fauna habitat

- The creeks and standing water provide habitat for frogs and aquatic invertebrates;
- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, possums and invertebrates. That habitat benefits from the fertility of the alluvium along the creeks, which favours high production of carbohydrates by plants and hence strengthens the base of the food chain;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

An ecological burn of almost 1 ha in and near the sanctuary two years prior to this study confounded assessment of the vegetation's ecological condition. Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the burn area appeared to vary between rating 'A' (excellent) and 'B' (good), with small areas possibly 'C' (fair).

The remaining EVC areas outlined in orange on the aerial photograph on p. 348 overwhelmingly fit rating 'C' (fair).

The health of the eucalypt canopy in the Valley Heathy Forest is poor, with signs of excessive possum browsing. Elsewhere, the eucalypt canopy is in generally fair to good health.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

Each EVC in Warrien Reserve except Valley Grassy Forest easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Those EVCs are all endangered within the relevant bioregion (the Gippsland Plain). Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The reserve has a possibly viable population of Dandenong Range Cinnamon Wattle (*Acacia stictophylla*), although it may be from offspring of planted plants. That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance unless they are deemed to be unnatural.

The following plant species that fall into the 'critically endangered' category of dying out in Maroondah have apparently viable populations in the reserve: *Correa reflexa*, *Eucalyptus macrorhyncha*, *Hakea decurrens*, *Senecio minimus* and *Solanum aviculare*. They fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable

management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

The section above headed 'Relationship to other land' describes how fauna move between Warrien Reserve and other sites of biological significance. Because of these movements, the reserve fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of the Dandenong Range Cinnamon Wattle and the EVCs present.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the reserve or living in neighbouring homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The reserve's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the reserve into surrounding streets and gardens.

The natural ambience also encourages people to get exercise by walking or running through the reserve.

The reserve preserves something of the area's natural landscape. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

While the volunteers who work in the reserve provide ecological benefits to the bushland, the bushland reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there has been no detectable change in the extent of habitat in Warrien Reserve during that period.

Change in the plant species present

As is apparent from the section above headed 'Significant flora', many locally or regionally rare plant species appear to have died out in Warrien Reserve. Most of those species are plants of the Swampy Woodland and creeks. The main causes for disappearance appear to have been drainage works and revegetation (e.g. mulching over some rare plants and digging others up to facilitate planting). The Millennium Drought was probably also a significant factor.

Conversely, this study found several wild, indigenous plant species that were not detected in the previous flora surveys. A few of the new discoveries may be offspring of planted plants. Others have been stimulated to germinate by an ecological burn in 2015.

Change in the ecological condition of habitat

The author's ecological surveys of the reserve in 1995–1997 recorded that the creeks supported little native vegetation other than mature trees, due to recent drainage works. Since then, revegetation and natural regeneration have grown up to form a much more natural vegetation structure. The flora of the creek channels remains rather unnatural.

Revegetation in the reserve's northeast, southeast and southwest corners has also improved the vegetation structure in those areas.

The 2015 ecological burn in the northwest has stimulated a great deal of natural regeneration, including locally rare plants. At this stage of the regeneration cycle, it is not possible to compare the vegetation's ecological condition with prior work, except to say that the eucalypt canopy is significantly depleted.

Eucalypt deaths and debilitation has affected the whole reserve, as has been common in Maroondah. The Valley Heathy Forest is the worst affected part of the reserve. Aerial photographs from 2001, 2011 and 2017 show that many eucalypts died between 2001 and 2011, attributable to the Millennium Drought. A smaller number of eucalypts appear to have died since 2011. The surviving eucalypt canopy is in poor health.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued drying of the winter-sodden soils of the lower-lying parts of the reserve due to climate change and the legacy effects of past drainage works, leading to decline of the vegetation and its dependent fauna;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. Deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Displacement of indigenous flora and their dependent fauna in the 2015 burn area by rampant growth of hybrid correas or Downy Dodder-laurel (*Cassytha pubescens*).

Strategic planning

The reserve is zoned 'Public Conservation and Resource Zone'. Tree removal is controlled by Schedule 4 of the Significant Landscape Overlay. Removal of native vegetation (trees or otherwise) comes under the state-wide controls of clause 52.17 of the Victoria Planning Provisions as well as the Vegetation Protection Overlay (VPO).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to replace the VPO with the proposed schedule ESO1, with the slightly modified boundary in the northeast corner as outlined in mid-blue on the aerial photograph on p. 348.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of approximately 8½ hours of fieldwork by the author for this study on 7/6/17, 14/6/17, 21/11/17, 21/2/18, 2/3/18 and 17/8/19, including: (a) compiling a list of indigenous and introduced plant species (including mosses and liverworts) and their abundances for each of five parts of the reserve (the sanctuary, the rest of the Valley Heathy Forest, the Valley Grassy Forest, the Swampy Woodland and the Swampy Riparian Woodland/Complex); (b) documenting the details of rare or scarce plants; (c)

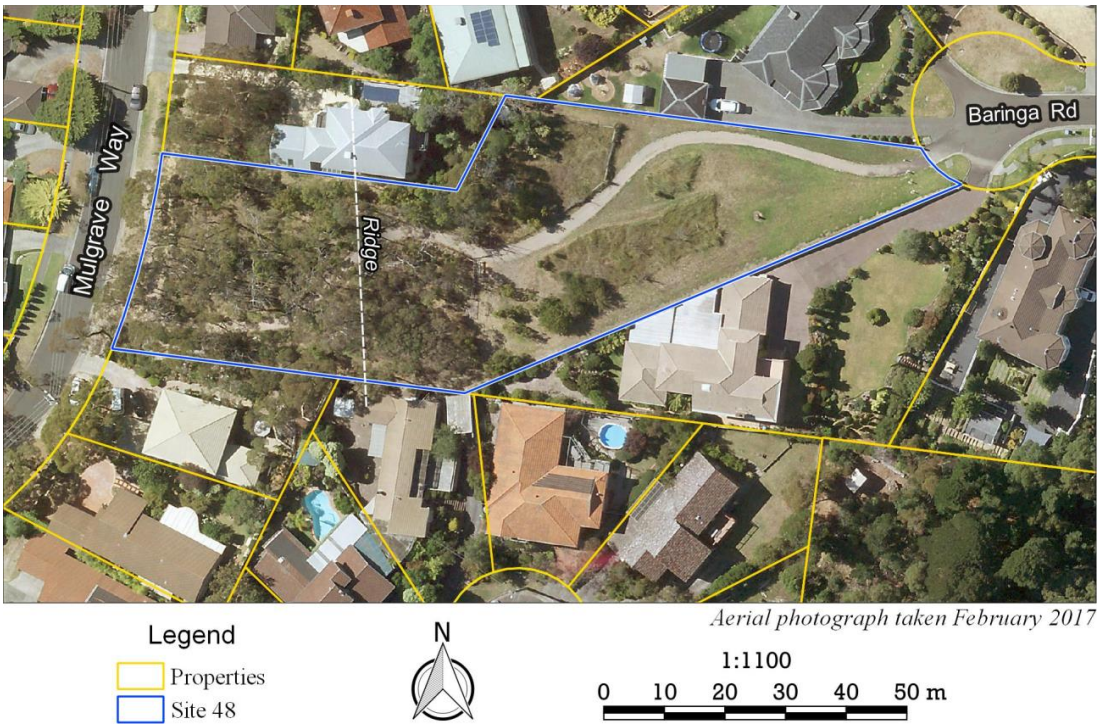
mapping the vegetation and rare plants; and (d) recording fauna observed incidentally (29 vertebrate species and 7 butterfly species);

- Information from Llywellyn Staiff (former bushland manager in the reserve) for information about several plant species in the reserve, including the planted origins of the *Pterostylis concinna* and the parents of the *Hakea decurrens*;
- Maroondah City Council's records of planting in the reserve;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and the *'Warrien Reserve Management Plan, 1997'* (Lorimer & Moss 1997). The relevant fieldwork for both documents was done in December 1995 and comprised: (a) compiling a list of indigenous and introduced plant species (without abundances) for each of four parts of the reserve; (b) documenting basic information about rare or scarce plants; (c) mapping the vegetation; (d) a 20-minute bird census; (e) a mammal hair survey with two hair-tubes; (f) spotlighting; (g) a frog call survey; and (h) incidental fauna observations;
- A May 1988 record in the online Victorian Biodiversity Atlas of c. 100 Victorian Smooth Froglets observed by Steve Rowe;
- A quadrat (no. B1829800 in the online Victorian Biodiversity Atlas database) by Jane Ellis in December 1986. Note that her record of *Xanthosia pusilla* is a clear misidentification of *X. dissecta* and *Eucalyptus viminalis* should presumably have been *Eucalyptus ovata*;
- An anonymous, rather cursory list of 35 plant species or genera (no. T1565400 in the Victorian Biodiversity Atlas) said to have been from February 1959. However, some of the species could not possibly have been seen in February (e.g. species of *Calochilus* and *Diuris*) and some of the records are fairly clearly misidentifications (e.g. *Bossiaea cinerea*).
- A slightly pruned version of the list just mentioned (no. T4055100 in the Victorian Biodiversity Atlas), this time attributed to the government botanist Jim H. Willis on 29/10/68 but still with evident errors; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No other useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Site 48. Mulgrave Way Reserve, Croydon North

Biological Significance Level: *Local*



Aerial photograph taken February 2017

Boundary

The site coincides exactly with the council bushland reserve at 16 Mulgrave Way, Croydon North. The easternmost 20 m of the reserve is not of biological significance now but is included because of its potential for expanding the area of habitat in future, which would increase the site's ecological viability.

Land use and tenure

Mulgrave Way Reserve is a council reserve managed to conserve the indigenous flora and fauna, with a path to allow pedestrian passage between Mulgrave Way and Baringa Road.

General description

Mulgrave Way Reserve occupies 0.4 hectares, straddling the north-south Exeter Ridge. Most of the forested area is almost flat, on top of the ridge. However, there is a steep, west-facing cutting next to Mulgrave Way and a moderate slope (1:6) over most of the reserve's eastern half.

The vegetation is regrowth of two ages, separated by a north-south line through the bend in the southern boundary. In the west, the sizes of eucalypt trunks suggest the regrowth is approximately 35–40 years old. Further east, the regrowth dates to c. 1994.

The older regrowth is in excellent ecological condition, with a rich range of plant species. The younger regrowth suffered badly from the Millennium Drought and has been outcompeted to a substantial degree by introduced plants and the vigorous indigenous species, Thatch Saw-sedge (*Gahnia radula*).

A total of seventy-eight naturally-occurring, indigenous plant species were observed in the reserve during this study.

Relationship to other land

The front yard of the house to the north is in excellent condition, like the abutting part of the reserve. It is not included in this site because it was not surveyed in this study and it is probably not appropriate to apply a planning overlay to it.

Being only 0.4 ha in size and having no water, Mulgrave Way Reserve is too small to provide the full habitat needs for nearly all wildlife except Garden Skinks and non-flying invertebrates.

Mulgrave Way Reserve lies on the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, there is a sequence of sites of biological significance at intervals along the ridge. The areas of native vegetation closest to Mulgrave Way Reserve are Tadji Close Reserve (100 m to the south), followed by Palmer Avenue Reserve (Site 49, 170 m northeast) and Warrien Reserve (Site 47, 400 m east-southeast). It is expected (without direct observational evidence) that birds move along the ridge, using the sites (including Mulgrave Way Reserve) as ecological stepping-stones.

The gaps between Mulgrave Way Reserve and the nearby sites are small enough not to deter passage by most native birds, bats and flying insects, allowing pollen to be exchanged. However, species with lower mobility, such as most lizards and invertebrates, would find the intervening urbanised landscape too hostile to traverse.

Bioregion: Highlands - Southern Fall

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Grassy Dry Forest (Ecological Vegetation Class no. 22, 'Least concern' in the bioregion), tending toward Valley Heathy Forest (EVC no. 127) in the east

Canopy trees: Dominated by Red Stringybark (*Eucalyptus macrorhyncha*). The only other eucalypt is Bundy (*E. goniocalyx*), which is moderately abundant west of the ridge and scarce further east. The regrowth to the east of the fenced areas contained seedlings of Messmate Stringybark (*E. obliqua*) in 1998 but they died in the Millennium Drought.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Lightwood (*Acacia implexa*) and a few Black Wattle (*A. mearnsii*) are also present. Golden Wattle (*A. pycnantha*) was present in the 1996 flora survey but not in 1998 or this study.

Medium to large shrubs: Moderately dense and fairly rich in species. Dominated by Common Cassinia (*Cassinia aculeata*). The following species are also fairly abundant: Myrtle Wattle (*Acacia myrtifolia*), Dandenong Range Cinnamon Wattle (*A. stictophylla*), Common Correa (*Correa reflexa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*) and Yarra Burgan (*Kunzea leptospermoides*). The abundance of most of those species has been boosted by planting. Other medium to large shrub species are scarce.

Small shrubs: Fairly abundant and rich in species, represented mostly by Grey Parrot-pea (*Dillwynia cinerascens*), Common Flat-pea (*Platylobium obtusangulum*) and Pink-bells (*Tetratheca ciliata*). (Most of the *Tetratheca* appear to have been planted but some may be from the small wild population recorded in 1996.) Tangled Guinea-flower (*Hibbertia empetrifolia*) is probably only present due to planting. Common Beard-heath (*Leucopogon virgatus*) was recorded in 1998.

Shrubby herbs: Rock Fireweed (*Senecio phelleus*) and Cotton Fireweed (*Senecio quadridentatus*) are abundant.

Ferns: Absent.

Climbers: Downy Dodder-laurel (*Cassytha pubescens*) is fairly abundant. Common Apple-berry (*Billardiera scandens*) was present in 1998 but appears to have died out (probably temporarily).

Creepers: Fairly abundant, the most abundant species being Kidney-weed (*Dichondra repens*), Purple Coral-pea (*Hardenbergia violacea*) and Ivy-leaf Violet (*Viola hederacea*). The wood-sorrel *Oxalis exilis / perennans* is scarce and there is a single Running Postman (*Kennedia prostrata*).

Grasses, rushes and sedges: Moderately dense and quite rich in species, dominated variously by Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*), Kneed Wallaby-grass (*Rytidosperma geniculatum*) or Red-anther Wallaby-grass (*Rytidosperma pallidum*). Forest Wire-grass (*Tetrarrhena juncea*) is fairly abundant in the east, reflecting the vegetation's tendency toward Valley Heathy Forest. Eighteen other wild, indigenous grassy species were recorded in smaller numbers, the most ecologically informative being Variable Sword-sedge (*Lepidosperma laterale*), Grey Tussock-grass (*Poa sieberiana*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Black-anther Flax-lily (*Dianella revoluta*) is the dominant groundcover in part of the reserve. Other abundant species include Milkmaids (*Burchardia umbellata*), Slender Onion-orchid (*Microtis parviflora*) and the sun-orchid, *Thelymitra* ?*peniculata*. The liverwort, Green Worms (*Chiloscyphus semiteres*), is dense over substantial areas and mosses are fairly abundant. Species of lily and sundew are fairly abundant.

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. There are three individuals in Mulgrave Way Reserve. They may have been planted, as a 1998 flora survey recorded only planted individuals of the species. The species occurs naturally at all nearby sites of biological significance (Sites 45–51).

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Mulgrave Way Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Correa reflexa* (Common Correa) – approximately eleven west of the ridge and two east of the ridge. There are also approximately three hybrids with garden correas, so hybridisation threatens the natural gene pool;
- *Eucalyptus macrorhyncha* (Red Stringybark) – the dominant species; approximately 48 were counted;
- *Hibbertia empetrifolia* subsp. *empetrifolia* (Tangled Guinea-flower) – scarce and probably only present from planting;
- *Juncus flavidus* (Gold Rush) – one plant was recorded in the 1998 flora survey; and
- *Kennedia prostrata* (Running Postman) – one plant was found in this study on the ridgeline.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats and invertebrates but the small area of habitat limits the abundance of fauna;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.1 ha rates 'A' (or excellent), 0.1 ha rates 'B' (or very good) and 0.1 ha rates 'C' (or fair).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local (or State if the three Dandenong Range Cinnamon Wattles were not planted)

Threatened plant species

Mulgrave Way Reserve has three plants of Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. These attributes meet standard criterion 3.1.2 for a site of State significance if the plants are natural but that is quite likely not the case, as the species was absent in both previous flora surveys (1996 and 1998).

Referring to the section above headed 'Significant plants', the reserve's populations of *Correa reflexa* and *Eucalyptus macrorhyncha* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological Vegetation Class

The area of native vegetation in the reserve is large enough to meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The patch contains Grassy Dry Forest, whose conservation status is listed by the state government as 'least concern' within the relevant bioregion. The author is confident that if a 'habitat score' were determined, it would be less than 0.6. It follows that the patch meets standard criterion 3.2.3 for a site of Local significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Mulgrave Way Reserve fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The reserve's overall 'State' significance rating differs from the 'high Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of the Dandenong Range Cinnamon Wattle, which had not even been described as a species in 1997.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. These effects of microclimate moderation benefit people visiting the reserve or living next-door. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The reserve's natural ambience is expected to contribute in a small way to the enjoyment, health, wellbeing, childhood development and quality of life of visitors to the reserve.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the reserve into neighbouring streets and gardens.

The reserve preserves something of the area's natural landscape. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there has been no significant loss of native vegetation over that period.

Changes in the species present

Nearly all of the naturally-occurring, indigenous plant species recorded in 1996 and 1998 remain. The few losses have been outweighed by a larger number of gains, with a net increase of approximately eight species.

Change in the ecological condition of habitat

With the exception of a small strip on the southern fringe that has become occupied by a neighbour's garden, the ecological condition of the vegetation west of the ridgeline has remained excellent since 1996. The vegetation east of the ridgeline has declined from rating 'A' (excellent) in 1996 to being partly 'B' and partly 'C' now. Mowing is supressing the condition of vegetation east of the bend in the reserve's southern boundary.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Encroachment of the reserve by a residential garden to the south;
- Displacement of indigenous plants by introduced plants (except that this is being controlled by council staff);
- Hybridisation of the natural Common Correas with garden Correas; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The reserve is zoned 'Public Park and Recreation Zone'. Tree removal is controlled by Schedule 3 of the Significant Landscape Overlay and removal of native vegetation is controlled by the Vegetation Protection Overlay (VPO).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the reserve and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 48 as outlined in blue on the aerial photograph on p. 358.

Planting recommendation

To reduce the tree canopy gap between Mulgrave Way Reserve and Palmer Avenue Reserve (Site 49), it would be desirable to plant a few eucalypts (*Eucalyptus obliqua* and *E. macrorhyncha*) in the lawn at the eastern end of the reserve, and another eucalypt as a street tree (e.g. *E. melliodora*) in front of 1 Crestview Court.

Information sources

The analysis above draws on the following sources of information about the site:

- 4¾ hours of ecological survey for this study by the author and Leigh Kett on 25/8/17, followed-up by a half-hour inspection on 27/6/19 for ground-truthing and to detect seasonal species. The fieldwork included: (a) compiling separate lists of indigenous plant species (including mosses and liverworts) for the west-facing and east-facing halves of the site; (b) documenting the details of rare or scarce plants; (c) mapping the vegetation and rare plants; and (d) recording birds and lizards observed incidentally;
- Maroondah City Council's records of planting in the reserve;
- *'Mulgrave Way Reserve Management Plan, 1998'* (Lorimer 1998g), which was based on about one day of fieldwork to map and document the reserve's vegetation, scarce species and ecological condition;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve included a flora survey by Helen Moss on 3/4/96 that produced two plant lists; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the VBA, Atlas of Living Australia or eBird.

Site 49. Palmer Avenue Reserve & Adjacent Land, Croydon North

Biological Significance Level: *State* due to the presence of a rare species of wattle



Boundary

Site 49 includes most of Palmer Avenue Reserve (27 Baringa Road, Croydon North) as well as a 60-metre-long stretch of nature strip beside Palmer Avenue and parts of five adjacent residential properties. The boundary is shown as a dashed blue line above and, as with all sites in the volume, it is available in a shapefile for geographic information systems. The boundary differs from the original (1997) version of Site 49 in *'Sites of Biological Significance in Maroondah'* to improve mapping accuracy and respond to the development of 26 Palmer Avenue and rehabilitation of native vegetation in the reserve.

Land use and tenure

Palmer Avenue Reserve is a council reserve managed to conserve the indigenous flora and fauna, with paths to allow pedestrian passage between Elana Court and Palmer Avenue. The rest of Site 49 is on private residential lots of 1,587–2,051 m², each with one dwelling.

General description

Site 49 occupies 1.17 hectares of forest on the Wicklow Hill ridge. Palmer Avenue Reserve has the spine of the ridge running north-south just inside its western boundary, reaching an elevation of 165 m. The eastern half of the reserve and the abutting 26 Palmer Avenue have a fairly steep gradient (1:3) to the east. The parts of the site in 23 & 25 Baringa Road slope to the southeast at a similar gradient. The site's southwest corner faces south with a slope of approximately 1:5. The soil is shallow and stony.

In 1997, the reserve's understorey within 40 m of the northern boundary was described as being dominated by the environmental weed, Sallow Wattle (*Acacia longifolia* subsp. *longifolia*), also with the declared noxious weed, Boneseed (*Chrysanthemoides monilifera*). A concerted effort has reduced those species to small numbers and indigenous plants have regenerated well. Further south, about one quarter of the reserve has a thicket of regrowth of Burgan (*Kunzea leptospermoides*) with sparse undergrowth that includes Maroondah's largest colony of Small Gnat-orchid (*Acianthus pusillus*), estimated at 250 plants. The most natural part of the reserve, with a number of locally or regionally rare plant species, lies in the corner next to 26 Palmer Avenue and 23 & 25 Baringa Road. Vegetation of comparable significance extends into those adjoining properties, though the indigenous species are being suppressed on 23 Baringa Road by pines and associated weeds.

The small parts of 29 Baringa Road and 4 Crestview Court that lie within Site 49 have a canopy of indigenous trees but fewer indigenous understorey species than the abovementioned areas.

The reserve's narrow, eastern neck to Palmer Avenue has some wild, indigenous trees and patches of wild, indigenous understorey but most of the vegetation is revegetation with a high cover of introduced groundcover species.

Altogether, seventy-two naturally-occurring, indigenous plant species were observed in the site during this study's midwinter ecological survey. Additional species would be found in spring and summer.

Relationship to other land

Because Site 49 occupies only 1.2 hectares and has no water, its fauna species other than small lizards and non-flying invertebrates would need to periodically travel elsewhere to fulfil their habitat needs. The presence of forest birds and flying insects such as butterflies relies on the ability to use habitat in the abutting Site 50a and/or reach habitat in other forest areas.

Fortunately, As can be seen on the key map on p. 1, Site 49 is well connected to other sites of biological significance along the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont. Site 50a abuts Site 50b, which is separated from Hochkins Ridge Nature Conservation Reserve (Site 51) only by Exeter Road. Other substantial areas of habitat abut or almost adjoin Site 51 to the north and northwest, some of them extending into Manningham municipality.

To the southwest of Site 49, Mulgrave Way Reserve (Site 48) is 170 m away and Tadji Close Reserve (in Site 46) is 260 m away. To the southeast (at the foot the ridge), Warrien Reserve (Site 47) lies 240 m away.

It is expected (without direct observational evidence) that birds move between all these sites, with each site acting as an ecological stepping-stone.

The movements of birds and flying insects between the sites spread pollen and seeds, thereby improving the reproduction and genetic diversity of indigenous flora.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Grassy Dry Forest (EVC 22, 'Least concern' in the bioregion), tending toward Valley Heathy Forest (EVC 127) in the east

Canopy trees: Dominated by Red Stringybark (*Eucalyptus macrorhyncha*). Bundy (*E. goniocalyx*) is fairly abundant. Messmate Stringybark (*E. obliqua*) is scarce and there are two White Stringybarks (*E. globoidea*).

Lower trees: Cherry Ballart (*Exocarpos cupressiformis*) is the only sub-canopy tree recorded and it is abundant.

Medium to large shrubs: Variably dense and fairly rich in species. Yarra Burgan (*Kunzea leptospermoides*) forms a dense thicket over a substantial area of the reserve. Elsewhere, Shiny Cassinia (*Cassinia longifolia*) is dominant. The following species are fairly abundant: Hedge Wattle (*Acacia paradoxa*), Dandenong Range Cinnamon Wattle (*A. stictophylla*), Hop Wattle (*A. stricta*), Sweet Bursaria (*Bursaria spinosa*), Sifton Bush (*Cassinia sifton*) and Narrow-leafed Bitter-pea (*Daviesia leptophylla*). Common Cassinia (*Cassinia aculeata*) and Common Heath (*Epacris impressa*) are scarce. The abundance of the local form of Common Correa (*Correa reflexa*) is hard to determine due to a mixture with a range of hybrids and cultivars, but around 5–10 plants appear consistent with the local form.

Small shrubs: The only species in substantial numbers is Common Flat-pea (*Platylobium obtusangulum*). The others are Grey Parrot-pea (*Dillwynia cinerascens*), Tangled Guinea-flower (*Hibbertia empetrifolia*) and Pink-bells (*Tetratheca ciliata*).

Shrubby herbs: Clustered Everlasting (*Chrysocephalum semipapposum*), Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*Senecio quadridentatus*) are fairly abundant.

Ferns: Austral Bracken (*Pteridium esculentum*) forms a dense patch in the northeast of the reserve.

Climbers: Downy Dodder-laurel (*Cassytha pubescens*) is fairly abundant. The following species are scarce: Common Apple-berry (*Billardiera scandens*), Small-leafed Clematis (*Clematis decipiens*), Love Creeper (*Comesperma volubile*), Twining Glycine (*Glycine clandestina*), Purple Coral-pea (*Hardenbergia violacea*) and Twining Fringe-lily (*Thysanotus patersonii*). The non-indigenous Wonga Vine (*Pandorea pandorana*) is similarly abundant to the indigenous climbers put together.

Creepers: Kidney-weed (*Dichondra repens*) forms substantial, dense patches. The wood-sorrel *Oxalis exilis / perennans* is fairly abundant. A crane's-bill (*Geranium* species) is scarce and localised.

Grasses, rushes and sedges: Moderately dense and quite rich in species. The most abundant species is Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), followed by Weeping Grass (*Microlaena stipoides*), Kneed Wallaby-grass (*Rytidosperma geniculatum*) and Clustered Wallaby-grass (*R. racemosum*). The following species are fairly abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Short-stem Sedge (*Carex breviculmis*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*), Red-anther Wallaby-grass (*Rytidosperma pallidum*), Purplish Wallaby-grass (*R. tenuius*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*). Finger Rush (*Juncus subsecundus*), Slender Sword-sedge (*Lepidosperma gunnii*) and Variable Sword-sedge (*Lepidosperma laterale*) are scarce.

Other groundcover: Moderately rich in species. Black-anther Flax-lily (*Dianella revoluta*) is a dominant groundcover species in parts of the reserve. Other abundant species include Honeypots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Button Everlasting (*Coronidium scorpioides*), Pale Flax-lily (*Dianella longifolia*) and Common Raspwort (*Gonocarpus tetragynus*). Common Cotula (*Cotula australis*) is abundant in the lawn on the reserve's western edge, accompanied by *Crassula decumbens*. Two colonies of Small Mosquito Orchid (*Acianthus pusillus*) were found, the larger containing around 250 plants. Other species are scarce.

Grassy Forest (EVC 128, **Vulnerable** in the bioregion)

Canopy trees: Dominated by Red Stringybark (*Eucalyptus macrorhyncha*) and Messmate Stringybark (*E. obliqua*). Bundy (*E. goniocalyx*) and Narrow-leaved Peppermint (*E. radiata*) are less abundant and there is a single White Stringybark (*E. globoidea*).

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Black Wattle (*Acacia mearnsii*) and Golden Wattle (*Acacia pycnantha*) are scarce.

Medium to large shrubs: Greatly depleted. Wild, indigenous species are represented only by Yarra Burgan (*Kunzea leptospermoides*).

Small shrubs: Greatly depleted. Wild, indigenous species are represented only by Grey Parrot-pea (*Dillwynia cinerascens*).

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*S. quadridentatus*) are both fairly abundant.

Ferns: Austral Bracken (*Pteridium esculentum*).

Climbers: Wonga Vine (*Pandorea pandorana*) is dense but can be regarded as an environmental weed rather than indigenous to the site.

Creepers: None seen.

Grasses, rushes and sedges: Greatly depleted, particularly in numbers of species. Dominated variously by Thatch Saw-sedge (*Gahnia radula*) or Weeping Grass (*Microlaena stipoides*), followed by Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Clustered Wallaby-grass (*Rytidosperma racemosum*) and Purplish Wallaby-grass (*R. tenuius*).

Other groundcover: Greatly depleted. The only species seen in this study were Black-anther Flax-lily (*Dianella revoluta*), Pale Flax-lily (*D. longifolia*) and Grass Trigger-plant (*Stylidium armeria*), none of which are abundant.

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. Ten individuals were counted in the reserve in 2019. There is also a rare hybrid *Acacia stictophylla* × *stricta* in the reserve.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 49 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acianthus pusillus* (Small Mosquito Orchid) – this study discovered a colony of 5 and a colony of approximately 250 in the reserve. This represents the largest known population of the species in Maroondah;
- *Chrysocephalum semipapposum* (Clustered Everlasting) – dozens were detected in this study, mostly in the reserve;
- *Correa reflexa* (Common Correa) – approximately 5–10 of the indigenous form are scattered through the site, intermixed with hybrids that may be offspring of the local form after pollination from garden plants;
- *Eucalyptus globoidea* (White Stringybark) – two grow right on the hilltop and one in the narrow neck adjoining Palmer Avenue;
- *Eucalyptus macrorhyncha* (Red Stringybark) – abundant, the dominant species throughout;
- *Hibbertia empetrifolia* (Tangled Guinea-flower) – five were counted in this study;
- *Persoonia juniperina* (Prickly Geebung) – recorded in 1996 but not detected in this study; and
- *Pultenaea forsythiana* (Eastern Prickly Bush-pea) – recorded in 1996 but not detected in this study.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats and invertebrates but the small area of indigenous understorey limits the abundance of fauna;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The corridor of treed habitat that extends along the Wicklow Hill ridge through the site amplifies the habitat values above; and

- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.1 ha rates 'A' (or excellent), 0.4 ha rates 'B' (or very good), 0.3 ha rates 'C' (or fair) and 0.35 ha rates 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Threatened plant species

The reserve has an apparently quite viable population of at least ten Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance. However, note that the plants at the reserve may all be either planted or descendants of planted individuals – see the section above headed 'Significant plants'.

Referring to the section above headed 'Significant plants', the reserve's populations of *Acianthus pusillus*, *Correa reflexa*, *Chrysocephalum semipapposum*, *Eucalyptus macrorhyncha* and *Hibbertia empetrifolia* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological Vegetation Class

The area of Grassy Dry Forest is large enough to meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The conservation status of Grassy Dry Forest is listed by the state government as 'least concern' within the relevant bioregion. The author expects that if a 'habitat score' were determined, it would be less than 0.6. It follows that the patch meets standard criterion 3.2.3 for a site of Local significance.

The area of Grassy Forest is too small to qualify as a 'patch' and therefore does not meet the standard criteria relating to patches of threatened EVCs.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 49 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The reserve's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of the Dandenong Range Cinnamon Wattle, which had not even been described as a species in 1997.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. These effects of microclimate moderation benefit people visiting the reserve or living close by. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to contribute in a small way to the enjoyment, health, wellbeing, childhood development and quality of life of the residents and visitors to the reserve.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens.

The site preserves something of the area's natural landscape, visible from far away. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Aerial photographs indicate that between 2001 and 2017, native vegetation in the original version on Site 49 has reduced by approximately 1,000 m², overwhelmingly due to residential development of 26 Palmer Avenue. The new version of the site excludes the developed parts of that property.

Changes in the species present

Nearly all of the naturally-occurring, indigenous plant species recorded in 1996 and 1998 remain. The few losses have been outweighed by a larger number of gains, with a net increase of approximately eight species.

Change in the ecological condition of habitat

The reserve's understorey within 40 m of the northern boundary was described in 1997 as being dominated by the environmental weed, Sallow Wattle (*Acacia longifolia* subsp. *longifolia*), also with the declared noxious weed, Boneseed (*Chrysanthemoides monilifera*). Those species have been removed and there has been a significant regeneration of indigenous flora. Otherwise, no indication can be found of any change in the site's ecological condition.

The health of the eucalypt canopy has deteriorated, as evidenced by aerial photographs from 2001 and 2017. A 2011 aerial photograph shows that most of the tree deaths occurred between 2001 and 2011, attributable to the Millennium Drought.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Gardening, landscaping or construction in the residential properties;
- Displacement of indigenous plants by introduced plants (mainly on 23 Baringa Road);
- Further eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Hybridisation of the natural Common Correas with garden Correas; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Most of the reserve is zoned 'Public Park and Recreation Zone'. However, there is an anomaly: the neck adjoining Palmer Avenue and a strip immediately west of 26 Palmer Avenue are zoned 'Neighbourhood Residential Zone – Schedule 2' – as for 26 Palmer Avenue. The other residential properties are zoned 'Neighbourhood Residential Zone – Schedule 3'.

Tree removal is controlled by Schedule 3 of the Significant Landscape Overlay throughout the site. In the reserve, removal of native vegetation is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. In addition, the Vegetation Protection Overlay (VPO) controls native vegetation removal within the original (1997) version of Site 49.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the original version of Site 49 and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 49 as outlined in blue on the aerial photograph on p. 364.

Information sources

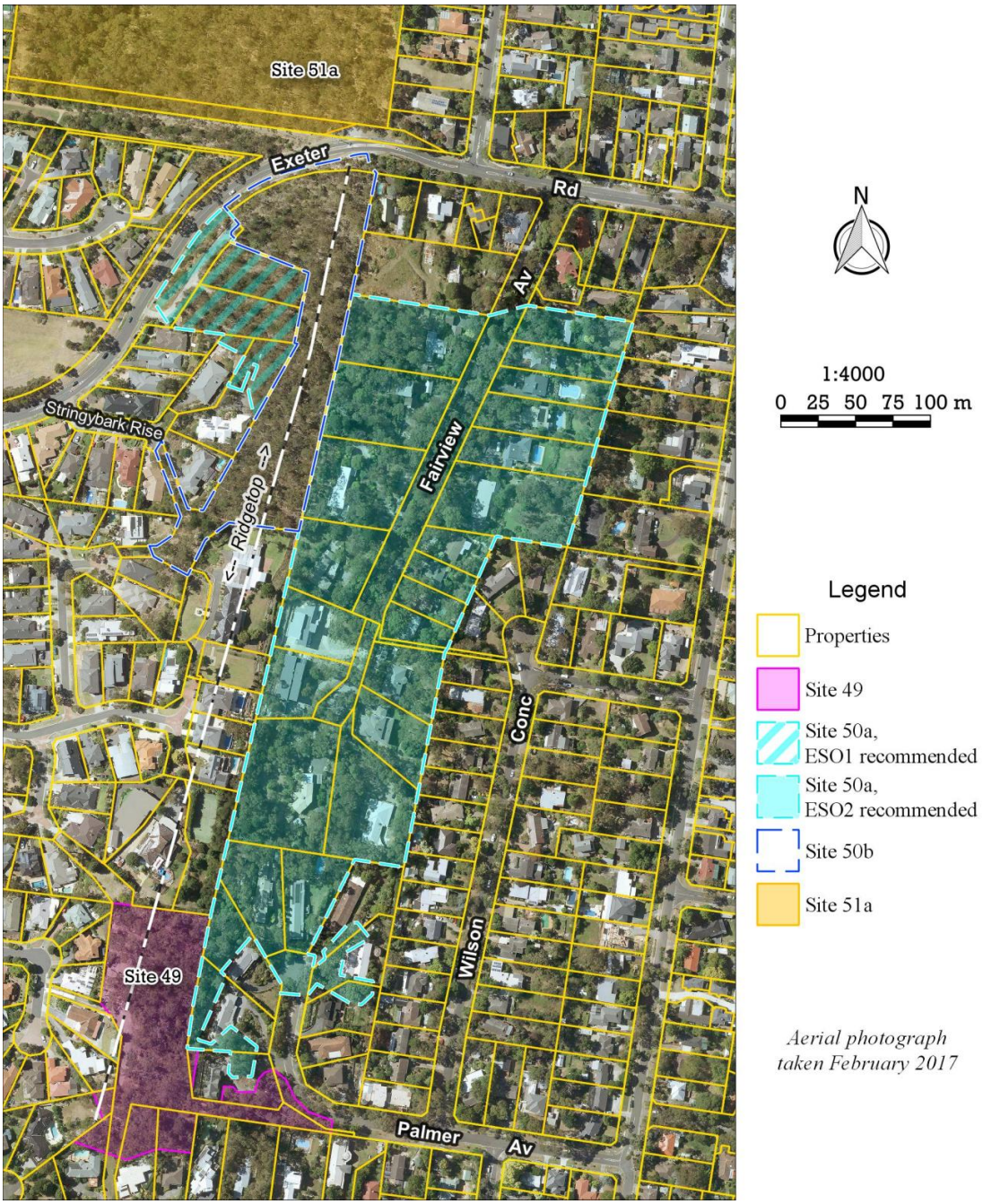
The analysis above draws on the following sources of information about the site:

- 1¾ hours of ecological survey for this study by the author on 28/6/19, including: (a) compiling separate lists of indigenous plant species for the two EVCs in the site; (b) documenting the details of rare or scarce plants; (c) mapping the vegetation and rare plants; and (d) an incidental observation of Brown Goshawk;
- Maroondah City Council's records of planting in the reserve;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the site included a flora survey by Helen Moss on 3/4/96;
- A quadrat – no. B1829900 in the online Victorian Biodiversity Atlas database (VBA) – by Jane Ellis in December 1986. Note that her coordinates (as mapped in the VBA) do not accord with her description of the quadrat's aspect, species, Melway reference or location at 'West of Fairview Ave, near cnr. Palmer Ave, Croydon'; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the VBA, Atlas of Living Australia or eBird.

Site 50a. Exeter Ridge, Croydon North

Biological Significance Level: *Local* due mainly to the site's locally threatened plants



Boundaries

Site 50a is shown on the aerial photograph above in two parts. The larger, eastern part has a cyan wash over the photograph and measures 6.3 ha. It corresponds to the area recommended below for the proposed schedule ESO2 of the Environmental Significance Overlay. The western part, of 0.7 ha, is overlaid with

cyan stripes and corresponds to the recommended schedule ESO1. Site 50b (Stringybark Rise Reserve) bisects Site 50a and is outlined with mid-blue dashes.

The boundaries of Sites 50a and 50b correspond with property boundaries where yellow can be seen in the gaps between the dashes of the outlines. The remaining boundaries are drawn to circumscribe the native vegetation as closely as practicable.

As with all sites in this volume, the precise boundaries are available in a shapefile of geographic information systems.

The original Site 50 designated by *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997) included a mixture of public and private land. Some of the private land has since been added to the public land and it is here deemed worthwhile to separately treat the public land (Site 50b) from the private properties and abutting road reserves (Site 50a). Some properties within the original Site 50 have been excised here due to clearing, and the Palmer Avenue properties have been added in recognition of the value of habitat continuity.

Land use and tenure

The site contains private residential land and the reservations of minor council roads.

General description

Site 50a is situated high in the local landscape, slightly each side of the ridgetop occupied by Site 50b. The segment of Site 50a fronting Exeter Rd is on a steep, west-northwest-facing slope with a gradient of approximately 1:3.5. The segment on the other side of the ridge faces in the opposite direction, with an even steeper gradient of 1:3 west of Fairview Avenue and a gradient of 1:4 east of Fairview Avenue.

The soil is stony and shallow, derived from weathering of Silurian siltstone and sandstone. The vegetation type on the western slope differs from the other side of the ridge due to the harshness of its west-northwesterly exposure.

The vegetation on two vacant residential blocks west of the ridge – 122 & 128 Exeter Road – is closer to pristine than the other properties. The author found eighty-eight wild, indigenous plant species there in 2016–2018, including thirteen whose risk of dying out in Maroondah falls into the 'critically endangered' category. He found only twenty-five species (two 'critically endangered') on the rest of the site but most of that area was not accessible to him.

On the eastern side of the ridgetop, the greatest concentration of indigenous understorey is in the road reservation of Fairview Avenue. Elsewhere on the eastern side of the ridgetop, indigenous understorey appears to be quite scarce except for the rear of two properties backing onto Stringybark Rise Reserve.

The residents of a few properties are maintaining their native vegetation in good condition. Elsewhere, the indigenous plant species are receiving strong competition from introduced plants, particularly 'environmental weeds' that are reproducing freely. Sweet Pittosporums and cotoneasters are probably the main introduced species displacing indigenous flora and wildlife.

Despite the competition from introduced species and the ongoing loss of tree canopy due to residential development, Red Stringybark (*Eucalyptus macrorhyncha*) is widespread throughout Site 50a. That species falls into the 'critically endangered' category of risk of dying out in Maroondah. It forms an almost pure stand west of the ridge and is co-dominant east of the ridge.

Across the whole site, fifty-three naturally-occurring, indigenous plant species were observed in this study.

Relationship to other land

As mentioned above, Site 50a has been separated from Site 50b (Stringybark Rise Reserve) largely on the basis of land tenure. From the perspective of wildlife, the two sites are not separate areas of habitat, although Site 50b is superior in condition.

The much larger area of habitat represented by Hochkins Ridge (Site 51) lies on the opposite side of Exeter Road. Many animals capable of crossing the road are likely to do so, at least occasionally to meet seasonal habitat needs or disperse from parental home ranges. In this respect, Sites 50a, 50b and 51 function almost as a single patch of habitat. There is further habitat beyond Hochkins Ridge Nature Conservation Reserve in the City of Manningham.

To the south, Site 50a abuts the Palmer Avenue Reserve (Site 49). Site 50a includes treed parts of private properties on Palmer Avenue in recognition that they provide canopy continuity and are presumed to increase the flow of wildlife to and from Palmer Avenue Reserve. That continuity may also contribute to movement of the more mobile bird species further south-southwest along the Wicklow Hill ridge, particularly to Mulgrave Way Reserve (Site 48) and Birt Hill (Site 46). A chain of sites along the ridge can be seen on the key map on p. 1.

Fauna moving between any of the abovementioned sites will occasionally disperse pollen or seeds of indigenous plants. That will improve the plants' reproductive success and hence their viability.

Bioregion: Highlands - Southern Fall

Habitat types

The descriptions of Ecological Vegetation Classes (EVCs) below include only the indigenous plant species except where stated otherwise.

Grassy Dry Forest (EVC 22, 'Least concern' in the bioregion) on the western side of the ridge

Canopy trees: An almost pure stand of Red Stringybark (*Eucalyptus macrorhyncha*), interrupted only by a few Bundies (*E. goniocalyx*).

Lower trees: Strongly dominated by Cherry Ballart (*Exocarpos cupressiformis*). Three Black Wattles (*Acacia mearnsii*) and one Lightwood (*A. implexa*) were also seen.

Medium to large shrubs: Dominated variously by Hedge Wattle (*Acacia paradoxa*), Shiny Cassinia (*Cassinia longifolia*), Sifton Bush (*Cassinia sifton*) or Yarra Burgan (*Kunzea leptospermoides*). Common Correa (*Correa reflexa*) is fairly abundant. Spreading Wattle (*Acacia genistifolia*), Juniper Wattle (*Acacia ulicifolia*), Common Heath (*Epacris impressa*) and Golden Bush-pea (*Pultenaea gunnii*) are scarce.

Small shrubs: Tangled Guinea-flower (*Hibbertia empetrifolia*) is abundant. Grey Parrot-pea (*Dillwynia cinerascens*), Grey Everlasting (*Ozothamnus obcordatus*) and Common Flat-pea (*Platylobium obtusangulum*) are fairly abundant. Heath Wattle (*Acacia brownii*) and Common Beard-heath (*Leucopogon virgatus*) are scarce.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) is fairly abundant. One Shrubby Fireweed (*Senecio minimus*) and two Beaked Fireweed (*Senecio prenanthoides*) were seen in this study but numbers will vary greatly from year to year.

Ferns: None seen.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is fairly abundant. Downy Dodder-laurel (*Cassytha pubescens*), Small-leafed Clematis (*Clematis decipiens*), Love Creeper (*Comesperma volubile*) and Purple Coral-pea (*Hardenbergia violacea*) are scarce.

Creepers: Ivy-leaf Violet (*Viola hederacea*) was fairly abundant at the time of this study's survey. Four Running Postman (*Kennedia prostrata*) were seen.

Grasses, rushes and sedges: Moderately dense and moderately rich in species, in the more natural areas. Dominated variously by Variable Sword-sedge (*Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) or Red-anther Wallaby-grass (*Rytidosperma pallidum*). Leafy Wallaby-grass (*R. fulvum*), Purplish Wallaby-grass (*R. tenuius*) and Small Grass-tree (*Xanthorrhoea minor*) are also abundant. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Weeping Grass (*Microlaena stipoides*) and Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*) are less abundant but not scarce. The scarce species seen are Reed Bent-grass (*Deyeuxia quadriseta*), Common Plume-grass (*Dichelachne rara*), Slender Sword-sedge (*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Cluster-headed Mat-rush (*L. longifolia* subsp. *exilis*), Soft

Tussock-grass (*Poa morrisii*), Bristly Wallaby-grass (*Rytidosperma setaceum*) and Common Bog-rush (*Schoenus apogon*).

Other groundcover: Mosses are abundant, particularly Broody Swan-neck Moss (*Campylopus clavatus*). Forbs are abundant and particularly rich in species. The following species are abundant: Milkmaids (*Burchardia umbellata*), Scented Sundew (*Drosera aberrans*), Tall Sundew (*D. auriculata*), Wax-lip Orchid (*Glossodia major*), Yellow Pennywort (*Hydrocotyle foveolata*) and Small Poranthera (*Poranthera microphylla*). The following species are less abundant but still not scarce: Blue Pincushion (*Brunonia australis*), Blue Stars (*Chamaescilla corymbosa*), Button Everlasting (*Coronidium scorpioides*), Common Cotula (*Cotula australis*), Spreading Crassula (*Crassula decumbens*), Sieber Crassula (*C. sieberiana/tetramera*), Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (*Gonocarpus tetragynus*), Common Hovea (*Hovea heterophylla*), Variable Stinkweed (*Opercularia varia*), Common Rice-flower (*Pimelea humilis*), Tall Greenhood (*Pterostylis melagramma*), Nodding Greenhood (*P. nutans*), Tiny Greenhood (*P. parviflora*), Trim Sun-orchid (*Thelymitra* ?*peniculata*) and Twining Fringe-lily (*Thysanotus patersonii*). The scarce species seen in this study were Honey-pots (*Acrotriche serrulata*), Pink Fingers (*Caladenia carnea*), Purplish Beard-orchid (*Calochilus robertsonii*), Wallflower Orchid (*Diuris orientis*), Star Cudweed (*Euchiton sphaericus*), Small Pennywort (*Hydrocotyle callicarpa*), Slender Bottle-daisy (*Lagenophora sublyrata*), Jersey cudweed (*Laphangium luteoalbum*), Maroonhood (*Pterostylis* ?*pedunculata*), Pink-bells (*Tetratheca ciliata*), Dotted Sun-orchid (*Thelymitra ixioides/juncifolia*), Yellow Rush-lily (*Tricoryne elatior*) and Sprawling Bluebell (*Wahlenbergia gracilis*).

Grassy Forest (EVC 128, **Vulnerable** in the bioregion) on the eastern side of the ridge, grading toward Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion) downhill from Fairview Avenue.

Canopy trees: Co-dominated by Red Stringybark (*Eucalyptus globoidea*) and Messmate Stringybark (*E. obliqua*). Bundy (*E. goniocalyx*), Yellow Box (*E. melliodora*) and Narrow-leaved Peppermint (*E. radiata*) are also fairly abundant.

Lower trees: Cherry Ballart (*Exocarpos cupressiformis*) is the only indigenous subcanopy species seen. It is fairly abundant. Other indigenous subcanopy trees have been displaced by introduced species, particularly Sweet Pittosporum (*Pittosporum undulatum*).

Medium to large shrubs: Sifton Bush (*Cassinia sifton*) is fairly abundant. Common Heath (*Epacris impressa*) and Golden Bush-pea (*Pultenaea gunnii*) are scarce.

Small shrubs: Tangled Guinea-flower (*Hibbertia empetrifolia*) is scarce, as viewed from the public realm.

Ferns: Austral Bracken (*Pteridium esculentum*) is present, neither abundant nor scarce.

Climbers: None visible from the public realm.

Creepers: the wood-sorrel, *Oxalis exilis/perennans*, is fairly abundant.

Grasses, rushes and sedges: Depleted in density and numbers of species. The species visible from the public realm are: Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Cluster-headed Mat-rush (*L. longifolia* subsp. *exilis*), Grey Tussock-grass (*Poa sieberiana*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), at least two other wallaby-grass species and Kangaroo Grass (*Themeda triandra*). None of those is particularly scarce.

Other groundcover: Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*) and Black-anther Flax-lily (*Dianella revoluta*) are fairly abundant. Grass Trigger-plant (*Stylidium armeria*) appears scarce, as seen from the public realm. The presence of the moss, Small Dawsonia (*Dawsonia longiseta*), serves as an ecological indicator.

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong

Ranges. The species was recorded in the site in 1994 but not in this study. It may have died out or been cleared or a small number may persist out of view from the public realm.

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Population sizes may be understated and some species may have gone undetected due to lack of access to private land:

- *Acacia brownii* (Heath Wattle) – six individuals grow on 122 Exeter Road and its nature strip. The only other records of the species in Maroondah this century are: (a) a small number in Hochkins Ridge Nature Conservation Reserve (in Site 51); (b) two plants in Site 12; (c) one plant in Site 50b; and (d) one in Site 52;
- *Caladenia carnea* (Pink Fingers) – one individual was seen on 122 Exeter Road and others are likely to appear in other years. The only other records of the species in Maroondah this century are: (a) one individual in F.J.C. Rogers Reserve (Site 29a), one year only; (b) one in 'Uambi' (Site 32), two years only; (c) one in Warrien Reserve (Site 45), one year only; and (d) a small colony at Bungalook Conservation Reserves (Site 66), every year;
- *Calochilus robertsonii* (Purplish Beard-orchid) – two individuals were seen on 122 Exeter Road and others may appear in other years. The only other records of the species in Maroondah this century are: (a) up to six individuals per year in F.J.C. Rogers Reserve (Site 29a); and (b) up to eleven individuals per year at Bungalook Conservation Reserves (Site 66);
- *Correa reflexa* var. *reflexa* (Common Correa) – fairly abundant on 122 & 128 Exeter Road;
- *Crassula sieberiana/tetramera* (Sieber Crassula) – fairly abundant on the nature strip of 122 Exeter Road and also on the slope between Exeter Road and its service road. The only other record of the species in Maroondah this century is on one property in Warranwood, in Site 16, during this study;
- *Diuris sulphurea* (Tiger Orchid) – recorded in 1994. There is a slight chance that it persists on the western side of the ridge;
- *Eucalyptus macrorhyncha* (Red Stringybark) – a dominant species throughout the site. Thirty-nine were counted from the public realm on the eastern side of the ridge. There are comparable numbers on the other side of the ridge but no count was taken;
- *Gompholobium huegelii* (Common Wedge-pea) – recorded in 1994 but probably no longer present, as the species has died out in almost all other sites in Maroondah where it was known in the 1990s;
- *Hibbertia empetrifolia* subsp. *empetrifolia* (Tangled Guinea-flower) – abundant on the western side of the ridge and one plant grows beside Fairview Avenue. Others may grow on private land out of sight from this study. In combination with nearby plants in Site 50b, Hochkins Ridge Nature Conservation Reserve (in Site 51) and Palmer Avenue Reserve (Site 49), the site's plants are part of the only known population of the species in the Melbourne Region;
- *Hydrocotyle callicarpa* (Small Pennywort) – seven were seen on 122 Exeter Road during this study, but the species is known for its large population fluctuations. The only other records of the species in Maroondah this century are in the adjacent Stringybark Rise Reserve (140 plants) and over the road in Hochkins Ridge Nature Conservation Reserve (Site 50a), where scarce;
- *Kennedia prostrata* (Running Postman) – four individuals grow on the nature strip of 122 Exeter Avenue. Others may grow out of sight from the public realm. This century, the species has been recorded at only seven other places in Maroondah and no more than two plants each;
- *Ozothamnus obcordatus* (Grey Everlasting) – thirteen were counted on 122 Exeter Road and five on 128 Exeter Road. Another twenty-one were recorded very close by in Stringybark Rise Reserve (Site 50b). There are also small numbers at Hochkins Ridge Nature Conservation Reserve (Site 51);
- *Pterostylis alpina* (Mountain Greenhood) – recorded in 1994 and perhaps still present, out of sight from the public realm;
- *Senecio minimus* (Shrubby Fireweed) – a solitary plant was seen on 122 Exeter Road but its appearance is probably a temporary aberration. The species may recur sporadically on any soil in the site;
- *Thelymitra ixioides/juncifolia* (Dotted Sun-orchid) – four individuals were seen on 122 Exeter Road. The only other records of the species in Maroondah this century are: (a) one individual in one year only

at F.J.C. Rogers Reserve (Site 29a); (b) a small but unquantified number at Power Street Reserve (Site 53); and (c) dozens every year at Bungalook Conservation Reserves (Site 66); and

- *Thelymitra rubra* (Salmon Sun-orchid) – recorded in 1994 and possibly overlooked in this study. The only other records of the species in Maroondah this century are: (a) eleven individuals at F.J.C. Rogers Reserve (Site 29a); (b) twenty-three individuals near F.J.C. Rogers Reserve, in Site 29d; and (c) up to twenty-five at Bungalook Conservation Reserves (Site 66) but none sprouted there in 2019 and the colony may have died out.

Significant fauna

Vulnerable in Victoria

One Powerful Owl was observed at Fairview Avenue on 20/3/13 and recorded on 'Birdata' at Birds Australia. Such observations can occur in much of suburbia, so it is unknown whether the observation at Fairview Avenue is more than a chance event.

Rare in Maroondah

A dead Sugar Glider was collected from Fairview Avenue by Elke Barczak of the Museum of Victoria on 17/5/16, now kept as a museum specimen. The species is probably resident within the site.

Fauna habitat

- The structure and composition of the native vegetation in the more natural areas represent suitable habitat for a range of common forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals;
- The habitat features just described are amplified by the site's role as part of a wildlife corridor along the Wicklow Hill ridge and the site's proximity to Hochkins Ridge Nature Conservation Reserve;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

On the A-to-D scale of ecological condition used by Lorimer *et al*. (1997):

- The vegetation in most of the western part of Site 50a rates 'B' (good) except for a firebreak and two backyards, which rate 'C' (fair);
- The part of the site on the eastern side of the ridge varies between ratings 'C' (fair), 'D' (poor) and devoid of native vegetation.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Regionally threatened Ecological Vegetation Classes

The Grassy Dry Forest west of the ridge (excluding the strip between Exeter Road and its service road) is part of a 'patch' of native vegetation, as defined for the purposes of the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. No 'habitat score' has been determined for the area but the present author suspects that it would be less than 0.6. That would lead to a 'Low' conservation significance rating under Table 5 of the 'Native Vegetation Framework' (NRE 2002),

taking into account the 'least concern' status of Grassy Dry Forest. Standard criterion 3.2.3 then leads to a rating of Local significance for the affected part of the site.

Without obtaining access to the rear of 51–55 and 57–61 Fairview Avenue, it is unclear whether there is a 'patch' of Grassy Forest there. If so, the vulnerable status of that EVC would give that part of the site Regional significance under standard criterion 3.2.3.

Locally threatened species

The section above headed 'Significant plants' includes a list of Site 50a's species whose risk of dying out in Maroondah is in the 'critically endangered' category. Having regard to the information there, the populations of twelve of those species are either clearly viable and/or make major contributions to the species' total population in Maroondah; namely *Acacia brownii*, *Caladenia carnea*, *Calochilus robertsonii*, *Correa reflexa*, *Crassula sieberiana/tetramera*, *Eucalyptus macrorhyncha*, *Hibbertia empetrifolia*, *Hydrocotyle callicarpa*, *Kennedia prostrata*, *Ozothamnus obcordatus*, *Thelymitra ixioides/juncifolia* and *Thelymitra rubra*. They clearly meet the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Sugar Gliders are so uncommon in Maroondah that the discovery of one in 2016 (presumably part of a population) meets standard condition 3.1.5 for Local significance in the same way that the abovementioned plants do.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 50a fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's 'Local' significance accorded here is equivalent to the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997), allowing for differences in terminology.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the site's residents as well as people living nearby. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

As explained in Section 1.3 of Volume 1, there is good evidence that people's health, wellbeing, quality of life and childhood development benefit from exposure to nature. Therefore, Site 50a's natural ambience is expected to bring such benefits to people living in or near the site. Some benefits are spread into surrounding areas by the movement of birds, butterflies and other animals attracted to the site.

The site's vegetation contributes substantially to the 'green and leafy' character of the neighbourhood and also more broadly, as the ridge is a conspicuous landscape feature from vantage points over a substantial area. By preserving the area's natural landscape and associated wildlife, the site helps to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Aerial photographs from 2001 and 2017 indicate approximately 0.7 ha of native vegetation was removed during that interval for residential development. The photographs also show that a much smaller area with no native vegetation in 2001 now has a eucalypt canopy, either due to growth of pre-existing trees or planting of new trees.

Change in the ecological condition of habitat

The ecological condition ratings given above in the section headed 'Ecological condition' are consistent with information from Lorimer *et al*. (1997) but the comparison is imprecise because of the different boundaries of the two reports' sites.

Comparison of aerial photographs from 2001 and 2011 shows that many eucalypts died in the intervening years – i.e. during the Millennium Drought. The area west of the ridge was worst affected. A 2017 aerial photograph shows that eucalypt deaths have continued less frequently since the Millennium Drought but still faster than the natural attrition rate. There is also some indication of a general thinning of foliage in the eucalypt crowns.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- House construction of 122 & 128 Exeter Road and consequent domestic activity;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Residential subdivision;
- Displacement of indigenous plants and their dependent fauna by introduced plant species, particularly Sweet Pittosporums and cotoneasters;
- Further eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Construction of outbuildings and other property improvements; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Site 50a is zoned 'Neighbourhood Residential Zone – Schedule 3', which specifies no minimum lot size.

Throughout Victoria, road reserves and properties larger than 0.4 ha are subject to the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. The only three properties affected in Site 50a are 30, 48–50 and 57–61 Fairview Avenue.

With the exception of the Exeter Road reservation and the Palmer Avenue land, the removal, lopping and destruction of the site's native vegetation is regulated under the Vegetation Protection Overlay (VPO). The VPO also applies to some surrounding land as a legacy of vegetation that existed prior to residential development over the past twenty years. Removal of trees (native or not) is controlled throughout the site by Schedule 3 of the Significant Landscape Overlay.

It is recommended here that:

- The VPO should be removed entirely;
- The proposed new overlay schedule ESO1 proposed in Section 11.1.2 of Volume 1 be applied to the part of Site 50a west of the ridgetop, as shown with cyan stripes on the aerial photograph on p. 371.

The choice of ESO1 is partly in recognition of the affected vegetation's very good ecological condition and its very high importance to the survival of many indigenous plant species in Maroondah. ESO1 is also chosen because it affords no protection for non-indigenous plants, which are ecologically negative or benign in such vegetation; and

- The proposed new overlay schedule ESO2 be applied to the part of Site 50a east of the ridgetop, as shown with a cyan wash over the aerial photograph on p. 371. ESO2 is chosen partly because it provides protection for planted 'Australian native' trees, which play an important role in that area by augmenting the area's fragmented canopy of remnant trees. ESO2 does not protect understorey, which is quite localised on the eastern side of the ridgetop and is deemed to gain adequate protection from clause 52.17 of the Victoria Planning Provisions. The indigenous groundcover is concentrated on the road reservation for Fairview Avenue, where clause 52.17 applies. Planning overlays seem rather ineffective, in practice, in limiting vegetation destruction beside roads.

It would be open to Maroondah City Council to enlarge the areas of ESO1 or ESO2 to conform with property boundaries or simplify the boundary, as was done with the existing VPO.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of just over thirteen hours of fieldwork by the author on 8/8/16, 31/8/16, 16/9/16, 13/10/16, 3/2/17 and 28/6/19, viewing every property while walking along the streets and through the abutting reserves. A detailed list of indigenous and introduced species of moss, liverwort and vascular plant, including abundances, was compiled for each of five separate parts of 122–128 Exeter Rd and the abutting roadside. A less thorough list was compiled on 28/6/19 for the other properties and roadsides in the site, without the benefit of having access to those properties. Occurrences of rare plants were mapped and counted. Each property was assessed for its cover of indigenous plants and 'Australian native' habitat trees, with the aid of binoculars where appropriate;
- A museum specimen of a Sugar Glider collected (dead) from Fairview Avenue by Elke Barczak (Museum of Victoria) on 17/5/16, the record available through the Atlas of Living Australia;
- A 'Birdata' record of a Powerful Owl at Fairview Avenue on 20/3/13, the record available through the Atlas of Living Australia;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was largely based on fieldwork by Helen Moss on 29/3/96 and 4/5/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in eBird or the Victorian Biodiversity Atlas. The state government's mapping of vegetation types within the site appears not to be based on any fieldwork and it conflicts with the vegetation on the eastern side of the ridge.

Site 50b. Stringybark Rise Reserve, Croydon North

Biological Significance Level: *Regional* due to the presence of high-quality vegetation

See page 371 for a 2017 aerial photograph that includes this site.

Boundaries

Site 50b comprises Stringybark Rise Reserve (116A Exeter Road, Croydon North) and the abutting nature strip but not the walkway from Hazelview Pocket in the southwestern corner. The site has a dashed, mid-blue outline on the aerial photograph on p. 371.

The original Site 50 designated by *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997) included a mixture of public and private land. Some of the private land (the former 118 Exeter Road) has since been added to the reserve and it is here deemed worthwhile to separately treat the reserve (Site 50b) from the private properties and abutting road reserves (Site 50a).

Land use and tenure

The site is a council reserve managed for nature conservation. Public access is difficult due to steep road frontages.

General description

Stringybark Rise Reserve measures 1.45 hectares. It contains the northern end of a rather sharp, north-south ridgetop and the associated upper western slope. It sits high in the local landscape, at elevations up to 158 m above mean sea level. The slope on the western side has a steep gradient of approximately 1:3.5. In the reserve's northeastern corner, the ridge's spine dips northwards with a slope of typically 1:6 above a cutting at Exeter Road. The cutting exposes the site's fine bedrock layers of Silurian siltstone and sandstone, as well as the shallow, stony clay-loam soil.

The combination of the soil type, the ridgetop location and the northerly to westerly exposure of most of the site creates harsher conditions for plants than most of Maroondah. That is reflected in the presence of the Ecological Vegetation Class (EVC) called Grassy Dry Forest.

Most of the reserve was acquired by Maroondah City Council in the mid-1990s and it was extended in the northwest in 2016 by the purchase of 118 Exeter Road. Some of the prior use of the land is revealed today by excavations, the young age of the eucalypts and the fallen remains of Monterey Pines and Sweet Pittosporums. Despite that history, the reserve retains a high density of orchids and other sensitive indigenous plant species. Council's bushland management team have worked to restore the understorey to a natural state. It will take some years for the vegetation to equilibrate following the removal of introduced plants and it will take decades for the reserve's eucalypts to reach their full size.

Fifty-three naturally-occurring, indigenous plant species were observed during this study's non-exhaustive ecological survey of the reserve.

Relationship to other land

The fact that Stringybark Rise Reserve is at the top of the local landscape means most of it is not subject to the ecologically harmful influences of nutrients and weed seeds gravitating into the reserve. The exception is in the southwest, where the influences of adjacent properties are evident. One private garden has been extended into the reserve.

As mentioned above, the reserve has been separated from Site 50a largely on the basis of land tenure. From the perspective of wildlife, the two sites are not separate areas of habitat, although the reserve is superior in condition.

The much larger area of habitat represented by Hochkins Ridge Nature Conservation Reserve and Hochkins Ridge Drainage Reserve (Site 51) lies on the opposite side of Exeter Road. Many animals capable of crossing the road are likely to do so, at least occasionally to meet seasonal habitat needs or disperse from parental home ranges. In this respect, Sites 50a, 50b and 51 function almost as a single patch of habitat. There is further habitat beyond Hochkins Ridge Nature Conservation Reserve in the City of Manningham.

That cluster of sites has Palmer Avenue Reserve (Site 49) at its southern tip. The key map of sites on p. 1 shows there to be a chain of other sites to the south-southwest along the Wicklow Hill ridge, extending to Heathmont.

Fauna moving between any of the abovementioned sites will occasionally disperse pollen or seeds of indigenous plants. That will improve the plants' reproductive success and hence their viability.

Bioregion: Highlands - Southern Fall

Habitat type

The vegetation description below includes only the indigenous plant species.

Grassy Dry Forest (Ecological Vegetation Class no. 22, 'Least concern' in the bioregion)

Canopy trees: An almost pure stand of Red Stringybark (*Eucalyptus macrorhyncha*), interrupted only by a few Bundies (*E. goniocalyx*) and Yellow Box (*E. melliodora*).

Lower trees: Strongly dominated by Cherry Ballart (*Exocarpos cupressiformis*), the only other subcanopy tree being a single Black Wattle (*Acacia mearnsii*).

Medium to large shrubs: Strongly dominated by Hedge Wattle (*Acacia paradoxa*) and Shiny Cassinia (*Cassinia longifolia*). Sifton Bush (*Cassinia sifton*) and Common Correa (*Correa reflexa*) are less abundant but not scarce. The following species are scarce: Spreading Wattle (*Acacia genistifolia*), Myrtle Wattle (*A. myrtifolia*), Juniper Wattle (*A. ulicifolia*), Sweet Bursaria (*Bursaria spinosa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Common Heath (*Epacris impressa*) and Yarra Burgan (*Kunzea leptospermoides*).

Small shrubs: Tangled Guinea-flower (*Hibbertia empetrifolia*), Grey Parrot-pea (*Dillwynia cinerascens*), Grey Everlasting (*Ozothamnus obcordatus*) and Common Flat-pea (*Platylobium obtusangulum*) are fairly abundant. Heath Wattle (*Acacia brownii*), Common Beard-heath (*Leucopogon virgatus*) and Prickly Geebung (*Persoonia juniperina*) are very scarce.

Shrubby herbs: Annual Fireweed (*Senecio glomeratus*), Rough Fireweed (*S. hispidulus*) and Beaked or Rock Fireweed (*S. prenanthoides/phelleus*) were scarce in this study's survey but numbers may vary greatly from year to year.

Ferns: None seen.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is fairly abundant. Downy Dodder-laurel (*Cassytha pubescens*), Love Creeper (*Comesperma volubile*) and Purple Coral-pea (*Hardenbergia violacea*) are scarce.

Creepers: The only creeper seen in this study was a single Cranberry Heath (*Astroloma humifusum*).

Grasses, rushes and sedges: Moderately dense and moderately rich in species. Dominated by Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), followed by Weeping Grass (*Microlaena stipoides*), Leafy Wallaby-grass (*Rytidosperma fulvum*) and Purplish Wallaby-grass (*R. tenuius*). The following species are less abundant but not scarce: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Variable Sword-sedge (*Lepidosperma laterale*), Soft Tussock-grass (*Poa morrisii*), Red-anther Wallaby-grass (*R. pallidum*) and Small Grass-tree (*Xanthorrhoea minor*). The following species are scarce: Pale Rush (*Juncus pallidus*), Finger Rush (*J. subsecundus*), Slender Sword-sedge (*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*) and Bristly Wallaby-grass (*Rytidosperma setaceum*).

Other groundcover: Mosses are abundant, particularly Broody Swan-neck Moss (*Campylopus clavatus*). Forbs are also abundant and particularly rich in species. Milkmaids (*Burchardia umbellata*) and Twining Fringe-lily (*Thysanotus patersonii*) are abundant. The following species are

less abundant but still not scarce: Honeypots (*Acrotriche serrulata*), Blue Pincushion (*Brunonia australis*), Blue Stars (*Chamaescilla corymbosa*), Spreading Crassula (*Crassula decumbens*), Black-anther Flax-lily (*Dianella revoluta*), Scented Sundew (*Drosera aberrans*), Tall Sundew (*D. auriculata*), Wax-lip Orchid (*Glossodia major*), Common Raspwort (*Gonocarpus tetragynus*), Common Hovea (*Hovea heterophylla*), Small Pennywort (*Hydrocotyle* ?*callicarpa*), Yellow Pennywort (*Hydrocotyle foveolata*), Variable Stinkweed (*Opercularia varia*), Common Rice-flower (*Pimelea humilis*), Small Poranthera (*Poranthera microphylla*) and Tiny Greenhood (*Pterostylis parviflora*). The following species are scarce or quite localised: Chocolate Lily (*Arthropodium strictum*), Eastern Bronze Caladenia (*Caladenia transitoria*), Button Everlasting (*Coronidium scorpioides*), Pale Flax-lily (*Dianella longifolia*), Tiger Orchid (*Diuris sulphurea*), Mountain Greenhood (*Pterostylis* ?*alpina*), Tall Greenhood (*P. melagramma*), Nodding Greenhood (*P. nutans*), Maroonhood (*P.* ?*pedunculata*), Grass Trigger-plant (*Stylidium armeria*) and Common Fringe-lily (*Thysanotus tuberosus*).

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species seen in Site 50b can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acacia brownii* (Heath Wattle) – one individual grows 25 m northeast of the dead end of the Exeter Road service road. It is part of a larger, interbreeding population comprising six plants close by in Site 50a and others over the road in Hochkins Ridge Nature Conservation Reserve (Site 51). The only other records of the species in Maroondah this century are two plants in Site 12 and one in Site 52;
- *Astroloma humifusum* (Cranberry Heath) – a single plant grows just east of the southeast corner of 122 Exeter Road;
- *Caladenia transitoria* (Eastern Bronze Caladenia) – one plant was seen by Stephanie Deane in 2016. Others have probably escaped detection because the species is so cryptic. The only other records of the species in Maroondah this century are of four plants at Grandfill Reserve (Site 42) and about a dozen plants in Bungalook Conservation Reserves;
- *Correa reflexa* var. *reflexa* (Common Correa) – fairly abundant;
- *Diuris sulphurea* (Tiger Orchid) – a single plant. The only other records of the species in Maroondah this century are a population of about thirty at Bungalook Conservation Reserves (Site 66) and one plant on a residential block in Ringwood North (in Site 5);
- *Eucalyptus macrorhyncha* (Red Stringybark) – abundant, by far the dominant species in the reserve, with many seedlings;
- *Hibbertia empetrifolia* subsp. *empetrifolia* (Tangled Guinea-flower) – fairly abundant. In combination with nearby plants in Site 50a, Hochkins Ridge Nature Conservation Reserve (Site 51) and Palmer Avenue Reserve (Site 49), the reserve's plants are part of the only known population of the species in the Melbourne Region;
- *Hydrocotyle callicarpa* (Small Pennywort) – 140 were seen in this study, but the species is known for its large population fluctuations. The only other records of the species in Maroondah this century are in the adjacent Site 50a (seven plants) and over the road in Hochkins Ridge Nature Conservation Reserve (Site 50a), where a colony of approximately 100 was found during this study;
- *Ozothamnus obcordatus* (Grey Everlasting) – twenty-one were counted within the reserve in this study and eighteen more were counted within a few tens of metres west of the reserve on vacant residential blocks (122 & 128 Exeter Road). There are also small numbers at Hochkins Ridge Nature Conservation Reserve (Site 51) but none others in Maroondah;
- *Persoonia juniperina* (Prickly Geebung) – a single plant grows in the northwest of the reserve; and
- *Pterostylis* ?*alpina* (Mountain Greenhood) – ten of these uncommonly leafy greenhood plants grow in the reserve's northwest but the identity must remain uncertain until one is seen in flower. The next most likely identity would be *P. foliata*, whose closest known occurrence is north of the Yarra River;

Fauna habitat

- The vegetation and its forest litter provide suitable habitat for a range of indigenous forest birds, bats, possums, lizards and invertebrates. It is also being used regularly by deer; and
- That habitat value is amplified by the reserve's role as part of a wildlife corridor along the Wicklow Hill ridge and its proximity to Hochkins Ridge Nature Conservation Reserve.

Ecological condition

On the A-to-D scale of ecological condition used by Lorimer *et al*. (1997):

- Approximately 500 m² in the southwest rates 'D' (poor);
- A further 1,000 m² in the southwest rates 'C' (fair), as does the Exeter Road cutting;
- The remaining 13,500 m² of the site rates 'B' (good).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Regional

Patch of an Ecological Vegetation Class

Stringybark Rise Reserve qualifies as a 'patch' of native vegetation for the purposes of the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. No 'habitat score' has been determined but the present author expects that it would be at least 0.6. That leads to a 'Medium' conservation significance rating under Table 5 of the 'Native Vegetation Framework' (NRE 2002), taking into account the 'least concern' status of Grassy Dry Forest. Standard criterion 3.2.3 then leads to a rating of **Regional** significance.

Threatened plant species

The section above headed 'Significant plants' includes a list of the reserve's species whose risk of dying out in Maroondah is in the 'critically endangered' category. Having regard to the information there, the populations of ten of those species are either clearly viable and/or make major contributions to the species' total population in Maroondah; namely *Acacia brownii*, *Caladenia transitoria, Correa reflexa, Diuris sulphurea*, *Eucalyptus macrorhyncha*, *Hibbertia empetrifolia*, *Hydrocotyle callicarpa*, *Ozothamnus obcordatus*, *Persoonia juniperina* and *Pterostylis* ?*alpina*. They clearly meet the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 50b fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's 'Regional' significance accorded here exceeds the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and reductions in the cover of introduced plants.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit neighbours and visitors to the reserve, though visits are few. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

As explained in Section 1.3 of Volume 1, there is good evidence that people's health, wellbeing, quality of life and childhood development benefit from exposure to nature. Therefore, the reserve's natural ambience is expected to bring such benefits to neighbours and visitors. Some benefits are spread into surrounding areas by the movement of birds, butterflies and other animals attracted to the site.

The reserve's vegetation contributes to the 'green and leafy' character of the neighbourhood and also more broadly, as the ridge is a conspicuous landscape feature from vantage points over a substantial area. By preserving the area's natural landscape and associated wildlife, the site helps to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

An aerial photograph from 2001 shows that the site was then almost fully covered with indigenous habitat and that remains the case.

Change in the ecological condition of habitat

The ecological condition ratings given above in the section headed 'Ecological condition' are consistent with information from Lorimer *et al*. (1997) but the comparison is imprecise because of the different boundaries of the two reports' sites.

A large number of mature Monterey Pines, Sweet Pittosporums and other environmental weeds have been removed from the reserve over the past twenty years, particularly in 2017 after the council's purchase and reservation of 118 Exeter Road. That has represented a significant improvement in the conditions for regeneration of indigenous flora and proliferation of indigenous fauna.

Comparison of aerial photographs from 2001 and 2011 shows that many eucalypts died in the intervening years – i.e. during the Millennium Drought. A 2017 aerial photograph shows that eucalypt deaths have continued less frequently since the Millennium Drought but still faster than the natural attrition rate. The deaths have been more numerous in the reserve's north. There is also some indication of a general thinning of foliage in the eucalypt crowns.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Damage to vegetation and wildlife habitat by deer, which have been rubbing bark from trees, browsing plants and trampling the groundcover;
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Displacement of indigenous plants by introduced plants, though that is currently being prevented by council's bushland management team; and
- Further eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The Exeter Road nature strip and the site's southernmost 932 m² are zoned 'Neighbourhood Residential Zone – Schedule 3'. The rest of the site is zoned 'Public Park and Recreation Zone'.

The removal, lopping and destruction of native vegetation within the 'Public Park and Recreation Zone' land is regulated under the Vegetation Protection Overlay (VPO). Additional native vegetation controls under clause 52.17 of the Victoria Planning Provisions apply throughout the site. Removal of trees (native or not) is controlled throughout the neighbourhood by Schedule 3 of the Significant Landscape Overlay.

Having regard to the discussion of planning controls in Section 11.1.2 of Volume 1, it is recommended here to remove the VPO and apply the proposed new ESO1 schedule of the Environmental Significance Overlay to Site 50b as mapped on p. 371.

Information sources

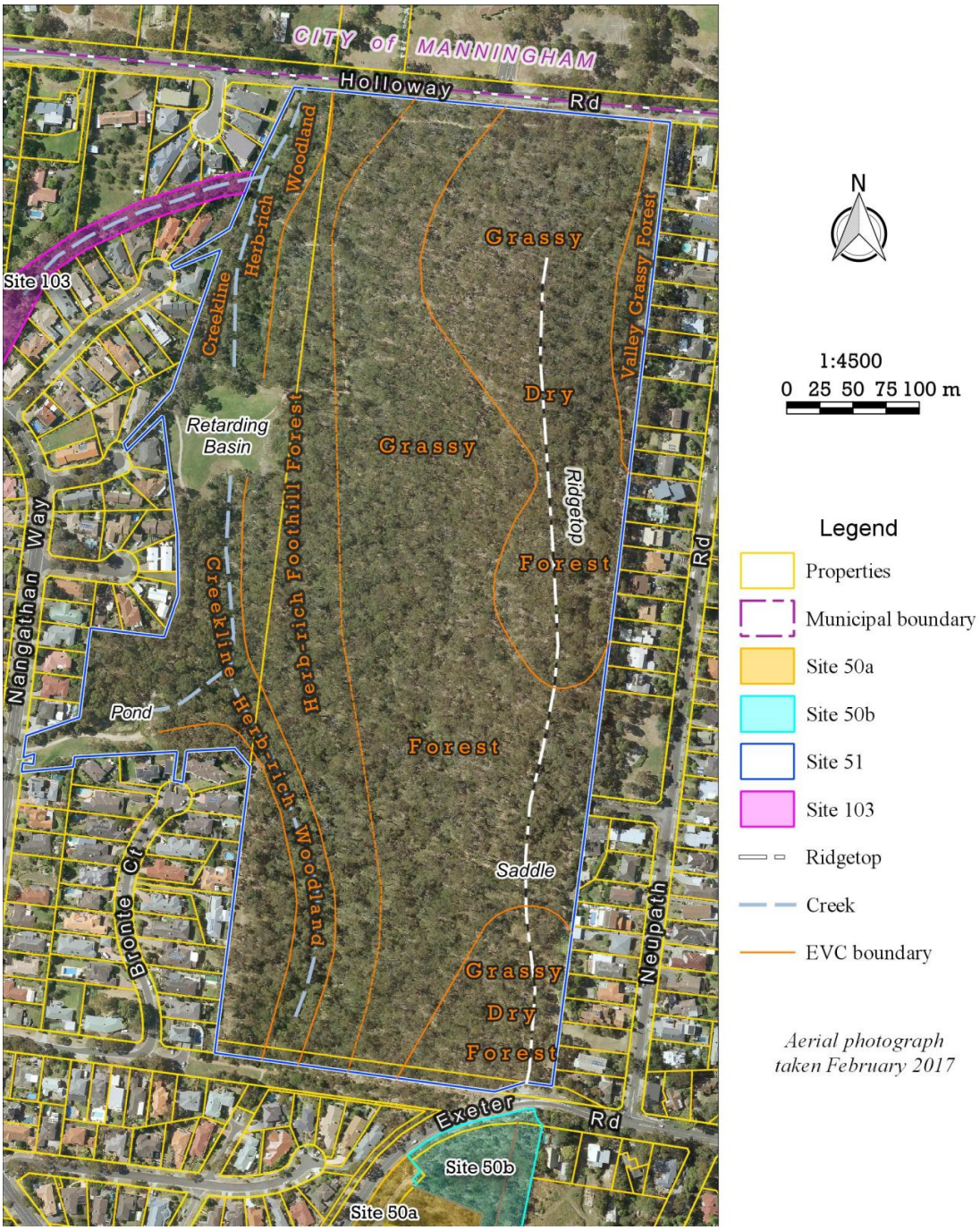
The analysis above draws on the following sources of information about the site:

- Over eight hours of fieldwork by the author on 8/8/16, 29/8/16, 3/2/17 and 28/6/19, including: (a) compiling five lists of indigenous and introduced plant species (including mosses and liverworts) and their abundances for different parts of the site; (b) mapping and counting plant species that are rare or scarce within the site; and (c) checking for other attributes of the site relevant to the standard criteria for assessing biological significance;
- *'Ecological Assessment of 118 Exeter Rd, Croydon North'*, a report dated 2/9/16 by the present author to Maroondah City Council, based on the earliest part of the fieldwork described above;
- An observation and photograph of *Caladenia transitoria* on 30/10/16 by Stephanie Dean;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was largely based on fieldwork by Helen Moss on 29/3/96 and 4/5/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in eBird or the Victorian Biodiversity Atlas. The state government's mapping of vegetation types within the site appears not to be based on any fieldwork and it conflicts with the vegetation on the eastern side of the ridge.

Site 51. Hochkins Ridge, Croydon North

Biological Significance Level: *National* due to a globally endangered species of flat-pea



Boundaries

Site 51 is outlined with a mid-blue line on the aerial photograph above. It comprises:

- Hochkins Ridge Nature Conservation Reserve (73-105 Holloway Road, Croydon North);
- The abutting council reserve (50A Nangathan Way, Croydon North) excluding Site 103; and
- The pipe track along the southern edge (113-133 Exeter Road, Croydon North) excluding the small car park on Exeter Road.

The original Site 51 designated by *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997) excluded the council reserve and included a strip of land to the south of the pipe track, whose ecological condition has deteriorated significantly since 1997.

Land use and tenure

Hochkins Ridge Nature Conservation Reserve is a Crown land reserve managed by Parks Victoria for nature conservation. The land to its west, separated by a yellow line on the aerial photograph, is a council reserve managed for nature conservation, passive recreation and drainage, with a retarding basin and a small stormwater treatment wetland. The pipe track is owned by Melbourne Water for the Silvan – Preston Pipe but its vegetation and management are not discernibly different from the nature conservation reserve.

General description

At 23.3 hectares, Site 51 is the largest site of biological significance in Maroondah and a close second to Bungalook Conservation Reserves (Site 66) in its level of significance. The site's main property – Hochkins Ridge Nature Conservation Reserve – is also the only part of Maroondah managed by Parks Victoria.

The spine of the ridge that gives the site its name runs north-south near the site's eastern edge. It is marked with a dashed white line on the aerial photograph on the previous page. The ridge is the northern end of the Wicklow Hill ridge, whose other end is next to Dandenong Creek at Simpson Court in Heathmont (Site 79). The ridge ends in Site 51 with a rather steep (1:3.5), north-facing descent in the 200 m closest to Holloway Road.

The land falls away fairly steeply on each side of the ridge. To the west, it descends fifty vertical metres to a north-flowing creek on which a retarding basin has been constructed. At mid-slope, the gradient is 1:3, compared with 1:4 on the eastern side of the ridge. The north-flowing creek receives two tributaries from the west, with a small stormwater treatment pond on the more southerly one.

The modest trunk diameters of all but a few of the largest of the site's eucalypts indicate that the vegetation is regrowth from selective clearing less than a century ago. It would be normal for that clearing to have not been the first clearing since European settlement of Maroondah. Despite that history, the site is very rich in indigenous plant species and has probably the richest birdlife in Maroondah.

By 1980, when the site was still owned by the Hochkins family, it was well known to local naturalists for its wealth of wildflowers, particularly orchids.

The land now known as Hochkins Ridge Nature Conservation Reserve was purchased from the Hochkins family in 1984, according to a 1991 management plan (Carr *et al*. 1991, see below). The council reserve that forms most of the rest of the site appears to have been reserved a few years later, based on Melway maps of the time. The catchment was then rapidly urbanised. The consequent large increase in the peak flows of the creeks initiated severe creek erosion, with the bed of the main creek now incised up to 2 m into the floodplain. The vegetation in and near the creek has suffered greatly and continues to deteriorate.

The most natural vegetation in the site is on the ridgetop and the slope to its west and north. The vegetation close to the site's western edge comprises patches of remnant vegetation linked by revegetation.

A total of 177 naturally-occurring, indigenous plant species were observed in the reserve during this study.

Relationship to other land

As seen on the aerial photograph on p. 386, the council reserve property in the west of Site 51 is not entirely contained with Site 51 but extends further west into Site 103. Site 103 would not be biologically significant without the connection to Site 51, from which indigenous birds and insects visit.

It can also be seen on the aerial photograph that Sites 50a and 50b lie just over Exeter Road from Site 51. Some of the fauna in Site 51 that are capable of crossing the road will do so, at least occasionally to meet seasonal habitat needs or disperse from parental home ranges. In this respect, Sites 50a, 50b and 51 function almost as a single patch of habitat. Some of the more mobile animals such as kangaroos and birds may travel further south-southwest, to Palmer Avenue Reserve (Site 49) and other sites that form a chain along the Wicklow Hill ridge to Heathmont – see the key map of sites on p. 1.

The municipal boundary lies immediately north of Site 51. Manningham City Council has identified that the private land fronting the northern side of Holloway Road, as close as 20 m from Site 51, is a site of biological significance – 'Biosite 9' of Foreman (2004). There is only a small gap in the high-quality wildlife habitat of Site 51 and that of Manningham's Biosite 9. The latter abuts the Brushy Creek wildlife corridor.

Fauna moving between any of the abovementioned sites will occasionally disperse pollen or seeds of indigenous plants. That will improve the plants' reproductive success and hence their viability.

Bioregion: Highlands - Southern Fall

Habitat types

The descriptions of Ecological Vegetation Classes (EVCs) below include only the more abundant, naturally-occurring, indigenous plant species except where stated otherwise. All reports written about the site (including this one) differ from the state government's classification and mapping of vegetation within the site.

Grassy Dry Forest (EVC 22, 'Least concern' in the bioregion)

Canopy trees: Strongly dominated by Red Stringybark (*Eucalyptus macrorhyncha*). Bundy (*E. goniocalyx*) is the only other species except near the edges of this EVC where there are occasional outliers from adjacent EVCs.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*) and Black Wattle (*Acacia mearnsii*). Lightwood (*Acacia implexa*), Golden Wattle (*A. pycnantha*) and Black Sheoak (*Allocasuarina littoralis*) are localised but in substantial numbers. Other species are scarce.

Medium to large shrubs: Dominated by Hedge Wattle (*Acacia paradoxa*), Shiny Cassinia (*Cassinia longifolia*) and Sifton Bush (*Cassinia sifton*). The following species are less abundant but not scarce: Spreading Wattle (*Acacia genistifolia*), Myrtle Wattle (*A. myrtifolia*), Hop Wattle (*A. stricta*), Common Correa (*Correa reflexa*), Common Heath (*Epacris impressa*), Yarra Burgan (*Kunzea leptospermoides*) and Snowy Daisy-bush (*Olearia lirata*).

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*), Common Beard-heath (*Leucopogon virgatus*), Silky Daisy-bush (*Olearia myrsinoides*) and Common Flat-pea (*Platylobium obtusangulum*) are fairly abundant or widespread within the EVC.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Beaked or Rock Fireweed (*S. prenanthoides/phelleus*) are fairly abundant and widespread across the area.

Ferns: Austral Bracken (*Pteridium esculentum*) forms localised, dense patches.

Climbers: Common Apple-berry (*Billardiera mutabilis*), Downy Dodder-laurel (*Cassytha pubescens*), Love Creeper (*Comesperma volubile*) and Purple Coral-pea (*Hardenbergia violacea*) are fairly abundant.

Creepers: Thin-leaf Wattle (*Acacia aculeatissima*), Trailing Speedwell (*Veronica plebeia*), Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel, *Oxalis exilis/perennans*, are fairly abundant. Among the scarcer species, Cranberry Heath (*Astroloma humifusum*) is a good indicator of Grassy Dry Forest.

Grasses, rushes and sedges: Moderately dense and very rich in species. Dominated by Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Red-anther Wallaby-grass (*R. pallidum*), followed by Thatch Saw-sedge (*Gahnia radula*) and Weeping Grass (*Microlaena stipoides*). The following species are less abundant but not scarce: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Reed Bent-grass (*Deyeuxia quadriseta*), Variable Sword-sedge (*Lepidosperma laterale*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Common Woodrush (*Luzula meridionalis* var. *flaccida*), Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Velvet Wallaby-grass (*Rytidosperma pilosum*), Clustered Wallaby-grass (*Rytidosperma racemosum*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Purplish Wallaby-grass (*R. tenuius*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Mosses and liverworts are abundant, including the ecologically informative species, Small Dawsonia (*Dawsonia longiseta*). Forbs are abundant and remarkably rich in species – seventy species have been recorded. The most abundant species overall are Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Blue Pincushion (*Brunonia australis*), Milkmaids (*Burchardia umbellata*), Blue Stars (*Chamaescilla corymbosa*), Button Everlasting (*Coronidium scorpioides*), Black-anther Flax-lily (*Dianella revoluta*), Scented Sundew (*Drosera aberrans*), Tall Sundew (*Drosera auriculata*), Wax-lip Orchid (*Glossodia major*), Common Raspwort (*Gonocarpus tetragynus*), Common Hovea (*Hovea heterophylla*), Yellow Pennywort (*Hydrocotyle foveolata*), Blue (or Common) Bottle-daisy (*Lagenophora stipitata*), Slender Bottle-daisy (*L. sublyrata*), Common Rice-flower (*Pimelea humilis*), Tall Greenhood (*Pterostylis melagramma*), Nodding Greenhood (*P. nutans*), Tiny Greenhood (*P parviflora*), Candles (*Stackhousia monogyna*), Grass Trigger-plant (*Stylidium armeria*), sun-orchids (*Thelymitra* species) and Twining Fringe-lily (*Thysanotus patersonii*).

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion)

Canopy trees: Dominated by Yellow Box (*Eucalyptus melliodora*) and Candlebark (*E. rubida*).

Understorey: Hardly any, having been removed over the past two decades by track construction, clearing and slashing to protect adjacent homes from fire.

Grassy Forest (EVC 128, **Vulnerable** in the bioregion), grading into …

Herb-rich Foothill Forest (EVC 23, 'Least concern' in the bioregion) on the lower slopes

These two EVCs merge imperceptibly into each other. Therefore, the dashed boundary between them shown on the aerial photograph on p. 386 should not be taken as precise and separate species lists are impracticable.

Canopy trees: Messmate Stringybark (*Eucalyptus obliqua*) is consistently the (or one of the) dominant species, in various mixtures with Bundy (*E. goniocalyx*), Red Stringybark (*E. macrorhyncha*) and Narrow-leaved Peppermint (*E. radiata*).

Lower trees: Dominated variously by Black Wattle (*Acacia mearnsii*), Golden Wattle (*A. pycnantha*), Cherry Ballart (*Exocarpos cupressiformis*) or – particularly on the lower slopes – Blackwood (*A. melanoxylon*).

Medium to large shrubs: Dominated in different areas by Hedge Wattle (*Acacia paradoxa*), Sweet Bursaria (*Bursaria spinosa*) or Burgan (*Kunzea leptospermoides*). Other species that are fairly abundant include Spreading Wattle (*Acacia genistifolia*), Myrtle Wattle (*A. myrtifolia*), Hop Wattle (*A. stricta*), Juniper Wattle (*A. ulicifolia*), Common Cassinia (*Cassinia aculeata*), Shiny Cassinia (*A. longifolia*), Common Correa (*Correa reflexa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Common Heath (*Epacris impressa*), Hop Goodenia (*Goodenia ovata*), Snowy Daisy-bush (*Olearia lirata*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*), Tangled Guinea-flower (*Hibbertia empetrifolia*), Silky Daisy-bush (*Olearia myrsinoides*) and Common Flat-pea (*Platylobium obtusangulum*) are fairly abundant or widespread within the EVC.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Beaked or Rock Fireweed (*S. prenanthoides/phelleus*) were scarce at the time of this study but those species are known for their large population fluctuations.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over substantial areas.

Climbers: Common Apple-berry (*Billardiera scandens*), Downy Dodder-laurel (*Cassytha pubescens*), Mountain Clematis (*Clematis aristata*), Love Creeper (*Comesperma volubile*) and Purple Coral-pea (*Hardenbergia violacea*) are fairly abundant. Twining Glycine (*Glycine clandestina*) is scarce.

Creepers: Ivy-leaf Violet (*Viola hederacea*) and the flat-pea, *Platylobium infecundum*, are fairly abundant. Trailing Goodenia (*Goodenia lanata*) is quite localised.

Grasses, rushes and sedges: Denser than the Grassy Dry Forest and similarly rich in species. Most areas are dominated by Thatch Saw-sedge (*Gahnia radula*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or Red-anther Wallaby-grass (*Rytidosperma pallidum*). Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Weeping Grass (*Microlaena stipoides*) are also abundant. The following species are less abundant but not scarce: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Blady Grass (*Imperata cylindrica*), Slender Sword-sedge (*Lepidosperma gunnii*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*), Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Velvet Wallaby-grass (*R. pilosum*), Clustered Wallaby-grass (*R. racemosum*), Purplish Wallaby-grass (*R. tenuius*), Common Bog-rush (*Schoenus apogon*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Fairly abundant and rich in species. Lilies and orchids are well represented but the orchids less so than in the Grassy Dry Forest. Mosses are also abundant, notably including many patches of *Dicranoloma billarderi*. The following other species are fairly abundant or widespread within these EVCs: Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Milkmaids (*Burchardia umbellata*), Blue Stars (*Chamaescilla corymbosa*), Common Bird-orchid (*Chiloglottis valida*), Button Everlasting (*Coronidium scorpioides*), Black-anther Flax-lily (*Dianella revoluta*), Scented Sundew (*Drosera aberrans*), Tall Sundew (*D. auriculata*), Common Raspwort (*Gonocarpus tetragynus*), Common Hovea (*Hovea heterophylla*), Blue (or Common) Bottle-daisy (*Lagenophora stipitata*), Slender Bottle-daisy (*Lagenophora sublyrata*), Variable Stinkweed (*Opercularia varia*), Common Rice-flower (*Pimelea humilis*), Tall Greenhood (*Pterostylis melagramma*), Nodding Greenhood (*Pterostylis nutans*), Pink-bells (*Tetratheca ciliata*), Twining Fringe-lily (*Thysanotus patersonii*) and Yellow Rush-lily (*Tricoryne elatior*).

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the bioregion).

The aquatic environment is included below.

Canopy trees: Dominated by Swamp Gum (*Eucalyptus ovata*), followed by Messmate Stringybarks (*E. obliqua*) that might be interpreted as outliers from the adjacent Herb-rich Foothill Forest.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*) and Swamp Paperbark (*Melaleuca ericifolia*). Black Wattle (*Acacia mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*) are scarce.

Shrubs: Dominated by Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*) and Elderberry Panax (*Polyscias sambucifolia*). The following species are moderately abundant: Prickly Moses (*Acacia verticillata*), Common Cassinia (*Cassinia aculeata*), Yarra Burgan (*Kunzea leptospermoides*), Manuka (*Leptospermum scoparium*), Snowy Daisy-bush (*Olearia lirata*), Tree Everlasting (*Ozothamnus ferrugineus*) and Large Kangaroo Apple (*Solanum laciniatum*).

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) is abundant and in parts, the dominant groundcover species. Other fireweeds are scattered.

Ferns: Less abundant than in decades past. Austral Bracken (*Pteridium esculentum*) forms extensive, dense patches. Common Maidenhair (*Adiantum aethiopicum*), Soft Water-fern (*Blechnum minus*), Common Ground-fern (*Calochlaena dubia*) and Mother Shield-fern (*Polystichum proliferum*) are now all scarce.

Climbers: Common Apple-berry (*Billardiera mutabilis*) and Mountain Clematis (*Clematis aristata*) are scarce.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is abundant and Angled Lobelia (*Lobelia anceps*) fairly abundant. The wood-sorrel, *Oxalis exilis/perennans*, is scarce. Centella (*Centella cordifolia*) and Swamp Mazus (*Mazus pumilio*) appear to have died out.

Aquatic species: Permanent water is dominated variously by Slender Knotweed (*Persicaria decipiens*) and Cumbungi (*Typha domingensis* and *T. orientalis*). Swamp Crassula (*Crassula helmsii*) is

abundant at water's edge. Water Plantain (*Alisma plantago-aquatica*) and Blunt Pondweed (*Potamogeton ochreatus*) are fairly abundant.

Grasses, rushes and sedges: Rich in rushes and sedges. Dominated variously by Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Tall Sedge (*Carex appressa*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or Weeping Grass (*Microlaena stipoides*). The following species are fairly abundant: Thatch Saw-sedge (*Gahnia radula*), Blady Grass (*Imperata cylindrica*), Swamp Club-rush (*Isolepis inundata*), Nodding Club-rush (*I. cernua*), Hollow Rush (*Juncus amabilis*), Green Rush (*J. gregiflorus*), Loose-flower Rush (*J. pauciflorus*), Tall Rush (*J. procerus*), Common Reed (*Phragmites australis*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Common Bog-rush (*Schoenus apogon*) and Streaked Arrow-grass (*Triglochin striata*). Of the scarcer species, Hooker Fescue (*Hookerochloa hookeriana*) is a very good environmental indicator.

Other groundcover: Mosses are abundant and rich in species. The only non-aquatic forbs found in this study were Black-anther Flax-lily (*Dianella revoluta*), Robust Willow-herb (*Epilobium billardiereanu*m subsp. *intermedium*) and Hairy Willow-herb (*E. hirtigerum*).

Significant plants

Endangered globally

The flat-pea *Platylobium infecundum* is listed as 'Endangered' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. It is fairly abundant in Hochkins Ridge Nature Conservation Reserve, principally in the south.

The Silurian Leek-orchid (*Prasophyllum pyriforme*) is similarly listed as 'Endangered'. The author remembers it as fairly abundant on the north- to north-west-facing slope near Holloway Road in the 1980s – the only population known in Maroondah's history. The population crashed in the 1990s for unknown reasons (as many Victorian populations of leek-orchids have done). The last record of it was a specimen taken by Dean Rouse in 2001 and lodged at the Australian National Herbarium. Searches in subsequent years have failed. The species is now presumed extinct in Maroondah.

Vulnerable in Victoria

Caladenia oenochila (Wine-lipped Spider-orchid) is listed as 'Vulnerable' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. It has been rapidly disappearing across its range, which is confined to southern Victorian forests. The only record in Maroondah was a verbal report by J. and G. Lade cited by J. Edwards in a 1982 postgraduate report about Hochkins Ridge Nature Conservation Reserve. That report was in turn cited in a 1991 management plan for the reserve by Ecological Horticulture. As the species has not been seen since 1982 at the latest, the species is presumed to be extinct in Maroondah.

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. There is a small but apparently viable population spread over much of Hochkins Ridge Nature Conservation Reserve.

This study detected two plants of the subspecies of Veined Spear-grass, *Austrostipa rudis* subsp. *australis*, in the council reserve near the walkway from Bronte Court and one plant in each of two locations in the Grassy Forest of Hochkins Ridge Nature Conservation Reserve. Other plants of the subspecies are likely to have gone undetected due to similarity with the common subspecies *rudis* when plants have no fertile material. Subspecies *australis* is listed by the Victorian Government as rare in Victoria but not otherwise threatened. It is scattered across southern Victoria, coastal NSW and eastern Tasmania.

The only record of Cobra Greenhood (*Pterostylis grandiflora*) in Maroondah's history was in Hochkins Ridge Nature Conservation Reserve by Geoff W. Carr in 1982, without quantification. Several thorough

flora surveys since then, including by Carr, have failed to find the species again. The species is presumed to be extinct in Maroondah.

Critically endangered in Maroondah

Apart from the species just mentioned, sixty-four naturally-occurring plant species recorded in Site 51 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Some of them have almost certainly died out. Rather than list all sixty-four, the following list provides information about those recorded in the past twenty years. Details of older records are available in the present author's 2000 management plan for the site (see below).

- *Acacia brownii* (Heath Wattle) – Scattered in small numbers through the Grassy Forest and Grassy Dry Forest, particularly in the south. These plants are part of a larger, interbreeding population that extends into Sites 50a and 50b. The only other records of the species in Maroondah this century are two plants in Site 12 and one in Site 52;
- *Acacia mucronata* subsp. *longifolia* (Narrow-leaf Wattle) – a few stems (perhaps as few as one genetically distinct individual) at two locations near the saddle – the last known population in Maroondah. The plants do not appear healthy;
- *Acianthus pusillus* (Small Mosquito Orchid) – a colony of twenty-two individuals was seen in the Grassy Dry Forest during this study. Other colonies probably went undetected;
- *Amyema pendula* (Drooping Mistletoe) – a few near the ridge;
- *Astroloma humifusum* (Cranberry Heath) – scarce, in the Grassy Dry Forest;
- *Blechnum minus* (Soft Water-fern) – four individuals grow in the creek just upstream (south) of the retarding basin;
- *Calochlaena dubia* (Common Ground-fern) – localised near the *Blechnum minus*;
- *Correa reflexa* var. *reflexa* (Common Correa) – fairly abundant but slowly being displaced by hybrids with garden correas – their own offspring;
- *Corunastylis despectans* (Sharp Midge-orchid) – four were detected by the author in 2003 but others are likely to have gone undetected due to the species' cryptic nature and the lack of a thorough flora survey since 2003;
- *Eriochilus cucullatus* (Parson's Bands) – formerly fairly abundant near the northern end of the ridgetop but the population collapsed in the early 2000s. The one seen by Ruth Jackson in 2010 is the last record, despite the present author's concerted searches in the same area in recent autumns;
- *Eucalyptus macrorhyncha* (Red Stringybark) – slowly dwindling in health and numbers but still the dominant species in the site;
- *Eucalyptus rubida* (Candlebark) – never abundant in the reserve, those that were present in decades gone by have dwindled to three individuals now due to track construction and slashing in the site's northeast;
- *Gompholobium huegelii* (Common Wedge-pea) – recorded as scarce in this study without further details;
- *Goodenia elongata* (Lanky Goodenia) – two patches were seen beside the creek in the site's southwest by the author up to 2000 but this study could not find them, probably explained by the 2-metre-deep creek erosion that has led to drying of the floodplain and a shift toward non-indigenous plants such as thistles;
- *Hibbertia empetrifolia* subsp. *empetrifolia* (Tangled Guinea-flower) – fairly abundant in the Grassy Forest. In combination with nearby plants in Site 50a, Stringybark Rise Reserve (Site 50b) and Palmer Avenue Reserve (Site 49), Site 51's plants are part of the only known population of the species in the Melbourne Region;
- *Hookerochloa hookeriana* (Hooker Fescue) – approximately one dozen individuals were seen beside the creek in the site's southwest by the author up to 2000 but this study could not find them, probably explained by the 2-metre-deep creek erosion that has led to drying of the floodplain and a shift toward non-indigenous plants such as thistles;
- *Hydrocotyle callicarpa* (Small Pennywort) – approximately 100 were seen in this study near the centre of the site, but the species is known for its large population fluctuations. The only other records of the

species in Maroondah this century are in the adjacent Sites 50a and 50b (approximately 150 plants between the two sites);

- *Kennedia prostrata* (Running Postman) – scattered through the Grassy Forest and (mainly) the Grassy Dry forest – the largest population in Maroondah;
- *Lagenophora stipitata* (Blue Bottle-daisy) – fairly abundant, the largest population in Maroondah;
- *Microseris walteri* (Murnong) – previously scattered thinly through drier parts of Hochkins Ridge Nature Conservation Reserve but not detected in this study, perhaps for seasonal reasons. The only other record of the species in Maroondah this century is this study's detection of one plant at F.J.C. Rogers Reserve;
- *Ozothamnus obcordatus* (Grey Everlasting) – roughly one dozen scattered along the ridgetop, part of a larger population that includes eighteen in Site 50a and twenty-one in Stringybark Rise Reserve (Site 50b). Together, those plants form the only population in Maroondah;
- *Persoonia juniperina* (Prickly Geebung) – recorded in this study without a count but the last count was of several dozen plants scattered through Hochkins Ridge Nature Conservation Reserve in 2000;
- *Poa tenera* (Slender Tussock-grass) – recorded in low-lying parts of the site up to 2000 but unable to be found during this study;
- *Polystichum proliferum* (Mother Shield-fern) – four plants grow in the deeply incised channel of the creek in the site's southwest;
- *Pterostylis atrans* (Dark-tip Greenhood) – last recorded by the author in 2003 (two plants) but perhaps overlooked due to lack of searching during this species' unusually flowering season;
- *Pultenaea forsythiana* (Eastern Prickly Bush-pea) – two suckering colonies near the centre of the site were not checked during this study; and
- *Senecio minimus* (Shrubby Fireweed) – abundant along the creek upstream of the retarding basin.

Significant fauna

The following species recorded at Hochkins Ridge are rare in Maroondah:

- Little Lorikeet – last recorded in December 2018, on eBird;
- Fan-tailed Cuckoo – recorded during this study and in eBird during 2014;
- Olive-backed Oriole – last recorded in 2014, on eBird;
- Rufous Whistler – last recorded in 2000, on eBird;
- Striated pardalote – last recorded in 2019, on eBird;
- Varied Sittella – up to twelve birds, last recorded in 2019, on eBird;
- Eastern Yellow Robin – last recorded in 2019, on eBird;
- Yellow-faced Honeyeater – last recorded in December 2018, on eBird;
- White-naped Honeyeater – last recorded in 2017, on eBird;
- Grey Shrike-thrush – last recorded in 2019, on eBird;
- Mistletoebird – heard during this study;
- Short-beaked Echidna – seen during this study and presumed to be resident;
- Sugar Glider – recorded during the last known spotlighting session (in 1999). The likelihood of the species' persistence in Site 51 is greatly increased by the collection of a dead Sugar Glider from a few hundred metres to the southeast by Elke Barczak of the Museum of Victoria on 17/5/16; and
- Black Wallaby – a resident group, observed during this study.

Fauna habitat

- The structure and composition of the native vegetation in most of the site represents good habitat for a wide range of forest birds, bats, possums and invertebrates, including sensitive species (hence the long list of significant fauna above);
- Tree hollows offer roost sites or nest sites for some animals, including bats;

- There are some large, old eucalypts, which are of high value as habitat trees;
- The site's substantial number of logs provide cover for invertebrates and small terrestrial vertebrates (e.g. lizards and frogs); and
- The value of the habitat is amplified by the site's location on a wildlife corridor along the Wicklow Hill ridge.

Ecological condition

On the A-to-D scale of ecological condition used by Lorimer *et al*. (1997):

- About 85% of the Grassy Forest, about two-thirds of the Grassy Dry Forest and roughly half of the Herb-rich Foothill Forest fit rating 'A' (excellent);
- About 10% of the Grassy Dry Forest and Grassy Forest, and quarter of the Herb-rich Foothill Forest, fits rating 'B' (good);
- A firebreak along the eastern edge fits rating 'D' (poor);
- Rating 'D' also fits about quarter of the Creekline Herb-rich Foothill Forest – in the northwest and southwest corners and close to the pond; and
- The rest of the site's native vegetation rates 'C' (fair).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened plant species

The following assessment relies on detailed information in the section above headed 'Significant plants'.

The flat-pea *Platylobium infecundum* is listed as 'Endangered' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. It has an apparently quite viable population in Hochkins Ridge Nature Conservation Reserve and its global distribution is confined to Victoria. It follows that the reserve meets standard criterion 3.1.2 for a site of **National** significance.

The Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) has a viable population scattered through much of Hochkins Ridge Nature Conservation Reserve. That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Those conditions standard criterion 3.1.2 for a site of **State** significance.

The known population of Veined Spear-grass *Austrostipa rudis* subsp. *australis* in Site 51 is small but additional plants have probably gone undetected. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

The section above headed 'Significant plants' includes a list of the reserve's species whose risk of dying out in Maroondah is in the 'critically endangered' category. Having regard to the information there, the populations of many of those species are either clearly viable and/or make major contributions to the species' total population in Maroondah. Those populations clearly meet the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Locally threatened fauna

Sugar Gliders are so uncommon in Maroondah that there is significance in the discovery of one in close proximity to the reserve in 2016 and the detection of the species within the reserve in the last known spotlighting session, in 1999. These observations satisfy standard condition 3.1.5 for Local significance in the same way that the abovementioned locally threatened plants do.

Patches of Ecological Vegetation Classes

The site's expanse of Grassy Forest and the southern strip of Creekline Herb-rich Woodland each includes over 0.25 ha that has native understorey cover of 10% or more. Those areas thereby qualify as 'patches' of native vegetation for the purposes of the standard criteria. No 'habitat score' has been determined but the present author is confident that in both EVCs, the score would be at least 0.3. Such a score leads to a 'High' conservation significance rating under Table 5 of the 'Native Vegetation Framework' (NRE 2002), taking into account the 'vulnerable' status of Grassy Forest and Creekline Herb-rich Woodland. Standard criterion 3.2.3 then leads to a rating of **State** significance.

The whole of the site's Grassy Dry Forest also qualifies as 'patch' vegetation but the EVCs are rated 'least concern', not 'vulnerable'. Most of it would have a habitat score of at least 0.6, which translates to 'Regional' significance under standard criterion 3.2.3. The remainder rates 'Local' significance under standard criterion 3.2.3.

The whole of the site's Herb-rich Foothill Forest also qualifies as 'patch' of 'least concern' vegetation but the author suspects that little if any of it has a habitat score of at least 0.6. As such, it rates 'Local' significance under standard criterion 3.2.3.

The strip of Valley Grassy Forest in the site's northeastern firebreak has so little native understorey that it does not qualify as a 'patch'.

The site's 'National' significance rating differs from the 'High Regional to State' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of *Platylobium infecundum*, which had not even been described as a species in 1997. The 'State' significance of the patches of Grassy Forest and Creekline Herb-rich Woodland exceeds the former 'High Regional to State' rating due to differences in the criteria and the state government's recognition in c. 2002 of the conservation status of Grassy Forest and Creekline Herb-rich Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit neighbours and visitors to the site. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creeks and pond helps to stabilise the soil and remove water pollution.

As explained in Section 1.3 of Volume 1, there is good evidence that people's health, wellbeing, quality of life and childhood development benefit from exposure to nature. Therefore, the reserve's natural ambience is expected to bring such benefits to neighbours and visitors. Benefits are spread into surrounding areas by the movement of birds, butterflies and other animals attracted to the site.

The site is probably the best place in Maroondah to see birds, which brings joy to many visitors.

The reserve's vegetation contributes to the 'green and leafy' character of the neighbourhood and also more broadly, as the ridge is a conspicuous landscape feature from vantage points over a substantial area. By

preserving the area's natural landscape and associated wildlife, the site helps to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparison of aerial photographs from 2001 and 2017 shows that 200–300 m² of native vegetation was removed in the northeast corner of Hochkins Ridge Nature Conservation Reserve in the intervening years, to enlarge the eastern firebreak and upgrade access from Holloway Road. Deaths of eucalypts and understorey along the creek south of the retarding basin created a gap in the habitat of roughly 0.1 ha. Those losses have been more than counterbalanced by growth of eucalypt crowns in the council reserve, now spreading over lawn or tracks where there was previously no canopy. The sum of the expanded areas of so many tree crowns is difficult to calculate but is estimated to be a few tenths of a hectare.

Change in the ecological condition of habitat

The ecological condition of the site's Valley Grassy Forest was rated 'C' (fair) by Lorimer *et al*. (1997) and is here rated 'D' (poor) in the parts of it that have not been destroyed to protect neighbouring houses from fire.

The condition of the Creekline Herb-rich Woodland upstream (south) of the retarding basin has deteriorated greatly since 1997. That is attributable to a marked drying of the floodplain and its water table as a result of creek erosion that reaches 2 m deep, exacerbated by the Millennium Drought and perhaps climate change. The erosion is, in turn, attributable to unregulated, strongly pulsed flows caused by the extensive impervious surfaces in the catchment. Many ferns and other species that cannot tolerate prolonged dry soil have either died out or dwindled. Introduced opportunistic plants such as thistles and Yorkshire Fog (*Holcus lanatus*) are replacing the dying indigenous plants.

Plant species have also been lost on the slopes and ridgetop. The reasons for the disappearance of orchids such as Parson's Bands and Silurian Leek-orchid from even the most natural vegetation in the site is quite obscure.

Comparison of aerial photographs from 2001 and 2011 shows that more than 100 mature eucalypts (perhaps many more) died in the intervening years – i.e. during the Millennium Drought. The worst-affected area was in a broad band along the creek in the site's southwest, where the creek erosion was greatest. A 2017 aerial photograph shows that the death rate has declined greatly since the Millennium Drought except in the eastern firebreak between Manuela Street and Holloway Road.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Exacerbation of the effects of the drying climate on the vulnerable Creekline Herb-rich Woodland and its rare plants by deep creek erosion, ultimately due to lack of effective management of pulsed flows from the urbanised catchment and changed rainfall patterns;
- Damage to vegetation and wildlife habitat by deer, which have been rubbing bark from trees, browsing plants and trampling the groundcover;
- Further eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and

- Continuing ecological degradation of the habitat along the eastern firebreak between Manuela Street and Holloway Road as a result of measures to reduce the threat of fire to adjacent homes.

Strategic planning

Site 51 is zoned 'Public Conservation and Resource Zone' except for the narrow projections to the west ('General Residential Zone') and the pipe track ('Public Use Zone – Service and Utility').

Throughout the site, the removal, lopping and destruction of native vegetation are regulated under the state-wide clause 52.17 of the Victoria Planning Provisions. The Vegetation Protection Overlay (VPO) provides additional native vegetation controls within the Hochkins Ridge Nature Conservation Reserve and the pipe track. Removal of trees (native or not) is controlled under Schedule 3 of the Significant Landscape Overlay.

As discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of such high biological significance as Site 51. It is recommended here to remove the VPO and apply the proposed new ESO1 schedule of the Environmental Significance Overlay to Site 51 as mapped on p. 386. However, the need for ESO1 is not great within the narrow projections in the site's west.

Information sources

The analysis above draws on the following sources of information about the site:

- Nineteen hours of fieldwork by the author for this study on 25/5/17, 25/8/17, 27/8/17, 9/10/17, 29/3/18, 2/4/18 and 22/5/18, including: (a) compiling five lists of indigenous and introduced plant species (including mosses and liverworts) and their abundances for different parts of the site; (b) targeted searching for, mapping and counting plant species that are rare or scarce within the site; (c) recording incidental observations of fauna, including abundances; and (d) checking for other attributes of the site relevant to the standard criteria for assessing biological significance;
- Bird observations from eBird between 2000 and September 2019;
- A record of *Eriochilus cucullatus* by Ruth Jackson on 10/4/10, the last record of the species in the reserve, as far as this study could find;
- Incidental observations of rare flora by the present author during casual visits over many years;
- A specimen of *Prasophyllum pyriforme* at the Australian National Herbarium (CANB 634812.1), collected from Hochkins Ridge Nature Conservation Reserve by Dean Rouse on 28th November 2001;
- *'Hochkins Ridge Flora Management Plan 2000'* by the present author for Maroondah City Council. Preparation of the document involved scores of hours of fieldwork during 1999–2000, including: (a) eighteen quadrats matching those assessed by Carr *et al*. for the document cited below; (b) five lists of indigenous and introduced vascular plant species for each of the drainage reserve and the Nature Conservation Reserves, differentiated by vegetation type; (c) mapping of vegetation types and ecological condition; (d) vegetation monitoring by various methods; (e) identification and assessment of ecological threats and degrading influences; and (f) detailed documentation of the population sizes and welfare of rare or scarce plant species, and an assessment of the threats faced by each;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was largely based on fieldwork that included: (a) plant lists; (b) mapping of vegetation types and condition; (c) incidental fauna observations; (d) a 20-minute bird census; (e) a mammal hair survey; (f) spotlighting; and (g) a frog call survey;
- *'The Vegetation and Management of Hochkins Ridge Flora Reserve, North Croydon, Victoria'* of 1991, by G.W. Carr, A.R.G. McMahon, S.E. Bedggood and G.J. Race of Ecological Horticulture Pty Ltd;
- Field data sheets of two quadrats by staff of the Arthur Rylah Institute in 1986;
- Wattle specimens at the National Herbarium of Victoria collected from the Nature Conservation Reserve by Bruce L. Maslin on 27/8/85, including *A. myrtifolia* (*B.R.Maslin 5864*), *Acacia paradoxa* × *stictophylla* (*B.R.Maslin 5865 & 5866*) and *A. stricta* (*B.R.Maslin 5867*), all inaccurately mapped in the 'Australasian Virtual Herbarium' at a point on Mount Dandenong Road, Croydon; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas. Note that the atlas's mapping of quadrat locations is quite inaccurate – they are more accurately shown in the management plans cited above.

Site 52. Roadside of 141–147 Holloway Road, Croydon North

Biological Significance Level: *Local* due to locally rare plants



Aerial photograph taken February 2017

Legend
Properties
Site 52
Municipal boundary

N

1:1000
0 10 20 30 40 50 m

Boundaries, land use and tenure

Site 52 includes the road verge of 141–143 and 145–147 Holloway Road, Croydon North, as well as the abutting two-metre-wide strips between those properties and the road reservation. The site's northern edge is the base of the roadside embankment. The western and eastern ends of the site are extensions of property boundary alignments.

The two-metre-wide strips are council reserves, presumably intended to conserve the rare plants there. However, the front fences and gardens of the properties currently extend into the reserves, as does the driveway crossover of no. 145–147.

The original version of Site 52 in the 1997 report, *'Sites of Biological Significance in Maroondah'*, included the two properties, which were vacant at the time. The properties have been excised here because residential development and garden creation have decimated their significant vegetation, though some remains.

General description

In horizontal projection, the site occupies 816 m². It includes a seven-metre-wide nature strip and a very steep, metre-high embankment that descends to the road gutter. Many of the wildflowers and rare plants

that were recorded in a 1996 flora survey remain but some have disappeared, mostly attributable to gardening and mowing. One of the plant species that remains was not found anywhere else in Maroondah during this study. In total, thirty-five naturally-occurring, indigenous plant species were observed during this study.

Powerlines pass over the site, so the site's eucalypts are periodically cut back or cut down.

The abutting residential properties were vacant in 1996 and supported similar vegetation to the roadside. Since then, the properties were developed for houses, gardens and lawns, leaving some eucalypts and roughly ten indigenous groundcover species.

Relationship to other land

The site is strongly affected by the abutting residential land use. Garden plants have been planted within the site and regular mowing is supressing some of the flora.

There are enough indigenous trees on the abutting properties and in the neighbourhood more generally to encourage birds and some flying insects to move around the local landscape. Pollen carried by those birds and insects is expected to aid the breeding of some of the site's plants.

There are few other indigenous understorey plants within 400 m.

Bioregion: Highlands - Southern Fall

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Grassy Dry Forest (Ecological Vegetation Class no. 22, 'Least concern' in the bioregion) with a tendency toward Valley Heathy Forest

Canopy trees: Red Stringybark (*Eucalyptus macrorhyncha*) is the only canopy species remaining. Bundy (*E. goniocalyx*) and Messmate Stringybark (*E. obliqua*) were present in 1996 but have been cut down. The presence of Messmate Stringybark represents a tendency toward the endangered EVC, Valley Heathy Forest.

Lower trees: There are several Golden Wattle (*Acacia pycnantha*). Lightwood (*A. implexa*) and Cherry Ballart (*Exocarpos cupressiformis*) are very scarce.

Medium to large shrubs: Hedge Wattle (*Acacia paradoxa*) is scattered. The following species are scarce: Myrtle Wattle (*A. myrtifolia*), Juniper Wattle (*A. ulicifolia*), Sifton Bush (*Cassinia sifton*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*) and Yarra Burgan (*Kunzea leptospermoides*). The following additional species were present in 1996 and may yet reappear: Common Heath (*Epacris impressa*), Prickly Tea-tree (*Leptospermum continentale*), Slender Rice-flower (*Pimelea linifolia*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: There are a number of Common Flat-pea (*Platylobium obtusangulum*), a few Grey Parrot-pea (*Dillwynia cinerascens*) and one Heath Wattle (*Acacia brownii*).

Ferns: Absent.

Climbers: There are two or three Purple Coral-pea (*Hardenbergia violacea*) and a single plant of Wonga Vine (*Pandorea pandorana*).

Creepers: None detected in this study but the 1996 flora survey detected Thin-leaf Wattle (*Acacia aculeatissima*), Creeping Bossiaea (*Bossiaea prostrata*) and Running Postman (*Kennedia prostrata*). All of those may reappear.

Grasses, rushes and sedges: Abundant and rich in species, dominated variously by Kangaroo Grass (*Themeda triandra*), Thatch Saw-sedge (*Gahnia radula*) or Weeping Grass (*Microlaena stipoides*). The next most abundant group of species (as seen in an August survey) comprises Slender Sword-sedge (*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Clustered Wallaby-grass (*Rytidosperma racemosum*), Bristly Wallaby-grass (*R. setaceum*) and Purplish Wallaby-grass (*R. tenuius*). Of the remaining species, the most ecologically informative are Variable

Sword-sedge (*Lepidosperma laterale*), Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*), Red-anther Wallaby-grass (*Rytidosperma pallidum*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: While grasses dominate the groundcover, there are substantial numbers of Black-anther Flax-lily (*D. revoluta*), Scented Sundew (*Drosera aberrans*) and Common Raspwort (*Gonocarpus tetragynus*). Among the less abundant species are Honeypots (*Acrotriche serrulata*), Milkmaids (*Burchardia umbellata*), Tall Sundew (*Drosera auriculata*), Common Hovea (*Hovea heterophylla*) and an onion-orchid (*Microtis* ?*parviflora*).

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 52 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acacia brownii* (Heath Wattle) – a single plant;
- *Cassytha glabella* (Slender Dodder-laurel) – two plants were found in this study but others may have escaped detection;
- *Eucalyptus macrorhyncha* (Red Stringybark) – scarce due to removal, as there are powerlines overhead;
- *Kennedia prostrata* (Running Postman) – recorded in 1996 and may reappear, but not seen in this study; and
- *Pimelea linifolia* subsp. *linifolia* (Slender Rice-flower) – recorded in 1996 on the embankment but not seen in this study.

Fauna habitat

The area is too small to provide much fauna habitat but:

- The wildflowers, shrubs and their litter provide food and cover for a range of insects and other invertebrates, some of which then become food for vertebrates such as lizards and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

However, mowing diminishes the habitat in substantial parts of the site.

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly quarter of the site's habitat rates 'B' (or good), half 'C' (fair) and quarter 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Threatened plant species

Throughout history, Slender Dodder-laurel (*Cassytha glabella*) has only been recorded at one other site in Maroondah, which was in the Warranwood Environmental Living Precinct (Site 16) in 1995. It was not found there during this study. The two plants in Site 52 form the last known population of the species in Maroondah.

Heath Wattle (*Acacia brownii*) was noted as locally rare in the 1997 report, *'Sites of Biological Significance in Maroondah'*. It has since become even more so. During this study, the only Heath Wattles found at sites other than Site 52 were two plants at 342-356 Wonga Rd, Warranwood (Site 12),

seven at Exeter Ridge (Site 50a, where at great risk from residential development) and a handful at Hochkins Ridge Nature Conservation Reserve (in Site 51).

Clearly, both the occurrences of Slender Dodder-laurel and Heath Wattle in Site 52 fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a **Local** significance rating.

Changes

Change in the extent of habitat

The original version of Site 52 in the 1997 report, *'Sites of Biological Significance in Maroondah'*, included not just the area circumscribed here but also the abutting residential lots, which were vacant at the time. Residential development, garden planting and the widening of the driveway of 145–147 Holloway Road have reduced the extent of habitat by approximately 0.4 ha (over 80% of the original site area).

Change in the ecological condition of habitat

Twelve indigenous plant species recorded in the 1996 flora survey within the new version of Site 60 appear to have died out (at least temporarily). Conversely, six species recorded in this survey were not detected in 1996. The net difference of six species suggests a modest loss of biodiversity and ecological condition. Similarly, the author's perception is that the ecological condition now has deteriorated somewhat compared with his recollection of the site in 1996.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order of importance:

- Gardening, particularly in the two-metre-wide reserves that have become occupied by the abutting residents' gardens;
- Mowing too frequently for the good of the indigenous flora;
- Non-indigenous plant species (particularly cotoneasters, non-indigenous wattles and W.A. Bluebell Creeper *Billardiera fusiformis*) slowly displacing the indigenous flora;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The part of the site that abuts 141–143 Holloway Road (and the property itself) are zoned 'Neighbourhood Residential Zone – Schedule 4', which is for sites of biological significance. The rest of the site and all nearby land on the Maroondah side of Holloway Road are zoned 'General Residential Zone – Schedule 1'.

Vegetation removal is controlled by the Vegetation Protection Overlay (VPO) within the whole site as well as 141–143 Holloway Road, 145–147 Holloway Road and the road itself to the middle of the road (which is the municipal boundary). On the road reservation, vegetation removal is also controlled by the state-wide native vegetation regulations in clause 52.17 of the Victoria Planning Provisions.

Of the two properties abutting Site 52, 145–147 Holloway Road has more indigenous understorey vegetation and 141–143 Holloway Road has more indigenous trees. This study found no reason to zone

the two properties differently, from the perspective of biological significance. It is therefore recommended that the zoning be reviewed.

It is important, from a biologist's perspective, to control vegetation removal on 141–143 Holloway Road and 145–147 Holloway Road because of those properties' roles as ecological buffers and attractors of pollinating birds and insects.

The existing VPO provides an appropriate level of planning control over vegetation removal on Site 52 and the abutting properties. It would therefore be appropriate to leave the overlay unchanged. However, the discussion of planning controls in Section 11.1.2 of Volume 1 explains that it is generally preferable to use an Environmental Significance Overlay rather than the VPO for sites of biological significance. It is therefore open to Council to remove the VPO from the new version of Site 52 (but not the abutting properties) and replace it with the proposed schedule ESO1.

Management recommendation

The site is a recognised site of biological significance and the two-metre-wide reserves in front of 141–143 Holloway Road and 145–147 Holloway Road are apparently intended to protect the site's significant vegetation. It would therefore be desirable for Council to remove at least some of the environmental weeds and discuss with the landowners the impacts of the extension of their gardens and gardening into the site.

Information sources

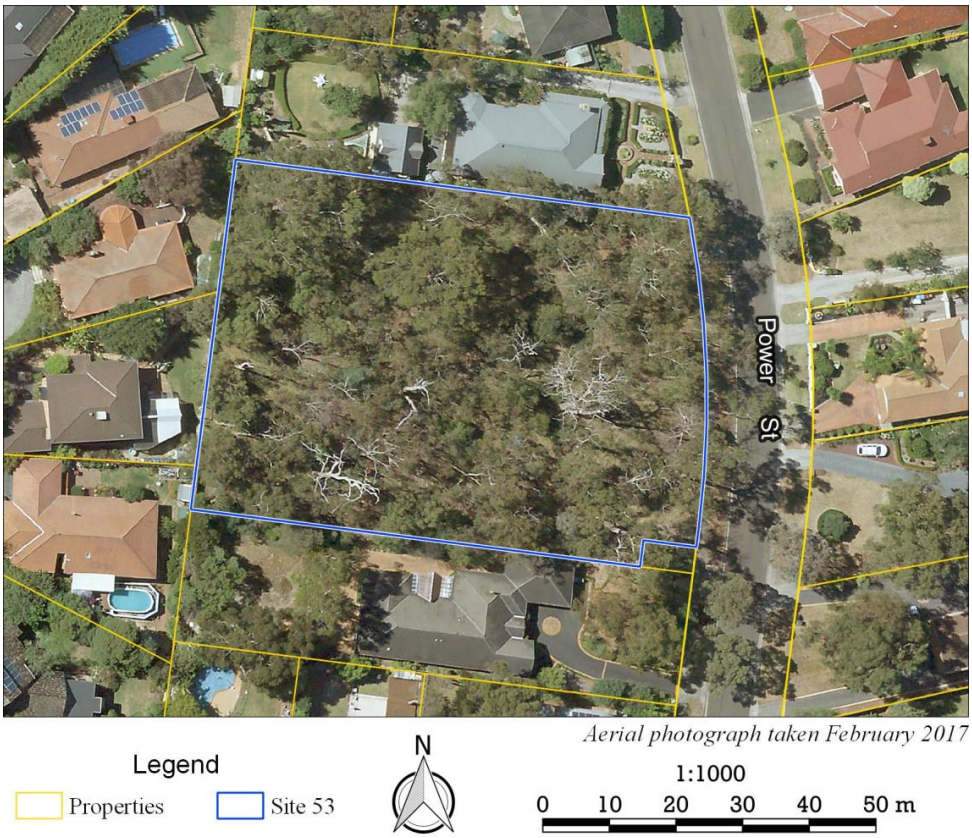
The analysis above draws on the following sources of information about the site:

- 30 minutes of fieldwork for this study in August 2019, including: (a) compiling a list of indigenous species of plants (excluding mosses and liverworts) in the site and another list for the abutting properties; (b) documenting and mapping rare or scarce plants; and (c) assessing the site against the standard criteria for sites of biological significance;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which fieldwork at Site 52 was done by the present author and Helen Moss on 25/8/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird.

Site 53. Power Street Reserve, Croydon North

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries, land use and tenure

Site 53 coincides precisely with 60A Power Street, known as Power Street Reserve. It is a municipal reserve managed for nature conservation.

General description

Power Street Reserve occupies 0.39 hectares and has a slight gradient of 1:20 facing east.

An aerial photograph from 1945 shows the site fully forested – an uncommon condition in metro Melbourne at the time. Some of the eucalypts in the reserve today would have been mature even then. However, the reserve suffered substantial ecological damage in the early 1990s from vehicles, machinery, rubbish dumping and other activities associated with the residential development that was going on around it. Maroondah City Council has been nurturing the reserve back to ecological health since then.

Seventy-two naturally-occurring, indigenous plant species were observed in the reserve during this study.

Relationship to other land

Because the reserve is so small and has no water, all its wildlife except small lizards and non-flying invertebrates would need to periodically travel to other areas of habitat to fulfil their habitat needs. The closest other habitat is the Northern Waterways Reserve (Site 103, 100 m north), which provides a link

eastward to the extensive habitat of Hochkins Ridge (Site 51). For flying fauna, there is a more direct, 160-metre, eastern route from Power Street Reserve to Hochkins Ridge above houses.

Fortunately, as can be partly seen on the aerial photograph on p. 276, Site 36 is the southern edge of a much larger area of habitat that includes the Lilydale Railway Line reservation (Site 28, p. 200), the Ruthven Way – Vasey Concourse precinct (Site 37, p. 284) and the Mount Dandenong Road median strip (Site 38, p. 291). The railway line reservation provides rudimentary connectivity with Ringwood Lake Park (Site 26, p. 185) and Bedford Park (Site 27, p. 194), each nearly 2 km to the west.

The closest other habitat with understorey is at Cheong Park (Site 35, 330 m to the east) and the Tintern Grammar Sanctuary (Site 34, 600 m south).

Between those sites, the landscape is made more permeable for native birds and other flying fauna by the presence of indigenous eucalypts and 'Australian native' trees along some nature strips and in some gardens. There is also a tiny council reserve at 43 Eastfield Road (200 m to the east) with a sickly canopy of remnant eucalypts and a weedy understorey.

Bioregion: Gippsland Plain

The state government's vegetation mapping wrongly shows the vegetation type ('Ecological Vegetation Class' or EVC) in the reserve to be Grassy Dry Forest. This has led to the reserve being wrongly placed in the 'Highlands - Southern Fall' bioregion. In reality, the vegetation type is clearly Valley Heathy Forest (e.g *Eucalyptus obliqua* is dominant and *Lindsaea linearis* & *Xanthosia dissecta* are present) and the correct bioregion is therefore the Gippsland Plain.

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Strongly dominated by Messmate Stringybark (*Eucalyptus obliqua*). There are small numbers of Bundy (*E. goniocalyx*) and Narrow-leaved Peppermint (*E. radiata*). Red Stringybark (*E. macrorhyncha*) was recorded in the 1990s but in 2019, all that could be found was one young tree that could not be confidently identified as that species.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*). Cherry Ballart (*Exocarpos cupressiformis*) is scattered. Golden Wattle (*A. pycnantha*) is scarce.

Medium to large shrubs: Patchily dense and diverse in species. Hedge Wattle (*Acacia paradoxa*) was quite dense in the 1990s but is now much less so, sharing dominance of the shrub layer with Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*), Shiny Cassinia (*C. longifolia*), Sifton Bush (*C. sifton*) and Common Heath (*Epacris impressa*). Hop Wattle (*A. stricta*), Juniper Wattle (*A. ulicifolia*) and Yarra Burgan (*Kunzea leptospermoides*) are scarce. Dandenong Range Cinnamon Wattle (*A. stictophylla*) was present in the 1990s before dying out (perhaps temporarily).

Small shrubs: As is normal for Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) and Grey Parrot-pea (*Dillwynia cinerascens*) are present, albeit scarcer than is typically the case.

Shrubby herbs: In 2019, Rough Fireweed (*Senecio hispidulus*) is abundant and there are roughly 50 Shrubby Fireweed (*S. minimus*) but both species are likely to be much scarcer in most years. Narrow Groundsel (*S. phelleus/prenanthoides*) and Cotton Fireweed (*S. quadridentatus*) are currently scarce.

Ferns: Austral Bracken (*Pteridium esculentum*) is scarce. Screw Fern (*Lindsaea linearis*) was recorded in the 1990s but not seen in this study's brief site inspection.

Climbers: Common Apple-berry (*Billardiera mutabilis*) and Purple Coral-pea (*Hardenbergia violacea*) are fairly abundant. Small-leafed Clematis (*Clematis decipiens*) is scarce.

Creepers: Kidney-weed (*Dichondra repens*), Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel, *Oxalis exilis/perennans*, are fairly abundant. Creeping Bossiaea (*Bossiaea prostrata*) is scarce.

Grasses, rushes and sedges: Abundant and rich in species. Variously dominated by Thatch Saw-sedge (*Gahnia radula*), Weeping Grass (*Microlaena stipoides*) or Red-anther (or Silvertop) Wallaby-grass

(*Rytidosperma pallidum*). The following species are fairly abundant or widespread: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Finger Rush (*Juncus subsecundus*), Variable Sword-sedge (*Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) Common Woodrush (*Luzula meridionalis*), Grey Tussock-grass (*Poa sieberiana* subsp. *sieberiana*), Purplish Wallaby-grass (*R tenuius*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*). Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*) and Slender Wallaby-grass (*Rytidosperma penicillatum*) are the most ecologically informative of the remaining graminoid species.

Other groundcover: Abundant and rich in species, particularly lilies and orchids. In season, Nodding Greenhood (*Pterostylis nutans*) is the dominant groundcover over substantial parts of the reserve. Scented Sundew also forms dense carpets in season. The following are the most ecologically informative of the many other groundcover species: Cut-leaf Xanthosia (*Xanthosia dissecta*), Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*), Common Rice-flower (*Pimelea humilis*), Grass Trigger-plant (*Stylidium armeria*), Pale Flax-lily (*Dianella longifolia*), Common Hovea (*Hovea heterophylla*), Blue (or Common) Bottle-daisy (*Lagenophora stipitata*), Dwarf Greenhood (*Pterostylis nana*), Blue Stars (*Chamaescilla corymbosa*), Common Wedge-pea (*Gompholobium huegelii*) and Yellow Rush-lily (*Tricoryne elatior*).

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. It grew in the reserve in the 1990s and may regenerate naturally from seed in future. There was also a rare hybrid *Acacia paradoxa* × *stictophylla* in the 1990s.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 36 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acacia mucronata* subsp. *longifolia* (Narrow-leaf Wattle) – not recorded since 1993;
- *Corybas diemenicus* (Veined Helmet-orchid) – a colony of nine plants;
- *Eucalyptus macrorhyncha* (Red Stringybark) – probably died out but one or two young trees may turn out to be this species when older;
- *Gompholobium huegelii* (Common Wedge-pea) – three individuals were seen in 1998 but were not found in this study's brief site inspection;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – a dense patch of c. 1.2 m²;
- *Lobelia browniana/gibbosa* – recorded by Brad Curtis on 20/1/1997, numbers unknown;
- *Pterostylis nana* (Dwarf Greenhood) – a compact colony of at least 22 individuals;
- *Senecio minimus* (Shrubby Fireweed) – 45–50 young plants were counted in this study and smaller plants probably escaped detection; and
- *Thelymitra ixioides/juncifolia* (Dotted Sun-orchid) – recorded in 1993 and seen by Maroondah City Council bushland staff in the past year or two.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for a range of common forest birds, bats, possums and invertebrates but the size of the reserve greatly limits the usage of the habitat;
- There are at least five large, old eucalypts, which are of high value as habitat trees. Two of those trees are dead;
- Tree hollows offer roost sites or nest sites for some animals, including bats;

- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), Power Street Reserve comprises approximately 0.3 ha that rates 'B' (or good) and 0.1 ha that rates 'C' (fair).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The reserve's vegetation easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. It contains Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the vegetation meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) once occurred in the reserve and may one day regenerate from seed, e.g. after fire. That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. If a viable population establishes by natural means, it will meet standard criterion 3.1.2 for a site of State significance. However, that does not apply at the moment.

The following plant species fall into the 'critically endangered' category of dying out in Maroondah and they have apparently viable populations in the reserve: *Corybas diemenicus*, *Lagenophora stipitata*, *Pterostylis nana*, *Senecio minimus* and *Thelymitra ixioides/juncifolia*. They fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'High local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation

benefit people visiting the reserve or living adjacent. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to be enjoyed by visitors and passers-by but visitation is scarce.

Some of the benefits that nature offers are spread into the surrounding area by the movement of birds, butterflies and other animals out of the reserve into surrounding streets and gardens.

The reserve preserves something of the area's natural landscape. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing the current extent of habitat with that recorded in a 1998 management plan (Lorimer 1998i), there has been no detectable change.

Change in the ecological condition of habitat

The 2019 assessment of ecological condition in the section headed 'Ecological condition' above is indistinguishable from the description in the 1998 management plan. However, the condition of the eucalypt canopy has deteriorated. Aerial photographs show that most of the dead eucalypts in the reserve today died between 2001 and 2011, attributable to the Millennium Drought. One or two additional eucalypts appear to have died between 2011 and 2017.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Further eucalypt deaths and consequent ecological disruption to understorey and fauna. Deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

Power Street Reserve is zoned 'Public Park and Conservation'. Most of the surrounding land is zoned 'General Residential Zone – Schedule 1'. The exception is the residence to the north (60 Power Street), which is zoned 'Neighbourhood Residential Zone – Schedule 4', presumably on the basis that it supported high-quality habitat with many orchids until the late 1990s. However, the habitat on 60 Power Street has since been completely destroyed.

Vegetation removal in the reserve and 60 Power Street is controlled by the Vegetation Protection Overlay (VPO).

As there is no longer any native vegetation on 60 Power Street, it is recommended to remove the VPO from it and consider rezoning it to General Residential.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the reserve and replace it with the proposed schedule ESO1.

Information sources

The analysis above draws on the following sources of information about the site:

- 70 minutes of fieldwork for this study on 17/8/19, including: (a) compiling a list of indigenous species of plants (excluding mosses and liverworts); (b) documenting and mapping rare or scarce plants; and (c) assessing the site against the standard criteria for sites of biological significance;
- The Maroondah City Council bushland management team's observations of a number of uncommon plant species in the reserve over the past few years;
- Maroondah City Council's records of planting in the reserve;
- *'Power Street Reserve Management Plan, 1998'* (Lorimer 1998i), which was based on a detailed flora survey and ecological assessment in May–June 1998;
- An incidental record of Tall Lobelia (*Lobelia browniana/gibbosa*) by Brad Curtis on 21/1/97;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which fieldwork was done in Power Street Reserve by Lynlee Tozer on 31/1/96;
- A list of indigenous plant species compiled by Helen Moss between 9/6/93 and 12/10/93 with additions by the present author on 22/10/93; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird.

Site 54. Yarra Road Primary School, Croydon North (Discontinued)

Biological Significance Level: *Not Significant*

Site 54 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) occupied 0.35 hectares of forest with indigenous understorey east (downhill) from Yarra Road Primary School's playing field and north of a driveway that passes through the school's eastern gate. The eastern boundary extended to the road formation of Power Street.

The reasons for the site being recognised were that some of the vegetation was quite natural and it included the following rare plant species:

- Dandenong Range Cinnamon Wattle (*Acacia stictophylla*), which is listed by the state government as rare due to its small geographic range;
- A hybrid between the Dandenong Range Cinnamon Wattle and Hedge Wattle (*Acacia paradoxa*); and
- Variable Sallow Wattle (*Acacia mucronata*), whose risk of dying out in Maroondah falls into the 'critically endangered' category.

Aerial photographs show that approximately one-third of the site has been cleared since the 1997 report and many of the shrubs and trees have been removed in the rest of the site. When viewed for this study in January 2019, none of the abovementioned rare plants were present and all of the surviving vegetation was in poor ecological condition. No aspect of the site met any of the standard criteria of Amos (2004) for a site of biological significance. The significance level is therefore 'Not significant' in the scheme of Amos (2004).

Strategic planning

The Vegetation Protection Overlay (VPO) currently covers an area that approximates Site 54 as delineated in 1997. As the site no longer qualifies as a site of biological significance, it is recommended to remove the VPO. Native vegetation in the school and on the road reserve remains subject to the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions.

Site 55. Croydon Primary School

Biological Significance Level: *National* due to two globally endangered species;
State due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Legend
Properties
Site 55

N

1:2500
0 20 40 60 80 100 m

Boundaries

Site 55 includes part of Croydon Primary School, adjacent nature strip along Tallent Street and a 17 m-diameter circle corresponding to a large White Stringybark on the opposite side of Tallent Street. A dashed blue line is used to mark the boundary on the aerial photograph above, allowing yellow to show between the dashes where they coincide with property boundaries. The boundary along Tallent Street follows the kerb, which coincides approximately with the canopy of eucalypts along the edge of the school. The boundary through the oval has been chosen to enclose the parts of the lawn that are dominated by indigenous groundcover. The rest of the boundary follows the edge of the canopy of wild, indigenous trees.

As with all sites in this volume, the precise site boundary is available in a shapefile for geographic information systems.

Land use and tenure

Croydon Primary School is a state school. The fenced area marked on the aerial photograph is a sanctuary with a Trust for Nature covenant. Tallent Street is a council road. The White Stringybark on the northern side of Tallent Street is on Croydon Uniting Church's land that was recently subdivided for residential use.

General description

Site 55 occupies 1.8 hectares at the southeastern foot of a hill, with a typical slope of 1:15. The soil has been deposited from further uphill (colluvium).

The school has a native plant sanctuary surrounded by a tall, chain-mesh fence with locked gates, shown in orange on the aerial photograph on the previous page. However, people and foxes have penetrated the fence. Contractors conduct basic weed control work in the sanctuary. Firebreaks are kept clear to the north and northwest.

The sanctuary's tree canopy has been decimated over the past twenty years by tree deaths that can be attributed, at least in part, to the Millennium Drought and excessive browsing by possums. The understorey contains a high number of wild, indigenous plant species as well as some planted species and their descendants. Among the wild species is a globally-endangered species, *Platylobium infecundum*. There is also a fairly high density of wild, non-indigenous trees and shrubs, some of them posing a major threat to the welfare of the indigenous flora and their dependent fauna.

East of the oval and above the Tallent Street nature strip, the site contains a near-full canopy of wild, indigenous eucalypts, larger and older than is usual for metropolitan Melbourne. Beneath the trees are scattered indigenous shrubs and, in lawn areas, a mixture of introduced grass and hardy indigenous grasses. The trees include some White Stringybarks (*Eucalyptus globoidea*), which are rare west of Gippsland.

A particularly large and impressive specimen of White Stringybark grows across Tallent Street in the car park next to the Croydon Uniting Church hall, in the blue circle on the aerial photograph on the previous page. It has no native understorey beneath it.

The uphill half of the school oval is included in the site because it is dominated by indigenous species of grass and sedge, with scattered wildflowers.

The rest of the site has a near-full canopy of eucalypts, patches of indigenous shrubs and a substantial density of wildflowers and indigenous grasses, which are periodically mown. A number of indigenous plant species found in these areas were not seen in the sanctuary.

In total, seventy-eight naturally-occurring, indigenous plant species were observed in the school during this study.

Relationship to other land

The closest substantial patch of habitat to Site 55 is at the former Croydon High School (Site 44), 270 m to the north. There are scattered habitat trees between the two sites, probably facilitating movements of birds and perhaps flying insects.

There are also wild, indigenous eucalypts around the Croydon Uniting Church and lining Croydon Road from the eastern edge of Croydon Primary School to Lincoln Road.

These trees augment the bird habitat at the school and facilitate bird movements around the neighbourhood. Overall, though, the connectivity of habitat within 500 m of Site 55 is mediocre.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*), followed by White Stringybark (*E. globoidea*). Mealy Stringybark (*E. cephalocarpa*) and Narrow-leaved Peppermint (*E. radiata*) are also moderately abundant. Bundy (*E. goniocalyx*) and Red Stringybark (*E. macrorhyncha*) are scarce but the latter was fairly abundant in the 1990s before many died. There is a single Swamp Gum (*E. ovata*).

Lower trees: Dominated variously by Blackwood (*Acacia melanoxylon*) and/or Cherry Ballart (*Exocarpos cupressiformis*). Black Wattle (*A. mearnsii*) is scarce. Black Sheoak (*Allocasuarina littoralis*) is scarce and possibly only present due to planting.

Medium to large shrubs: Patchily dense. Dominated variously by Yarra Burgan (*Kunzea leptospermoides*), followed by Sweet Bursaria (*Bursaria spinosa*), Hop Goodenia (*Goodenia ovata*), Snowy Daisy-bush (*Olearia lirata*) and Victorian Christmas-bush (*Prostanthera lasianthos*). There are at least seven other wild, indigenous species but all are scarce.

Small shrubs: As is normal for Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant. Grey Parrot-pea (*Dillwynia cinerascens*) was present in 1997 but appears to have died out since.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches.

Climbers: Twining Glycine (*Glycine clandestina*) is fairly abundant. Common Apple-berry (*Billardiera mutabilis*) and Love Creeper (*Comesperma volubile*) are scarce. Wonga Vine (*Pandorea pandorana*) is dense and should be treated as an environmental weed.

Creepers: Ivy-leaf Violet is abundant. Kidney-weed (*Dichondra repens*) is scattered through most of the site. The endangered flat-pea, *Platylobium infecundum*, has a healthy population in the sanctuary. The wood-sorrel *Oxalis exilis/perennans* is fairly abundant outside the sanctuary.

Grasses, rushes and sedges: Abundant and rich in species (28 indigenous species recorded). Dominated variously by Thatch Saw-sedge (*Gahnia radula*), Weeping Grass (*Microlaena stipoides*) or Purplish Wallaby-grass (*Rytidosperma tenuius*). Other abundant species include Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Smooth Wallaby-grass (*R. laeve*), Slender Wallaby-grass (*R. penicillata*) and Velvet Wallaby-grass (*R. pilosum*). The ecological indicators, Forest Wire-grass (*Tetrarrhena juncea*) and Small Grass-tree (*Xanthorrhoea minor*) are fairly abundant.

Other groundcover: Fairly rich in species, particularly lilies such as Chocolate Lily (*Arthropodium strictum*), Pale Grass-lily (*Caesia parviflora*), Matted Flax-lily (*Dianella amoena*), Pale Flax-lily (*D. longifolia*), Black-anther Flax-lily (*D. revoluta*) and Yellow Rush-lily (*Tricoryne elatior*). The presence in the site of Cut-leaf Xanthosia (*Xanthosia dissecta*) is a good indicator of Valley Heathy Forest.

Significant plants

Globally endangered

The Matted Flax-lily (*Dianella amoena*) is listed as 'Endangered' under the federal *Environment Protection and Biodiversity Conservation Act 1999* and the Victorian Government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. The species is scattered across Victoria, Tasmania and possibly New South Wales. A single individual was discovered in the grounds of Croydon Primary School during the survey for this report in 2017.

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. A healthy population occurs in the fenced sanctuary of Croydon Primary School

Rare (but not otherwise threatened) in Victoria

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* is listed by the Victorian Government as 'Rare but not otherwise threatened'. Some plants east of the fenced sanctuary appear intermediate between that subspecies and the common subspecies *rudis*, which is abundant in the site. Further investigation would be needed to decide which subspecies the plants in question belong to, or whether they are genuinely intermediate.

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah.:

- *Banksia marginata* (Silver Banksia) – a single banksia seedling was found near the northeastern corner of the sanctuary in 2017. The identity is uncertain because it was only a seedling but it was consistent with Silver Banksia;
- *Eucalyptus globoidea* (White Stringybark) – approximately five grow in the sanctuary and ten near the school's fence with Tallent Street. The tree on the church land is a particularly large and impressive specimen of the species; and
- *Eucalyptus macrorhyncha* (Red Stringybark) – formerly one of the dominant species but most died over the past twenty years, leaving many dead trunks and a few living trees scattered through the schoolgrounds.

Fauna habitat

- The structure and composition of the forest represents suitable habitat for a range of forest birds, bats and invertebrates, now somewhat impaired by the death of so many eucalypts in the sanctuary;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the site's native vegetation rates as follows:

- 'B' (or good) in most of the sanctuary;
- 'D' (poor) in the 3 m-wide strips to the north and northwest of the sanctuary fence;
- 'D' at the church, on the nature strip and to the east and northeast of the oval; and
- 'C' (fair) elsewhere.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The Matted Flax-lily (*Dianella amoena*) is listed as 'Endangered' under federal legislation. Any known habitat for such a species (including the grounds of Croydon Primary School within Site 55) is a site of **National** significance under standard criterion 3.1.1.

The flat-pea *Platylobium infecundum* is listed as 'Endangered' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. It has a healthy population in the Croydon Primary School Sanctuary and its global distribution is confined to Victoria. It follows that the sanctuary meets standard criterion 3.1.2 for a site of **National** significance.

If the Veined Spear-grass *Austrostipa rudis* subsp. *australis* is confirmed to exist to the east of the sanctuary, it would represent Regional significance under standard criterion 3.1.2. That is because the subspecies is listed as 'rare' in Victoria and it occurs interstate as well as Victoria.

The site's population of *Eucalyptus globoidea* (which falls into the 'critically endangered' category of dying out in Maroondah) fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Regionally threatened Ecological Vegetation Classes

Native vegetation west and north of the oval easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the vegetation meets standard criterion 3.2.3 for a site of State significance. The rest of the site has too little native vegetation to meet the definition of a 'patch' and are therefore not of State significance.

The site's overall 'National' significance rating differs from the 'Municipal' rating of Site 55 in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria, the discovery of *Dianella amoena* and the state government's recent recognition in of the conservation status of *Platylobium infecundum*.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the school community and immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site is expected to contribute to the enjoyment, health and wellbeing of the school community and those attending the church or its hall. It is particularly important for the school children, as nature helps the development of children's minds (Section 1.3 of Volume 1).

The native vegetation is a valuable educational asset for the school.

The site contributes to the amenity of neighbouring streets and gardens by birds, butterflies and other animals moving between the site and other areas of habitat.

The site's vegetation contributes substantially to Croydon's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, it is evident that approximately 200 m² of forest has been cleared since 2001 just inside the northern fence of the sanctuary. That is presumably for fire safety. It is also evident that some eucalypts have been lost around the school's entrance from Kent Avenue, immediately southeast of the site boundary adopted here. On the other hand, the site's eucalypts have grown significantly since 2001, so the crowns of those at the edge of the forested land have spread out over land that previously had no native vegetation cover.

Change in the ecological condition of habitat

The level of detail in the flora surveys in 1997 and 2017 were inadequate to make a quantitative comparison of ecological condition. Nevertheless, it is clear that the eucalypt canopy has declined badly and environmental weed species have become more abundant and mature in the centre of the sanctuary. The ecological condition of the centre of the sanctuary was rated 'A' (excellent) in 1997 and 'B' (good) in 2017. Despite the indications of a decline in ecological condition, the number of indigenous plant species has not declined since 1997.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Possible inadvertent destruction of the Matted Flax-lily, as it is in a location vulnerable to mowing. The location is known to the Principal and two people managing the grounds but people working in the grounds in future may not be aware of the plant or its high significance;
- Displacement of indigenous plants and their dependent fauna by introduced plant species, particularly Cedar Wattle (*Acacia elata*), Sallow Wattle (*A. longifolia* subsp. *longifolia*), Tall Flax-lily (*Dianella caerulea* var. *producta*), Wonga Vine (*Pandorea pandorana*) and Sweet Pittosporum (*Pittosporum undulatum*);
- Continued eucalypt decline and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change. Excessive browsing by possums was observing during the fieldwork for this study;
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Adverse effects to the White Stringybark on the church land when the site is developed for residential use, as the land has been recently subdivided.

Strategic planning

The school is zoned 'Public Use Zone - Education'. The northwestern two-thirds of the sanctuary and the land between there and Kent Avenue is covered by the Vegetation Protection Overlay (VPO). The delineation of the VPO area was presumably a flawed attempt to coincide with the sanctuary, as recommended in the 1997 report, *'Sites of Biological Significance in Maroondah'*. There are no other overlays on the school.

Tallent Street and the church land are zoned 'Neighbourhood Residential Zone – Schedule 3'. The removal, lopping or destruction of the White Stringybark on the church land is controlled by Schedule 3 of the Significant Landscape Overlay. The state-wide native vegetation controls of clause 52.17 of the Victoria Planning Provisions apply to the school and the nature strip of Tallent Street.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the whole site as outlined in blue on the aerial photograph on p. 411. The proposed schedule ESO2 could be applied to the White Stringybark on the church land instead of ESO1 as there is very little difference in effect on a single tree with no native understorey. The existing VPO should be removed.

Information sources

The analysis above draws on the following sources of information about the site:

- A flora survey of five hours duration for this study on 21/12/17;
- A detailed assessment of the naturally-occurring, indigenous eucalypts of the grounds of Croydon Uniting Church by the present author on 5/6/16;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site included a flora survey by Helen Moss on 17/2/97; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

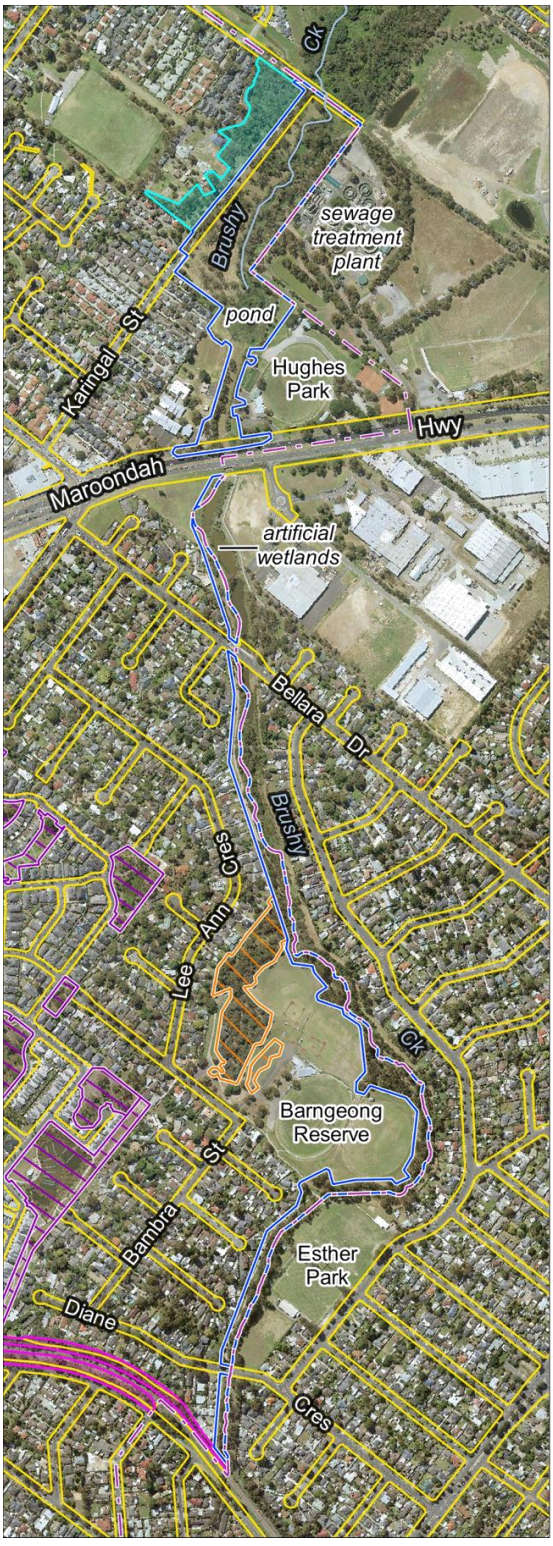
No useful information could be found in the online resources, eBird, the Atlas of Living Australia or the Victorian Biodiversity Atlas. The state government's vegetation correctly shows Valley Heathy Forest on the land but treats it as being part of the Highlands - Southern Fall bioregion, which appears quite wrong.

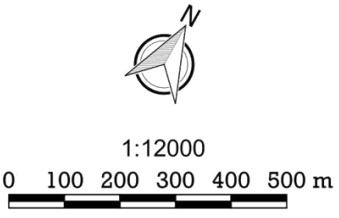
Acknowledgement

Thanks to the school's principal, Julie Gilbert, for providing permission to inspect the school and information about the use and management of the schoolgrounds.

Site 56. Brushy Creek Corridor

Biological Significance Level: *State or Regional* due to a vulnerable vegetation type





Legend

- Road & rail reserves
- Municipal boundary
- Site 56
- Site 57
- Site 58
- Site 59
- Site 60

Aerial photograph Feb 2017

Boundaries

The locations where Brushy Creek flows into and out of Maroondah form the southern and northern extremities of Site 56. As shown on the aerial photograph, the northeastern site boundary follows the municipal boundary except in Hughes Park, where it skirts the sports facilities. The southwestern boundary of the site follows the edge of the public land except at Barngeong Reserve, where it abuts the playing fields and Site 58. There are gaps in the site at Maroondah Highway and Bellara Drive. The site includes a 180-metre-long line of trees (largely indigenous species) on the northwestern verge of Maroondah Highway. It also includes a 35-metre line of indigenous trees along the northern edge of the former Croydon North Primary School, west of Hughes Park.

See also the descriptions of Sites 57, 58 & 60 below for more detail around those sites.

As with all sites in this volume, the precise site boundary is available as a shapefile for geographic information systems.

Land use and tenure

The land west of the Brushy Creek Sewage Treatment Plant, known as 44 Karingal St, Croydon North, is owned by Yarra Valley Water. The land north from Maroondah Highway to the middle of the pond marked on the aerial photograph above is Crown land. A small area (247 m²) of eucalypts south of the pond is within the grounds of the former Croydon North Primary School. VicRoads is responsible for the small part of the site within the road reservation of Maroondah Highway. Melbourne Water owns the land extending 150 m upstream (south) from Maroondah Highway. The rest of the site is council reserve.

Melbourne Water has management responsibility and authority over the bed and banks of Brushy Creek throughout. The creek receives treated sewage from the treatment plant marked on the aerial photograph. The whole corridor serves a drainage function.

A path runs beside the creek from the northern end of Barngeong Reserve to Bellara Drive and from the southern end of Barngeong Reserve to Diane Crescent. Another path runs northward from the northern end of Karingal St beside the Village School (Site 57).

General description

Site 56 occupies 12.0 hectares along a 2.8 km stretch of Brushy Creek through Croydon and Croydon North. The creek flows generally northward toward the Yarra River. Some of it has been moved from its natural course.

From the northern site boundary at Holloway Road to the pond marked on the aerial photograph on the previous page, the creek flows through a swampy woodland of quite large Swamp Gums (*Eucalyptus ovata*). Regular slashing and a history of grazing have caused that area to have little indigenous understorey except for scattered revegetation beds and clumps of Swamp Paperbark (*Melaleuca ericifolia*) or Blackwood (*Acacia melanoxylon*).

The abovementioned pond is managed as a trap for sediment washed down by the creek. It contains surprisingly few indigenous plants and few waterbirds were observed there during this study.

Between the pond and Maroondah Highway, the creek flows through a pipe beneath a floodway. The eastern side of the floodway has been planted with indigenous species and the western side is lined with non-indigenous eucalypts.

The northwestern verge of Maroondah Highway retains some naturally-occurring Swamp Gums and a large, uncommon hybrid eucalypt – possibly *Eucalyptus goniocalyx* × *ovata*.

Between Maroondah Highway and Bellara Drive, there is a recently-constructed chain of wetlands that help reduce water pollution and provide aquatic habitat. However, the wetlands are just outside the municipal boundary and therefore not included in Site 56. On the Maroondah side of the boundary, there is revegetation of various ages to 25 years plus a single wild tree – a large, old Swamp Gum.

From Bellara Drive to the northern tip of Barngeong Reserve, the riparian vegetation is revegetation planted in c. 2000.

The part of the site that fringes Barngeong Reserve contains the most natural vegetation – the only part with a substantial component of naturally-occurring, indigenous shrubs, groundcover and aquatic plants. It also contains a substantial component of revegetation, much of which is 20–25 years old.

Upstream of Barngeong Reserve, the riparian vegetation is mainly revegetation, some of which is recent and some is about 25 years old. There are occasional wild, indigenous trees and aquatic plants.

A total of forty-two naturally-occurring, indigenous plant species were observed within the site during this study.

The catchment of Site 56 is mostly quite urbanised but it includes some horticulture in its headwaters.

Relationship to other land

Platypus have been observed within Site 56. For Platypus to exist in a site the size of Site 56, they must be able to move into and/or out of the site in order to find mates, find food or disperse from their parents' home ranges. Detection of environmental DNA of Platypus over recent years by Cesar Pty Ltd suggests that the Platypus in Site 56 are probably not just occasional young or weak animals forced there in search of habitat.

Shortfin Eels have been observed in Site 56 recently and they must migrate via Brushy Creek and the Yarra River to and from the Coral Sea to complete their lifecycle.

On its own, Site 56 has too little tree cover to provide all the habitat needs of the common forest birds found there, such as Eastern Rosellas. Those birds almost certainly move between Site 56 and the neighbouring Sites 57–60 (marked on the aerial photograph on p. 418). Site 57 is the Village School, Site 58 is at Barngeong Reserve, Site 59 is at 'The Range' residential estate and Site 60 is along the Lilydale Railway Line.

Pollination that occurs from movements of birds and insects between Site 56 and other sites improves the reproductive success and genetic diversity of plants in all the visited sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

Some frog species – particularly the Southern Brown Tree Frog – are likely to move along Brushy Creek and between Sites 56–60.

A shortage of tree canopy for most of the stretch from Bellara Drive to Maroondah Highway represents an impediment to movement of forest birds and flying insects, significantly impairing the site's function as a wildlife corridor. A dearth of habitat trees in residences near Site 56 also reduces the site's value as a habitat corridor.

The ecological functions of Site 56 are dependent on the creek's catchment. Increased subdivision and impermeable surfaces are causing increasing problems of pulsed flows in the creek. Water pollution significantly affects what can live in the creek and on its banks, particularly downstream of the sewage treatment plant.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'. So many indigenous plants have been planted that one or two of the species presumed to be present naturally may have been planted.

Swampy Riparian Woodland (EVC 83, **Vulnerable** in the bioregion)

Dominant canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*). At Barngeong Reserve, there are three large Mealy Stringybark (*E. cephalocarpa*) and a Yellow Box (*E. melliodora*). At the site's northern extremity, there are some Narrow-leaved Peppermints (*E. radiata*) and a large Candlebark (*E. rubida*) on the creek bank.

Lower trees: Dominated in different areas by Blackwood (*Acacia melanoxylon*) or Swamp Paperbark (*Melaleuca ericifolia*). Black Wattle (*Acacia mearnsii*) is scattered, not abundant. Silver Wattle (*A. dealbata*) is also scattered but appears to have been planted, as it was not recorded in a 1996 flora survey. Cherry Ballart (*Exocarpos cupressiformis*) is quite scarce, localised near Barngeong Reserve. There is a solitary Hazel Pomaderris (*Pomaderris aspera*) in the far north.

Medium to large shrubs: The following species are neither abundant nor scarce: Prickly Moses (*Acacia verticillata*), Sweet Bursaria (*Bursaria spinosa*), Hop Goodenia (*Goodenia ovata*), Prickly Currant-bush (*Coprosma quadrifida*) and Yarra Burgan (*Kunzea leptospermoides*), but the last two of these may be the result of planting because they were not recorded in 1996. Immediately north of Barngeong Reserve, there is a dense cluster of eight seedlings of Hemp Bush (*Gynatrix pulchella*) that are too small to have been planted but they may have arisen from planted parents. There is a

cluster of nine Cluster Pomaderris (*Pomaderris racemosa*) at the southern end of Barngeong Reserve but they have perhaps been planted, as not recorded in the 1996 flora survey. The following species are scarce: Tree Everlasting (*Ozothamnus ferrugineus*), Elderberry Panax (*Polyscias sambucifolia*) and Large Kangaroo Apple (*Solanum laciniatum*). Prickly Tea-tree (*Leptospermum continentale/scoparium*) was recorded in 1996.

Small shrub: None seen.

Ferns: Austral Bracken (*Pteridium esculentum*) was present in 1996 but not seen in this study.

Climbers: None seen.

Creepers: None seen in this study but Creeping Raspwort (*Gonocarpus micranthus*) and Matted St John's Wort (*Hypericum japonicum*) were recorded in 1996.

Grasses, rushes and sedges: Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) dominates the groundcover in an area next to Barngeong Reserve. Clustered Wallaby-grass (*Rytidosperma racemosum*) is dominant in some other areas. Weeping Grass (*Microlaena stipoides*) and Bristly Wallaby-grass (*Rytidosperma setaceum*) are widespread or fairly abundant; so is Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) but some of it has been planted. The following species are quite scarce: Veined Spear-grass (*Austrostipa rudis*), Thatch Saw-sedge (*Gahnia radula*), Hollow Rush (*Juncus amabilis*), Austral Rush (*J. australis*), Green Rush (*J. gregiflorus*), Common Tussock-grass (*Poa labillardierei*) and Common Bog-rush (*Schoenus apogon*).

Other groundcover: Severely depleted. The only vascular species detected in this study were Black-anther Flax-lily (*Dianella revoluta*) and Hairy Willow-herb (*Epilobium hirtigerum*). The 1996 flora survey also recorded Pale Flax-lily (*Dianella longifolia*) and Lesser Loosestrife (*Lythrum hyssopifolia*).

Perennial stream, stream channel and shallow depressions (no EVC or conservation status applicable)

Trees: Suckering patches of Swamp Paperbark (*Melaleuca ericifolia*) are fairly frequent in the channel, extending onto the adjacent bank. Blackwood (*Acacia melanoxylon*) is scarce.

Shrubs: Sweet Bursaria (*Bursaria spinosa*) is scarce. Woolly Tea-tree (*Leptospermum lanigerum*) is present but probably only due to planting, as it was absent in the 1996 flora survey.

Fern: None seen.

Climbers: None seen.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is widespread in the site.

Grasses, rushes and sedges: Common Reed (*Phragmites australis*) and Cumbungi (*Typha domingensis* and *T. orientalis*) form frequent, dense patches. Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) is abundant on the slope of the creek channel next to Barngeong Reserve. Clustered Wallaby-grass (*Rytidosperma racemosum*) is scattered along the channel. Green Rush (*Juncus gregiflorus*) is fairly abundant at low-flow level from Barngeong Reserve to Diane Crescent. Tall Sedge (*Carex appressa*) is scarce. This study found two plants of each of Loose-flower Rush (*Juncus pauciflorus*) and Broom Rush (*Juncus sarophorus*) at low-flow level.

Amphibious species: Slender Knotweed (*Persicaria decipiens*) is fairly abundant. Swamp Crassula (*Crassula helmsii*) is scattered, mainly in wet depressions west of the sewage treatment plant. Water Plantain (*Alisma Plantago-aquatica*) is highly localised in the far north of the site. Lesser Joyweed (*Alternanthera denticulata*), Creeping Raspwort (*Gonocarpus micranthus*) and Glandular Brook-lime (*Gratiola pubescens*) were recorded in 1996.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 56 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus rubida* (Candlebark) – one large tree beside the creek at the site's northern extremity;
- *Gonocarpus micranthus* (Creeping Raspwort) – recorded near the Village School (Site 57) in the 1996 flora survey but not this study;
- *Gratiola pubescens* (Glandular Brooklime) – as above;

- *Gynatrix pulchella* (Hemp Bush) – immediately north of Barngeong Reserve, there is a dense cluster of eight seedlings that are too small to have been planted but they may have arisen from planted parents. The species was not recorded in 1996. There are a few planted individuals in Barngeong Reserve, raising the prospect that they are the parents of the seedlings;
- *Hypericum japonicum* (Matted St John's Wort) – recorded near the Village School (Site 57) in the 1996 flora survey but not this study;
- *Leptospermum lanigerum* (Woolly Tea-tree) – scattered along the creek near Barngeong Reserve, where probably planted because this species was not recorded in 1996; and
- *Pomaderris racemosa* (Cluster Pomaderris) – quite a few have been planted but there is a chance that the cluster of nine at the southern end of Barngeong Reserve is natural. The 1996 flora survey recorded this species just outside Site 56 in the north of Barngeong Reserve.

Significant fauna

- Platypus – an injured Platypus was discovered beside Brushy Creek in 2013 and Platypus DNA has been detected in the water since then;
- Red-rumped Parrot – rare in Maroondah, observed by multiple observers near Maroondah Highway between October 2018 and April 2019;
- Yellow Thornbill – two individuals beside the creek at Barngeong Reserve in 2012;
- Buff-banded Rail – a single individual beside the creek at Barngeong Reserve in 2012;
- Imperial Hairstreak Butterfly – during this study, a colony was found on a stunted Silver Wattle, 24 m south of Diane Crescent. The stunting suggests that the colony has been present for some years.

Fauna habitat

- The stream channel and the new stormwater wetlands abutting the site in the Shire of Yarra Ranges provide habitat for fish, aquatic invertebrates, waterbirds and Platypus. However, the value of the habitat is significantly constrained by water pollution, particularly downstream of the Brushy Creek Sewage Treatment Plant[3,4];
- The fertility of the valley favours high production of carbohydrates by plants and hence strengthens the base of the food chain;
- The structure and composition of the native vegetation represent suitable habitat for a range of common forest birds, bats, possums and invertebrates;
- The survey for this study counted thirteen eucalypts with trunk diameters over 70cm. Such large, old trees are of high value for habitat;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

The 260-metre section of Brushy Creek that has been converted to a barrel drain downstream from the southern side of Maroondah Highway represents a barrier to movement of some aquatic fauna. The weir at the downstream end of the pond may also be a minor barrier.

Ecological condition

The ecological condition of the site's vegetation varies from poor to fair, or between ratings 'D' and 'C' on the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The site's native vegetation is fragmented into so many parts, and the

[3] EPA Victoria water monitoring data, available at yarraandbay.vic.gov.au/report-card/yarra/YABRU0036.

[4] E.K. Richmond, E.J. Rosi, D.M. Walters, J. Fick, S.K. Hamilton, T. Brodin, A. Sundelin & M.R. Grace (2018). A diverse suite of pharmaceuticals contaminates stream and riparian food webs. *Nature Communications* **9**, Article no. 4491, https://doi.org/10.1038/s41467-018-06822-w.

condition varies so much over short distances, that estimating the amount of vegetation within each category of ecological condition is beyond the capacity of this study.

Vegetation beside Barngeong Reserve has the best ecological condition and the highest density of indigenous plant species. The creek channel is also less modified there than elsewhere in the site.

The health of eucalypts in the site is generally good. A substantial number of eucalypts died during the Millennium Drought but there have been very few deaths since, as evidenced by aerial photographs from 2001, 2011 and 2017.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State or Regional

Regionally threatened Ecological Vegetation Classes

The riparian strip beside Barngeong Reserve meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Swampy Riparian Woodland, which is listed by the state government as 'vulnerable' within the relevant bioregion – the Highlands - Southern Fall. Under such circumstances, standard criterion 3.2.3 gives a site a rating of State significance if the 'habitat score' is at least 0.3, or Regional otherwise. Without performing a detailed assessment to determine the habitat score, it is uncertain which of these conditions applies.

Rare or threatened fauna species

The Platypus is quite rare in Maroondah, being restricted to Brushy Creek and Mullum Mullum Creek. The presence of Platypus DNA in the water of Brushy Creek suggests that Platypus are present more regularly than had previously been thought, according to Platypus researcher, Josh Griffiths of Cesar Pty Ltd. The Brushy Creek corridor therefore fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The Imperial Hairstreak butterfly is also rare in Maroondah. The thriving, well-established colony beside Brushy Creek 24 m south of Diane Crescent fits the same description just quoted, therefore amplifying the site's Local significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 56 is believed to act as a corridor for movement of Platypus and Shortfin Eels, and to combine with Sites 57–60 to facilitate movement of birds, frogs and flying insects. Melbourne Water's 'Co-Designed Catchment Program for the Yarra Catchment' of 2018 aims to improve the habitat and corridor value of the Brushy Creek corridor.

For these reasons, Site 56 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords **Local** significance to such a site.

The section of Site 56 north of Maroondah Highway has sparse native understorey and large tracts of mown, introduced grass. The section immediately south of Maroondah Highway has few trees or shrubs. Revegetation of these sections holds potential to significantly improve the habitat and corridor function of Site 56 and the rest of Brushy Creek. This situation fits the following description from standard criterion 1.3.3: "Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor… Site (or one of a group of such sites) to form a strategic corridor of local importance and scale". That description applies to a site of **Local** significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people within the site and also neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creeks and wetlands helps to stabilise the soil and remove water pollution.

The natural ambience of the site is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors and those who use the paths.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens.

The natural ambience also encourages people to get exercise by walking, running or cycling through the site.

The site's vegetation and the associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. The site's large, old eucalypts are particularly important in that regard, some of them likely to date back over a century.

The site's location along a stream also has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017:

- The extent of habitat in Site 56 has been incremented by approximately 1.5 ha due to revegetation and growth of tree crowns to cover areas that had no native vegetation in 2001; and
- There has been a loss of less than 0.1 ha through the death or removal of trees that had no native understorey.

Changes in the species present

The previous (1996) flora survey detected thirteen indigenous plant species that were not detected in this study. Six of those species have a high probability of being detected again in the right time of year or at the right stage following a flood. At least two species (*Gonocarpus micranthus* and *Gratiola pubescens*) have probably died out, as they have almost throughout Maroondah.

Twelve indigenous plant species that were recorded in the present survey were not recorded in 1996. Three of them must have been overlooked in 1996 because they are represented by large eucalypts that would have been mature well before 1996. Some others are perhaps offspring of planted parents and still others are opportunistic species (e.g. Cotton Fireweed, *Senecio quadridentatus*) that only appear in favourable years.

Change in the ecological condition of habitat

Aerial photographs show that a substantial number of eucalypts in Site 56 died between 2001 and 2011, attributable to the Millennium Drought. One or two additional eucalypts appear to have died between 2011 and 2017.

Much of the site's vegetation was planted in the mid- to late-1990s. The maturation of that vegetation and the growth of naturally-occurring trees have substantially improved the overall ecological condition of the site's habitat.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Water pollution, affecting vegetation, aquatic invertebrates, fish, frogs, waterbirds and Platypus, particularly downstream of the Brushy Creek Sewage Treatment Plant;
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and further urbanisation of the catchment;
- Further mauling of Platypus by pet dogs or foxes;
- Renewed eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Debilitation of indigenous plants, particularly eucalypts, by over-competition from unnaturally high densities of eucalypts in revegetation areas (see pp. 89–90 of Volume 1). Over-competition will have its worst effects during drought;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Displacement of indigenous plants by introduced plants;

Strategic planning

The various zonings in the site are:

- 'Public Use Zone – Service and Utility' downstream of the sediment trap pond;
- 'Public Use Zone – Education' in the grounds of the former Croydon North Primary School;
- 'Road Zone – Category 1' in the road reservation for Maroondah Highway;
- 'Urban Floodway Zone' for a distance of approximately 140 m upstream of Maroondah Highway; and
- 'Public Park and Recreation Zone' elsewhere.

The state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions apply throughout, as does Schedule 4 of the Significant Landscape Overlay. The Vegetation Protection Overlay (VPO) applies to nearly all of the site.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to:

- Remove the VPO entirely, including from 38, 40 and 42 Karingal Street, Croydon North;
- Apply the proposed schedule ESO2 of the Environmental Significance Overlay to the parts of Site 56 that lie within the Maroondah Highway road reservation and downstream from there to the northern end of the former Croydon North Primary School. Non-indigenous 'Australian native' trees contribute substantially to the habitat in that area and there are few if any indigenous groundcover species; and
- Apply the proposed schedule ESO1 of the Environmental Significance Overlay to the rest of Site 56.

Restoration opportunities

The Brushy Creek habitat corridor is badly fragmented from just upstream of Maroondah Highway to the sediment trap pond. It would be ecologically desirable to increase the amount of native vegetation – particularly trees and shrubs – in that vicinity. Any such planting should have regard to Melbourne Water's guidelines for planting beside streams.

It would also be ecologically desirable to greatly increase the revegetation west of the pond and the sewage treatment plant. However, no planting should occur in the depressions in that area until a flora survey has been done in summer, as there is a chance that the locally rare *Gonocarpus micranthus* and/or *Gratiola pubescens* still grow there, as they did in 1996. (The present study's flora survey was in winter and the depressions contained water.)

Information sources

The analysis above draws on the following sources of information about the site:

- Four hours of ecological survey in the site for this study on 13/11/18, 30/8/19, 31/8/19 and 10/9/19, including: (a) compiling a list of indigenous plant species and their abundances, for each of three different parts of the site; (b) documenting the details of rare plants and large trees; and (c) mapping the vegetation, rare plants and large trees;
- Data in the Victorian Biodiversity Atlas from a fyke net capture-and-release survey of fish by Peter Lind near Holloway Road in March 2018, with 15 Shortfin Eels being the only indigenous species caught;
- eBird records of Red-rumped Parrot near Maroondah Highway in 2018–2019, from multiple observers;
- A bird list by Andrew McCutcheon from 29/9/12 in the online Atlas of Living Australia, including two Yellow Thornbills and a Buff-banded Rail;
- Correspondence from Josh Griffiths of Cesar Pty Ltd, reporting that he rescued an injured Platypus on Brushy Creek near Maroondah Highway in 2013 and that his company has detected Platypus on Brushy Creek by environmental DNA;
- Melbourne Water's *'Co-Designed Catchment Program for the Yarra Catchment'*, Version 1 of October 2018;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- Water pollution information from the references cited in the footnotes on p. 422;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork by Helen Moss and Graeme Lorimer in May 1996 that included a flora survey, frog call survey, spotlighting and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird.

Site 57. Village School, Croydon North

Biological Significance Level: *State or Regional* due to the presence of a vulnerable vegetation type



Boundaries, land use and tenure

Site 57 occupies part of 9 Holloway Rd, Croydon North, which is occupied by the private school called 'the Village School'. The western boundary is irregular, to follow the edge of the contiguous tree canopy. The rest of the boundary follows the property boundary.

General description

Site 57 occupies 1.9 hectares. The total area of the school is 3.5 hectares.

The site lies entirely on the floodplain of Brushy Creek. It has an elevation range of scarcely one metre except for the former channel of Brushy Creek in the southeast, which now acts as a wetland. (Until the late 20th Century, the creek flowed through the southeast of the Village School, as marked on the aerial photograph above.) Despite the presence of drains, the land is normally boggy during the wetter months.

The significance of the southern half of the site relates mainly to its tree cover. There is a dense cover of Swamp Paperbark (*Melaleuca ericifolia*) along the former creek channel and there is a fragmented canopy of Swamp Gums (*Eucalyptus ovata*). The southern half of the site is used for grazing and therefore contains few indigenous shrubs or groundcover plants, except perhaps in summer when annuals may appear. (This study's inspection was done in winter and had to be done from outside the fence, so summer-seasonal species could not be detected.)

The northern half of the site contains forest that is moderately natural except in part which is grazed. Part of it has a dense cover of Austral Bracken (*Pteridium esculentum*) and Thatch Saw-sedge (*Gahnia radula*); other parts are more open. There is also an artificial pond, which was established in 1993.

This study's inspection of Site 57 was conducted from outside the fence. Despite that constraint, nineteen naturally-occurring, indigenous plant species were observed.

Relationship to other land

Site 57 is so small that no birds would be able to fulfil all their habitat needs entirely within the site. Frogs and flying insects probably also need more habitat than the site can provide on its own. Fortunately, there are substantial areas of habitat that abut the site and provide a treed corridor to facilitate more distant travel.

As seen on the aerial photograph above, part of Site 56 (the Brushy Creek corridor) abuts the eastern edge of Site 57. To the north, the Yarra Ranges Council has designated the treed corridor along Brushy Creek 'Site of Botanical Significance B27' and 'Site of Zoological Significance Z22'. To the west, Griff Hunt Reserve and the Woodview Court subdivision provide small areas of rudimentary eucalypt habitat.

Pollination that occurs from movements of birds and insects between Site 57 and other sites improves the reproductive success and genetic diversity of plants in all the visited sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

The residential land in the vicinity of the Village School contains little habitat for indigenous fauna or flora.

Bioregion: Highlands - Southern Fall

Habitat type

The description of vegetation below includes only the most ecologically informative, naturally-occurring, indigenous plant species. Species that were detected in 1996 but not this study are indicated with asterisks.

Swampy Riparian Woodland (Ecological Vegetation Class no. 83, **Vulnerable** in the bioregion)

Dominant canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*). There are also some Narrow-leaved Peppermints (*E. radiata*).

Lower trees: Dominated in different areas by Blackwood (*Acacia melanoxylon*) or Swamp Paperbark (*Melaleuca ericifolia*). Black Wattle (*Acacia mearnsii*) is also present and Cherry Ballart (*Exocarpos cupressiformis*) is scarce.

Medium to large shrubs: The following species are neither abundant nor scarce: Sweet Bursaria (*Bursaria spinosa*) is moderately abundant. Prickly Currant-bush (*Coprosma quadrifida*), Manuka (*Leptospermum scoparium*) and Tree Everlasting (*Ozothamnus ferrugineus*) are all scarce.

Small shrub: None seen.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over a substantial area.

Climbers: Coarse Dodder-laurel (*Cassytha melantha*) grows on some Blackwood trees.

Creepers: None seen in this study but Bidgee-widgee (*Acaena novae-zelandiae*) and the wood-sorrel, *Oxalis exilis/perennans*, were recorded in 1996.

Grasses, rushes and sedges: Thatch Saw-sedge (*Gahnia radula*) and Weeping Grass (*Microlaena stipoides*) are abundant in different parts of the northern half of the site. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is fairly abundant. Veined Spear-grass (*Austrostipa rudis*) and rushes (*Juncus* species) are scattered thinly.

Other groundcover: Severely depleted. The only vascular species detected in this study's site inspection (from outside the fence) was Pale Flax-lily (*Dianella longifolia*).

Significant plants

Critically endangered in Maroondah

Senecio minimus (Shrubby Fireweed) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. It was recorded in the previous (1996) flora survey. It was not detected from outside the fence during this study's site inspection. A closer inspection is likely to detect the species, at least during some years.

Baumea arthrophylla/rubiginosa (a twig-rush) is another species in the 'critically endangered' category of dying out in Maroondah. It was recorded in 1996, probably in the former course of Brushy Creek, in the site's southeastern corner. It may persist there but grazing makes that less likely than would otherwise be the case.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates. That habitat benefits from the fertility of the alluvial soil, which favours high production of carbohydrates by plants and hence strengthens the base of the food chain;
- Tree hollows and nest boxes offer roost sites or nest sites for some animals, including bats;
- The native vegetation and its litter provide food and cover for invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The location on the Brushy Creek habitat corridor amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), approximately 0.7 ha in the northern half of the site rates 'C' (fair) and the remaining 1.2 ha rates 'D' (poor).

The health of the tree canopy is generally good.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Regional to State

Regionally threatened Ecological Vegetation Classes

Part of the northern half of the site meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type

is Swampy Riparian Woodland, which is listed by the state government as 'vulnerable' within the relevant bioregion – the Highlands - Southern Fall. Under such circumstances, standard criterion 3.2.3 gives a site a rating of State significance if the 'habitat score' is at least 0.3, or Regional otherwise. Without performing a detailed assessment of the vegetation on-site, it is uncertain which of these conditions applies.

Threatened plant species

As mentioned in the section above headed 'Significant plants', Site 57 represents good habitat for the Shrubby Fireweed (*Senecio minimus*), which falls into the 'critically endangered' category of dying out in Maroondah. The site fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

The section above headed 'Relationship to other land' describes how Site 57 represents a component of the Brushy Creek habitat corridor. In this way, the site fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Sites fitting that description are deemed by the criteria to represent Local significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the school community and people living in neighbouring homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to contribute to the enjoyment, health, wellbeing and childhood development of the school community, as well as users of the public path just outside the school's eastern fence. Some of those benefits are spread into surrounding streets and gardens by the movement of birds, butterflies and other animals attracted to the site.

The site preserves something of the area's natural landscape. It, and the associated fauna, help to pass on an appreciation of the area's natural heritage from generation to generation.

The site's location beside a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

At the time of the previous (1996) biological assessment of Site 57, the Village School included what is now the Woodview Court residential estate. The construction of the estate resulted in the clearing of 0.8 ha.

Aerial photographs from 2001 and 2017 indicate that the growth of eucalypt crowns during that period caused a gain of approximately 0.03 ha of canopy cover.

Change in the ecological condition of habitat

Aerial photographs show that a substantial number of eucalypts in Site 57 died between 2001 and 2011, attributable to the Millennium Drought. A much smaller number of additional eucalypts appear to have died between 2011 and 2017 and the canopy health is now generally good.

The verbal description of the ecological condition of the site's habitat in the 1997 report, *'Sites of Biological Significance in Maroondah'*, is consistent with the present assessment.

Threats

This study has identified the following threats to the site's biodiversity:

- Horse grazing, particularly in the former course of Brushy Creek;
- Possible further subdivision;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Drying of the soil (most importantly in winter) due to climate change and increasing amounts of impervious surfaces in the site's groundwater and surface water catchments;
- Renewed eucalypt deaths and consequent ecological disruption to understorey and fauna. Deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Displacement of indigenous plants by introduced plants; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The school is zoned 'Neighbourhood Residential Zone – Schedule 4'. Vegetation removal throughout the school is regulated under the Vegetation Protection Overlay (VPO), Schedule 4 of the Significant Landscape Overlay (SLO4) and the state-wide controls of clause 52.17 of the Victoria Planning Provisions. The overlays also apply to the abutting Woodview Court residential estate, as a legacy of previously being part of the school.

Because the development of the residential estate cleared the habitat there except some eucalypts, and because those eucalypts are protected under SLO4, it is recommended to remove the VPO from that land.

Consistent with the principles in Section 11.1.2 of Volume 1, it is also recommended to remove the VPO that exists over the school and instead apply the proposed schedule ESO1 to Site 57 as outlined in mid-blue on the aerial photograph on p. 427. Native vegetation in the rest of the school will retain the planning protection of SLO4 and clause 52.17.

Information sources

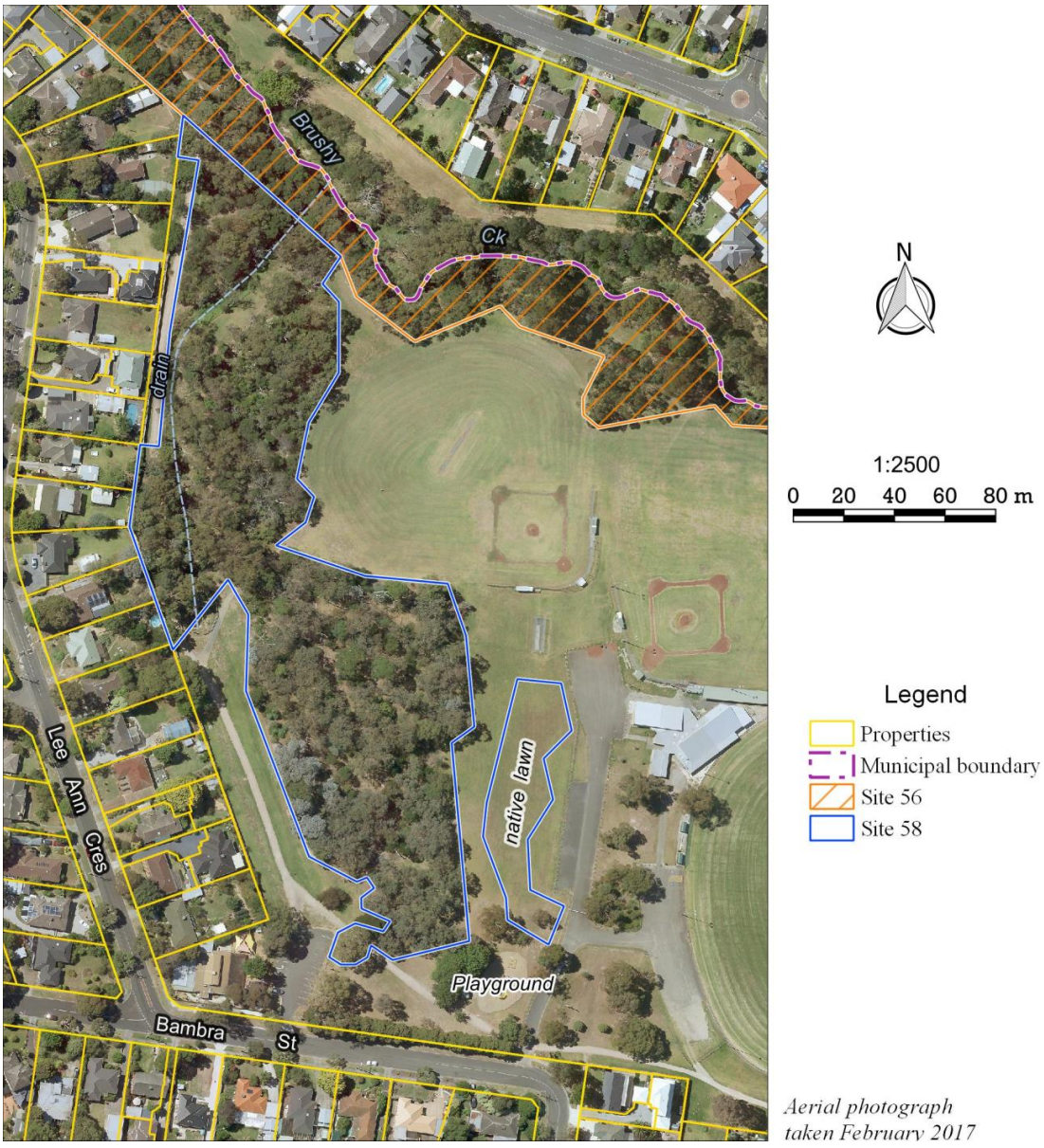
The analysis above draws on the following information sources about the site:

- Approximately three-quarters of an hour of fieldwork by the author for this study on 30/8/19, including: (a) compiling a list of indigenous and introduced plant species and their abundances; (b) documenting the details of rare or scarce plants; and (c) mapping the vegetation, rare plants and physical features;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The report's fieldwork at the Village School included: (a) compiling a list of indigenous plant species (without abundances) by Helen Moss; (b) a twenty-minute bird census by John C. Reid; and (c) incidental fauna observations by John C. Reid; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Site 58. Barngeong Reserve, Croydon

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries, land use and tenure

Site 58 occupies two polygons (outlined in mid-blue above) at Barngeong Reserve, Croydon. The larger polygon's boundary circumscribes the edge of the reserve's contiguous cover of indigenous trees except where it abuts Site 56 or the reserve's boundary. That area is managed for nature conservation, recreation and drainage. The smaller polygon (labelled 'native lawn' above) circumscribes a seasonally-boggy area of abundant Branched Sundews (*Drosera hookeri*), onion-orchids (*Microtis*) and other indigenous groundcovers. That area is managed for sport and recreation but at the time of this study's survey (August–September 2019), it was unsuitable for such uses because it was extremely boggy.

General description

Barngeong Reserve is situated on the broad floodplain of Brushy Creek. Most of it is covered by playing fields but this site is confined to two polygons (2.1 hectares and 0.2 hectares) dominated by native vegetation. With the exception of an engineered drain (shown on the aerial photograph), the elevation changes by only 2½ m from the highest point (in the southeast corner) to the lowest point (in the northwest corner). The slope is typically 1:85, resulting in slow drainage.

The site is undoubtedly less boggy than prior to the extensive engineering works that have drained the floodplain. The trees in the site's larger polygon keep the ground less boggy than the smaller, native lawn polygon. As a result, the native lawn polygon retains habitat for some of the area's pre-settlement plant species that can no longer survive in the treed area. Among those species is the Branched Sundew (*Drosera hookeri*), which is represented by thousands of individuals, by far the largest known population in Maroondah. Mowing prevented identification or detection of some of the indigenous species present. It is possible that some locally rare plant species have gone undetected. As discussed in Section 5.1.3 of Volume 21, the indigenous plant species of winter-sodden / summer dry soils have been more seriously depleted than any other vegetation type in Maroondah.

A combination of the draining of the landscape, tree removal and an apparent history of grazing have significantly depleted the range of indigenous plant species in the site. However, Maroondah City Council and its predecessor, Croydon City Council, have undertaken weed control and planting of indigenous species in the site's larger polygon since the early to mid-1980s to restore the treed area to a more natural state. The significance of the smaller polygon had not been noticed until this study.

Forty-five naturally-occurring, indigenous plant species were observed in the reserve during this study.

Relationship to other land

Site 58 is so small that none of its birds or frogs would be able to fulfil all their habitat needs entirely within the site. Most or all flying insects probably also need more habitat than the site can provide on its own. Fortunately, there are substantial neighbouring areas of habitat that augment the site.

As seen on the aerial photograph above, part of Site 56 (the Brushy Creek corridor) abuts the eastern edge of Site 58. It provides additional habitat and facilitates wildlife movements to and from more distant habitat. The aerial photograph on p. 418 shows that Site 56 connects with Site 60 (along the Lilydale Railway Line) and that Site 58 is close to Site 59 ('The Range' estate).

Between those sites, the scattered remnant indigenous trees and planted Australian native trees in gardens and nature strips are presumed to make the landscape more permeable for birds and flying insects.

Pollination that occurs from movements of birds and insects between Site 58 and other sites improves the reproductive success and genetic diversity of plants in all the visited sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

Bioregion: Highlands - Southern Fall

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species.

Swampy Woodland (Ecological Vegetation Class no. 937, **Endangered** in the Highlands - Southern Fall bioregion)

Canopy trees: The area east of the drain is strongly dominated by Swamp Gum (*Eucalyptus ovata*), with minor occurrences of Mealy Stringybark (*E. cephalocarpa*), Yellow Box (*E. melliodora*), Narrow-leaved Peppermint (*E. radiata*) and Candlebark (*E. rubida*). Further south, Mealy Stringybark is strongly dominant, accompanied by scattered Narrow-leaved Peppermint and a large hybrid eucalypt suspected to be *E. ovata* × *rubida*. (Records of Manna Gum from 1996 are misidentifications of Candlebark.)

Lower trees: Dominated in different areas by Black Wattle (*Acacia mearnsii*), Blackwood (*A. melanoxylon*) or Swamp Paperbark (*Melaleuca ericifolia*). Cherry Ballart (*Exocarpos cupressiformis*) is scarce.

Medium to large shrubs: Prickly Currant-bush (*Coprosma quadrifida*) is the densest and most widespread shrub. Sweet Bursaria (*Bursaria spinosa*), Sifton Bush (*Cassinia sifton*), Yarra Burgan (*Kunzea leptospermoides*) and Large Kangaroo Apple (*Solanum laciniatum*) are moderately abundant. The following species are scarce: Prickly Moses (*Acacia verticillata*), Common Cassinia (*Cassinia aculeata*), Tree Everlasting (*Ozothamnus ferrugineus*) and Cluster Pomaderris (*Pomaderris racemosa*). The last of these was represented by a single plant in 1996 and the present population (confined to an area that was bare in 1996) is probably the result of planting.

Small shrubs: None seen.

Shrubby herbs: Cotton Fireweed (*Senecio quadridentatus*) is fairly abundant and Rough Fireweed (*S. hispidulus*) is scarce, but numbers will vary from year to year.

Ferns: None seen.

Climbers: There is a single Purple Coral-pea (*Hardenbergia violacea*) but it may have been planted.

Creepers: Kidney-weed (*Dichondra repens*) is abundant and the wood-sorrel, *Oxalis exilis/perennans*, is somewhat less so. Bidgee-widgee (*Acaena novae-zelandiae*) was present in 1996 and is likely to reappear.

Grasses, rushes and sedges: This study's winter flora survey probably missed some grass species. Weeping Grass (*Microlaena stipoides*) is abundant and widespread. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is locally abundant, its numbers possibly boosted by planting. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Mat-grass (*Hemarthria uncinata*) and Common Bog-rush (*Schoenus apogon*) are localised. The following species are scarce: Hollow Rush (*Juncus amabilis*), Austral Rush (*J. australis*), Toad Rush (*J. bufonius*), Pale Rush (*J. pallidus*), Finger Rush (*J. subsecundus*), Slender Sword-sedge (*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) and Clustered Wallaby-grass (*Rytidosperma racemosum*).

Other groundcover: Greatly depleted due to past drainage works and grazing. Most of the surviving indigenous species in the site's treed polygon belong to the highly opportunistic species, Spreading Crassula (*Crassula decumbens*), Common Cotula (*Cotula australis*) and Jersey Cudweed (*Laphangium luteoalbum*). There is also a small number of Black-anther Flax-lily (*Dianella revoluta*) and Small Poranthera (*Poranthera microphylla*), and some Streaked Arrow-grass (*Triglochin striatum*) in a tiny excavation.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Barngeong Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus rubida* (Candlebark) – four healthy individuals grow east of the drain, two of whose trunk diameters exceed the state government's threshold to be deemed 'large trees'. The species also occurs in small numbers in the abutting Site 56;
- *Pomaderris racemosa* (Cluster Pomaderris) – seven grow west of the drain but they have probably all been planted, as that area was bare in 1996–2001;
- *Baumea arthrophylla* (Fine Twig-rush) – a single patch was recorded east of the drain in 1996 but could not be found in 2019. It may well have died during the Millennium Drought, as the species did in all but one other location in Maroondah;
- *Drosera hookeri* (Branched Sundew) – there are at least several thousand plants in the native lawn north of the playground, by far the largest population of the species in Maroondah.

Other

The solitary *Eucalyptus* ?*ovata* × *rubida* (a hybrid eucalypt) that is visually prominent from the western baseball diamond is also of significance as a very uncommon hybrid. Its trunk diameter is large enough to be deemed a 'large tree'.

The native lawn north of the playground contains a modest population of the plant, Waterblinks (*Montia fontana*). That species was presumed extinct in the Melbourne area until this decade when the author discovered it in lawns at several locations and Helen Moss found it in her vegetable patch. Despite the species' rarity, it does not appear to be highly threatened unless and until climate change makes its current habitats too dry for survival.

Significant fauna

Five Purple-crowned Lorikeets (a locally-rare species) were observed at Barngeong Reserve by Mike Honeyman on 20/2/16. Apart from Mr Honeyman's observations on that day and this author's incidental observations in August–September 2019, this study found no other fauna records from Barngeong Reserve except an obscure, anonymous record of the Whistling Tree Frog. It is therefore not possible to determine whether the observed presence of Purple-crowned Lorikeets in 2016 is any more than a rare occurrence.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates. That habitat benefits from the fertility and high moisture availability of the alluvial soil, which favours high production of carbohydrates by plants and hence strengthens the base of the food chain;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The site's location on the habitat corridor of Brushy Creek (Site 56) amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the site's larger, treed polygon is fair – rating 'C' on the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The ecological condition of the native lawn in the smaller polygon is on the borderline between ratings 'C' (fair) and 'D' (poor).

The health of the eucalypt canopy varies between fair and good.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The vegetation in the larger, treed polygon of Site 58 easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type (EVC) is Swampy Woodland, which is listed by the state government as 'endangered' in the Highlands - Southern Fall bioregion. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of **State** significance.

Locally threatened plant species

Referring to the section above headed 'Significant plants', Site 58's populations of *Eucalyptus rubida* and *Drosera hookeri* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

The section above headed 'Relationship to other land' describes how Site 58 is ecologically connected with the Brushy Creek habitat corridor as well as Sites 59 and 60. Those connections mean that Site 58 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Sites fitting that description are deemed by the criteria to represent Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Swampy Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting or passing through the reserve or living in neighbouring homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the drain helps to stabilise the banks and remove a small amount of water pollution.

The site's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into surrounding streets and gardens.

The natural ambience also encourages people to get exercise by walking or running through the reserve.

The site preserves something of the area's natural landscape. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

The site's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018* except the southwest corner.

Changes

Change in the extent of habitat

The original version of Site 56 in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) excluded land northwest of the drain due to absence of habitat there. An aerial photograph from 2001 shows half that area with young revegetation and the other half covered with fresh mulch ready for extending the revegetation. The growth of the revegetation has increased the site's habitat (and boundary) by 0.13 ha.

In the time between the 2001 aerial photograph and a 2017 aerial photograph, the extent of habitat is estimated to have grown by 0.2 ha through the expansion of eucalypt crowns over mown exotic grass.

Aerial photographs do not reveal any reduction of the extent of habitat elsewhere in the current or former versions of the site.

Change in the plant species present

The previous (March 1996) flora survey of the site recorded seven indigenous plant species that were not detected in this study's survey in August–September 2019. Two of those seven species are grasses that might be detected in a summer survey. At least one other (*Acaena novae-zelandiae*) is likely to reappear from time to time. *Dianella longifolia* may have been overlooked as a naturally-occurring species in this study due to confusion with planted plants.

Conversely, this study detected twenty-nine indigenous plant species that were not detected in 1996. Many of those are seasonal species, some tree species were evidently just overlooked in 1996 and a couple of species may have arisen as descendants of planted plants (particularly *Solanum laciniatum*). Four species of rush (*Juncus*) have convincingly established since 1996 by natural means. That establishment is probably attributable to the removal of the dense cover of the pasture grass, Cocksfoot (*Dactylis glomerata*) that was reported in 1996.

Change in the ecological condition of habitat

The removal of the Cocksfoot just alluded to, followed by enrichment planting, has significantly increased the ecological condition of the southern half of the site's larger polygon. The northern half was 'overrun with the weeds Hawthorn, Japanese Honeysuckle and Cotoneasters' in 1996 (as reported by Lorimer *et al.* 1997). Since then, those weeds have been completely controlled and replaced by a more diverse range of indigenous plants, improving the vegetation's ecological condition.

The native lawn in the site's smaller polygon was not recognised to be significant in 1996, possibly because of mowing and the time of year. It is therefore not possible to infer any change in ecological condition.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued drying of the site's winter-sodden soils due to climate change and the legacy effects of past drainage works, leading to decline of the indigenous flora and its dependent fauna;
- Mowing of the native lawn too frequently or when conditions are boggy, either of which could destroy some of the rare plants and promote their replacement by opportunistic introduced species such as Capeweed (*Arctotheca calendula*) and Brown-top Bent (*Agrostis capillaris*);
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. Deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The whole of Barngeong Reserve is zoned 'Public Park and Recreation Zone'. The drain and land along the swale that leads into the drain are covered by a Special Building Overlay because of periodic flooding.

Through the whole neighbourhood on the Maroondah side of Brushy Creek, tree removal is controlled by Schedule 4 of the Significant Landscape Overlay. Removal of native vegetation (trees or otherwise) within the reserve comes under the state-wide controls of clause 52.17 of the Victoria Planning Provisions. As

recommended by Lorimer *et al.* (1997), most of the site is covered by the Vegetation Protection Overlay (VPO), which protects native vegetation.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO altogether and instead apply the proposed schedule ESO1. The area to be covered by ESO1 should include the two polygons of Site 58 outlined in mid-blue on the aerial photograph on p. 432 and optionally be expanded to make the shape simpler and/or unite the two polygons.

Further work

The flora survey of this study was poorly timed to detect many of the types of locally-rare flora most likely to occur in the native lawn polygon of Site 58. It is recommended to conduct a flora survey of that area in November or December, preferably after a month or more without mowing.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of approximately 3 hours of fieldwork by the author for this study on 23/8/19, 30/8/19, 10/9/19 and 15/10/19, including: (a) compiling a list of indigenous plant species and their abundances for each of four parts of the site; (b) documenting the details of rare or scarce plants; and (c) mapping the vegetation, rare plants and large trees;
- A bird list by Mike Honeyman from 20/2/16 in the online eBird resource, including a record of five of the locally-rare Purple-crowned Lorikeet;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) , for which the relevant fieldwork comprised: (a) a flora survey by Helen Moss on 23/3/96, who mapped the vegetation and compiled a list of indigenous plant species (without abundances) for each of three parts of the reserve; and (b) a mammal hair survey; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

Site 59. 'The Range' Estate, Croydon

Biological Significance Level: *National* due to a globally endangered species



Aerial photograph taken February 2017

Legend

- Roads & rail reserve
- Site 56
- Site 58
- Site 59
- Site 60
- Site 88

N

1:5000

0 50 100 150 200 m

Boundaries

The original version of Site 59 in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was the Croydon District Golf Club. The golf club has since been transformed into 'The Range' housing estate, leading this report to reduce the site to a set of seventeen reserves (or parts thereof) that have not been developed. The seventeen areas are outlined in blue and individually labelled 'A' to 'Q' on the aerial photograph on the previous page.

The site boundaries largely follow fences or the boundaries of the reserves. The exceptions are to exclude areas that have no biological significance and cannot be expected to gain any.

As with all the sites in this volume, the precise boundaries are available in a shapefile for geographic information systems.

General description

Most of the seventeen reserves were set aside from development because they contain good examples of the former habitat – either forest or scattered trees. Reserves A, E and O retain little natural vegetation but their stormwater treatment wetlands provide habitat for wetland fauna. Reserve M contains revegetation that provides a habitat connection between reserves L and O.

Altogether, the reserves occupy 9.25 hectares. They are variously situated on drainage lines, slopes and a ridge. Altogether, sixty-one naturally-occurring, indigenous plant species were observed during this study's spring ecological survey. Additional species would be detected in summer.

The fact that the reserves have been set aside for nature conservation and are being actively managed for that purpose contributes to their ecological significance. Some of the less natural areas are steadily increasing in habitat importance as revegetation matures.

Relationship to other land

Most of the site's indigenous vertebrate fauna, and particularly the birds, could not fulfil all their habitat needs entirely within one of the reserves. They must therefore rely on moving between the reserves and/or other areas of habitat. Many of the site's insects are probably also reliant on such movements. The reserves can therefore be regarded as ecological 'stepping-stones'.

As seen on the aerial photograph on p. 439, reserves E and N are quite close (within 200 m) to Barngeong Reserve (Site 58), which abuts the Brushy Creek corridor (Site 56). Reserve Q is only 40 m from the Lilydale Railway Line habitat corridor (Site 60). None of these sites offers excellent wildlife habitat but in combination, they meet the needs of more common species such as Eastern Rosellas and Southern Brown Tree Frogs.

The gardens and street trees between the reserves of Site 59 provide poor habitat. Some trees in gardens and nature strips to the east are more suitable and are presumed to facilitate movement of birds and flying insects to and from Barngeong Reserve.

Pollination that occurs from movements of birds and insects between Site 59 and other sites improves the reproductive success and genetic diversity of plants in all the visited sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only the indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion)

Canopy trees: Dominated in most areas by Yellow Box (*Eucalyptus melliodora*) but in some areas by Candlebark (*E. rubida*). There are also substantial numbers of Narrow-leaved Peppermint (*E. radiata*) and Swamp Gum (*E. ovata*). There is also a single Red Stringybark (*E. macrorhyncha*).

Lower trees: Black Wattle (*Acacia mearnsii*) is fairly abundant, a little more so than Blackwood (*A. melanoxylon*). Black Sheoak (*Allocasuarina littoralis*) and Cherry Ballart (*Exocarpos cupressiformis*) are scarce as wild plants but the Sheoak has been widely planted in the estate. Silver Wattle (*A. dealbata*) has been planted.

Medium to large shrubs: Sparse except for a few clusters of Sweet Bursaria (*Bursaria spinosa*). Prickly Currant-bush (*Coprosma quadrifida*), Common Cassinia (*Cassinia aculeata*), Sifton Bush (*Cassinia sifton*) and Yarra Burgan (*Kunzea leptospermoides*) are scarce. The following species were present in the golf course before it became the housing estate but now appear to be represented only by planted plants: Gold-dust Wattle (*Acacia acinacea*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*) and Hop Goodenia (*Goodenia ovata*). Prickly Tea-tree (*Leptospermum continentale*), Snowy Daisy-bush (*Olearia lirata*) and Elderberry Panax (*Polyscias sambucifolia*) were also once present.

Shrubby herbs: In 2019 (an exceptional year for fireweeds), Cotton Fireweed (*Senecio quadridentatus*) was abundant and Rough Fireweed (*Senecio hispidulus*) was scarce.

Small shrubs: Represented only by a single Grey Parrot-pea (*Dillwynia cinerascens*).

Ferns: Austral Bracken (*Pteridium esculentum*) and Common Maidenhair (*Adiantum aethiopicum*) were present in the golf course prior to its conversion to a housing estate but neither appear to remain.

Climbers: Represented only by Common Apple-berry (*Billardiera scandens*), which is moderately abundant in two or three of the reserves.

Creepers: Slender Speedwell (*Veronica gracilis*) and the wood-sorrel *Oxalis exilis / perennans* are fairly abundant in the less weedy reserves. A single cluster of three Creeping Bossiaea (*Bossiaea prostrata*) grows in reserve 'D'. Kidney-weed (*Dichondra repens*), Shining Pennywort (*Hydrocotyle sibthorpioides*) and Ivy-leaf Violet (*Viola hederacea*) were present in the golf course prior to its conversion to a housing estate.

Grasses, rushes and sedges: Weeping Grass (*Microlaena stipoides*) is by far the most abundant grassy species, forming dense swards. The following species are fairly abundant or widespread: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis* and subsp. *australis*), Toad Rush (*Juncus bufonius*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea* and subsp. *filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Clustered Wallaby-grass (*Rytidosperma racemosum*) and Kangaroo Grass (*Themeda triandra*). The following species are scarce: Short-stem Sedge (*Carex breviculmis*), Thatch Saw-sedge (*Gahnia radula*), Slender Sword-sedge (*Lepidosperma gunnii*), Variable Sword-sedge (*Lepidosperma laterale*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*), Bristly Wallaby-grass (*Rytidosperma setaceum*) and Purplish Wallaby-grass (*R. tenuius*). At least ten other species were recorded in the golf course before it was transformed into a housing estate and a few of them may have escaped detection in this study's fieldwork due to the time of year (18th September).

Other groundcover: Spreading Crassula (*Crassula decumbens*) is the only abundant species. The following species are fairly abundant or widespread: Chocolate Lily (*Arthropodium strictum*), Yellow Bulbine-lily (*Bulbine bulbosa*), Pale Flax-lily (*Dianella longifolia*), Variable Willow-herb (*Epilobium billardiereanum* subsp. *cinereum*), Hairy Willow-herb (*Epilobium hirtigerum*), Common Raspwort (*Gonocarpus tetragynus*), Smooth Solenogyne (*Solenogyne dominii*) and Yellow Rush-lily (*Tricoryne elatior*). The following species are scarce: Button Everlasting (*Coronidium scorpioides*), Common Cotula (*Cotula australis*), Matted Flax-lily (*Dianella amoena*), Black-anther Flax-lily (*Dianella revoluta*), Scented Sundew (*Drosera aberrans*), Jersey cudweed (*Laphangium luteoalbum*), Broad-leaf Stinkweed (*Opercularia ovata*) and Nodding Greenhood (*Pterostylis nutans*). Field Daisy (*Brachyscome decipiens*) was present in 1996 and may have escaped detection in this study for seasonal reasons. Other species recorded previously but not in this study include: Common Cudweed (*Euchiton involucratus*), Creeping Cudweed (*E. japonicus*), Small St John's Wort (*Hypericum gramineum*), Golden Weather-glass (*Hypoxis hygrometrica*), Slender Bottle-daisy (*Lagenophora sublyrata*), Wiry Buttons (*Leptorhynchos tenuifolius*), Variable Stinkweed (*Opercularia varia*), Common Rice-flower (*Pimelea humilis*), Small Poranthera (*Poranthera microphylla*), Trim Sun-orchid (*Thelymitra* ?*peniculata*), Tadgell's Bluebell (*Wahlenbergia* ?*multicaulis*).

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the bioregion)

Canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*).

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*). Cherry Ballart (*Exocarpos cupressiformis*) is scarce. Black Wattle (*A. mearnsii*) is also present but mostly or wholly due to planting.

Medium to large shrubs: Prickly Currant-bush (*Coprosma quadrifida*) is fairly abundant in the most natural areas. The only other naturally-occurring shrubs are a few Sifton Bush (*Cassinia sifton*) and Large Kangaroo Apple (*Solanum laciniatum*).

Small shrubs: None seen.

Shrubby herbs: In 2019 (an exceptional year for fireweeds), Cotton Fireweed (*Senecio quadridentatus*) was abundant.

Ferns: None seen.

Climbers and creepers: None seen.

Grasses, rushes and sedges: Mostly, indigenous species have less cover than introduced species. Overall, Weeping Grass (*Microlaena stipoides*) is fairly abundant. Pale Rush (*Juncus pallidus*) is scattered thinly. The only other naturally-occurring, indigenous species are Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Clustered Wallaby-grass (*Rytidosperma racemosum*) and Hollow Rush (*Juncus amabilis*), all of them scarce.

Other groundcover: Highly depleted. Pale Flax-lily (*Dianella longifolia*) and Hairy Willow-herb (*Epilobium hirtigerum*) are scattered thinly. The only other species observed in this study was Jersey cudweed (*Laphangium luteoalbum*), which is scarce.

Artificial wetland (no EVC or conservation status applicable)

Trees and shrubs: Absent except for the planted environmental weed, Rough-barked Honey-myrtle (*Melaleuca parvistaminea*) and some peripheral suckers of planted Swamp Paperbark (*Melaleuca ericifolia*).

Grasses, rushes and sedges: Naturally-occurring, indigenous species are represented by occasional rushes (*Juncus amabilis, J. gregiflorus* and *J. sarophorus*). They are greatly outnumbered by dense plantings of a mixture of non-indigenous species (particularly *Baumea articulata, Bolboschoenus medianus, Eleocharis sphacelata* and *Schoenoplectus tabernaemontani*) and indigenous species (particularly *Carex appressa*).

Other species: No other indigenous species appear to be present other than due to planting.

Significant plants

Globally endangered

The Matted Flax-lily (*Dianella amoena*) is listed as 'Endangered' under the federal *Environment Protection and Biodiversity Conservation Act 1999* and the Victorian Government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. The species is scattered across Victoria, Tasmania and possibly New South Wales. Two healthy, naturally-occurring plants were discovered during this study on 18/9/19, adding to a larger patch that was known prior. Until the estate being developed, another plant occurred a few metres east of Dorset Road near the estate's northwest corner. That area was cleared and has been mulched and planted with indigenous species. This study could not determine what was done with the endangered plant.

Matted Flax-lilies hold no fertile material in September, making them hard to detect among dense grass in this study's flora survey. Additional wild plants may have escaped detection.

In addition to the known wild Matted Flax-lilies, there is a total of 22 small, planted individuals in three of the reserves. The origin of those plants is unknown.

Rare in Victoria

A subspecies of Veined Spear-grass (namely *Austrostipa rudis* subsp. *australis*) occurs in reserve C. It may also occur more widely within the site, as September was a poor time of year for this study's fieldwork

to distinguish it from subspecies *rudis*, which is also present. Subspecies *australis* is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Some were detected in Site 59 in this study and others were recorded up to 2006 in the (then) Croydon District Golf Club course that has since become 'The Range' housing estate. Some or all of the records prior to this study came from parts of the golf course that have since been fully developed and are therefore outside the new version of Site 59 adopted here.

- *Acacia acinacea* (Gold-dust Wattle) – recorded in the golf course in a 1996 flora survey without quantification, but not found in the 2000s or this study;
- *Brachyscome decipiens* (Field Daisy) – recorded in the golf course in the 1996 flora survey, with a herbarium specimen collected from between the 11th and 12th fairway of the golf course. That area is now mostly occupied by the properties, 2–12 Scheffer Crescent, outside the current version of Site 59. There appear to be no records of any other population of the species in Maroondah's history;
- *Eucalyptus macrorhyncha* (Red Stringybark) – only one tree remains, in mediocre health (50% on the scale of the state government's Vegetation Quality Assessment method), located in Reserve 'J';
- *Eucalyptus rubida* (Candlebark) – twenty-one trees were counted in this study, scattered among many of the reserves. Five of them have trunks over 70 cm diameter and are in fair health on average (70%);
- *Hypoxis hygrometrica* (Golden Weather-glass) – recorded in the golf course in a 1996 flora survey without quantification, but not found in the 2000s or this study (perhaps due to difficult detectability);
- *Isotoma fluviatilis* (Swamp Isotome) – recorded in 2006 as abundant on the 16th tee, which has since become 17 & 19 Morecroft Avenue;
- *Poa tenera* (Slender Tussock-grass) – recorded in the golf course in a 1996 flora survey without quantification; probably no longer present;
- *Potamogeton crispus* (Curly Pondweed) – recorded in the golf course in a 1996 flora survey without quantification; probably eliminated when the estate was developed;
- *Senecio minimus* (Shrubby Fireweed) – as above but may reappear sporadically;
- *Wahlenbergia* ?*multicaulis* (Tadgell's Bluebell) – recorded in the golf course in a 1996 flora survey without quantification, but not found in the 2000s or this study.

Significant fauna

Threatened in Victoria

Hardhead is a species of duck listed by the state government as 'vulnerable' in Victoria. Five individuals were seen by Sally Koehler in January 2004 at a waterbody in the Croydon District Golf Course, which subsequently became 'The Range' housing estate. The only waterbody in 2004 that was large enough to suit such a species has since been filled in and covered with houses and a road (Beatty Avenue). There is a chance that Hardhead may occasionally visit the new stormwater treatment wetland in reserve O.

Fauna habitat

- The artificial wetlands support waterbirds, frogs and aquatic invertebrates;
- The tree canopy and patchy occurrence of indigenous shrubs represent suitable habitat for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals and roost sites for bats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The site's indigenous fauna are somewhat limited by the small size of the reserves and the residential landscape between them. However, the site's ecological relationship to other land (see above) provides some compensation for the more mobile species of fauna; and

- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the ecological condition of the site's vegetation ranges from 'C' (fair) to 'D' (poor).

The health of the site's eucalypts varies by species. Yellow Boxes (*Eucalyptus melliodora*) and Narrow-leaved Peppermints (*E. radiata*) are generally in good condition; Candlebarks (*E. rubida*) are mostly in fair to good condition, Swamp Gums (*E. ovata*) are in fair condition on average and the sole Red Stringybark (*E. macrorhyncha*) is in mediocre condition.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened plant species

The section above headed 'Significant plants' provides details of the populations of species whose significance is discussed in this section.

The Matted Flax-lily (*Dianella amoena*) is listed as 'Endangered' under federal legislation. Any known habitat for such a species (including two of the reserves that make up Site 59) is a site of **National** significance under standard criterion 3.1.1.

The site also has a population of Veined Spear-grass *Austrostipa rudis* subsp. *australis*, which is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. The subspecies occurs interstate as well as Victoria. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

The site's population of *Eucalyptus rubida* appears quite viable, particularly as part of a larger population that extends into the abutting Site 60 along the Lilydale Railway Line. The species falls into the 'critically endangered' category of risk of dying out in Maroondah. These characteristics fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Regionally threatened Ecological Vegetation Class

Reserves B, L and possibly Q contain vegetation that meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The relevant Ecological Vegetation Classes (Valley Grassy Forest and Creekline Herb-rich Woodland) are listed by the state government as 'vulnerable'. Standard criterion 3.2.3 deems such patches to be of Regional significance if the 'habitat score' is less than 0.3 or State otherwise. No habitat score was determined in this study and the author is uncertain whether the scores in the three patches are above or below 0.3.

Ecological corridor

The section above headed 'Relationship to other land' describes how Site 59 is ecologically connected with Sites 56, 58 and 60. Those connections mean that Site 59 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Sites fitting that description are deemed by the criteria to represent Local significance.

Some of the reserves currently contain only mediocre habitat but they are planned to improve. Such areas fit the following description from standard criterion 1.3.3: "Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor… Site (or one of a group of such sites) to form a strategic corridor of local importance and scale". That description applies to a site of Local significance.

The site's overall 'National' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the discovery of the globally-endangered Matted Flax-lily (which had not even been described as a species in 1997).

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting or walking through the reserves and also surrounding residents. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the stormwater treatment wetlands helps to stabilise the soil and remove water pollution.

The natural ambience of the reserves is expected to contribute to the health, wellbeing, childhood development and quality of life of people in the estate. The ambience may also encourage people to get exercise by walking or cycling around the estate.

The movement of birds, butterflies and other animals out of the reserves into neighbouring streets and gardens spreads nature's benefits to the health, wellbeing, childhood development and quality of life of the local community.

Without the site's reserves, the estate would have no substantial trees and the landscape would have much less amenity.

The site's vegetation also preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

The development of the Croydon District Golf Club course to become 'The Range' housing estate resulted in the loss of an estimated 30 hectares of habitat – approximately half the total loss in Maroondah since 1997.

Changes in the species present

Referring to the section above headed 'Significant plants', this study failed to detect eight of the ten plant species that were previously found in the golf course and fall into the 'critically endangered' category of risk of dying out in Maroondah. Most of those can be presumed to have been removed as part of the estate's development. Numerous other plant species also appear to have been lost to the subdivision, which is not surprising in the wake of the loss of 30 hectares of habitat. Some other species that were recorded in 2006 as moderately or quite abundant are now scarce.

Change in the ecological condition of habitat

There is no prior data about the ecological condition of habitat specifically in the reserves that form the new version of Site 59 adopted here. Estimation of change is therefore difficult. However, the description of ecological condition in the section above headed 'Ecological condition' is consistent with the description given in the 1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) for the whole golf course in 1996.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Continuing loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Displacement of indigenous plants by introduced plants, although active management is currently preventing that from happening.

Strategic planning

Site 59 and the rest of 'The Range' housing estate is zoned 'Neighbourhood Residential Zone – Schedule 3'. Removal of native vegetation in the whole estate is subject to the Vegetation Protection Overlay (VPO). Removal of trees in the whole estate and some neighbouring areas is further regulated under Schedule 3 of the Significant Landscape Overlay. The state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions affect the reserves except those smaller than 0.4 hectares (namely, C, D, G, H, J, K, M and P). Some of the reserves are 'offsets' under planning permit conditions associated with development of the estate.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the whole estate and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the site adopted here, as outlined in blue on the aerial photograph on p. 439.

Information sources

The analysis above draws on the following sources of information about the site:

- 5½ hours of fieldwork by the author for this study on 18/9/19, including: (a) compiling separate lists of indigenous plant species and their abundances for the wetlands, the Valley Grassy Forest and the Creekline Herb-rich Woodland; (b) mapping and documenting the details of large trees and rare or scarce plants; and (c) collection of herbarium specimens of *Austrostipa rudis* subsp. *australis* and *Senecio glossanthus* (specimens *G.S.Lorimer 2835* & *2836*, respectively). The specimens will be lodged at the National Herbarium of Victoria;
- A 2004 'Flora and Fauna Report' on the Croydon District Golf Club course by Biosis Pty Ltd as part of the proposal to develop the course into 'The Range' housing estate. Of relevance, the assessment included: (a) lists of flora and fauna; (b) mapping of 'patches' of native vegetation; and (c) 'habitat hectares' assessments of the patches;
- The present author's 2006 assessment of the vegetation of the golf course for an appeal in the Victorian Civil and Administrative Tribunal regarding the development proposal. The assessment included 10¼ hours of fieldwork on 24/3/06 involving: (a) compiling separate lists of indigenous plant species and their abundances for fifteen parts of the course; (b) mapping and documenting the details of large trees and rare or scarce plants; and (c) a 'habitat hectares' assessment of one patch of native vegetation;

- Records of 250 Mosquitofish, ten Shortfin Eels and fourteen Common Long-necked Tortoises captured and released by Anthony Byrne in the stormwater treatment wetland at the northeast end of Scurry Drive in March 2011. The data is stored in the online Victorian Biodiversity Atlas (VBA);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) , for which the relevant fieldwork covered the whole of the golf course and comprised: (a) a flora survey by Helen Moss and Graeme Lorimer in April and October 1996; (b) a mammal hair survey; (c) a 20-minute bird census by John C. Reid on 28/12/95; and (d) incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No other useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Site 60. Lilydale Railway Line, Croydon

Biological Significance Level: *National* due to the presence of the nationally endangered Matted Flax-lily



The orange star near the right edge above matches the one near the left edge below.

N

1:5500
0 50 100 150 200 m



Aerial photographs taken February 2017

Legend

Road & rail reserves
Municipal boundary
Site 56
Site 59
Site 60
Site 85
EVC boundaries
CHW Creekline Herb-rich Woodland
SW Swampy Woodland
VGF Valley Grassy Forest
VHF Valley Heathy Forest

Boundary, land use and tenure

The site comprises parts of:

- The railway reserve (excluding the width delimited by the ballast);
- The abutting road reserves of Lincoln Road, Sherlock Road and Smith Avenue, extending to the back of the kerbs;
- Silcock Reserve; and
- Narrow strips at the rear of properties on Diane Crescent (as for the existing VPO area), mostly corresponding to whole parcels of land.

On each side of the railway tracks, the eastern limit corresponds to the municipal boundary. The western limit corresponds to the limit of native understorey. There is a gap from the Dorset Road railway bridge to the point where Smith Avenue abuts the railway reserve.

As with all sites in this volume, the precise boundary is available in a shapefile for geographic information systems.

General description

Site 60 occupies a total of 4.0 hectares in narrow strips on each side of the Lilydale Railway Line. There is remnant native vegetation in nearly all of it except small areas near the kink in Sherlock Rd.

As is usual along rail reserves, the native vegetation is least natural where the tracks are elevated above grade. This is most evident in the segment of Creekline Herb-rich Woodland (labelled 'CHW' on the aerial photograph above).

Conversely, the greatest density of indigenous understorey plants occurs on and next to the tall railway cutting near Churchill Road. Among the plant species in that area are some that are rare – one of them, globally endangered. There are many wildflowers.

The site includes the road verge of Sherlock Road, where there are remnant trees and extensive areas of revegetation. There has also been extensive revegetation between the tracks and Smith Avenue recently, intermixed with naturally-occurring indigenous plants.

The native vegetation west of Dorset Road is very patchy in ecological condition. Sections of the railway embankments there have wildflowers and native grasses but the shrub layer is strongly dominated by woody weeds that tolerate the regular herbicide spraying. At the top of the embankments and into Silcock Reserve, the tree cover is a mixture of natural and planted trees. There are unmown patches where the groundcover is dominated by naturally-occurring indigenous plants and other areas dominated by introduced grass, much of it regularly mown.

Across the whole site, this study detected sixty-five naturally-occurring, indigenous plant species.

Large, old eucalypts (which are important for wildlife habitat) are scattered along the site. They also extend from the western end of Site 60 toward Croydon Station, where there is little other native vegetation.

Herbicide is regularly sprayed onto vegetation on embankments above track level. Some indigenous plants keep regenerating but there has been a notable decline since a botanical survey of the site in 1996.

Relationship to other land

As can be seen from the upper aerial photograph on p. 200, the part of Site 60 west of Dorset Road is like a side-shoot to Site 85 (Lincoln Road). Silcock Reserve's planted trees (mainly eucalypts) in the angle between the two sites helps provide habitat continuity. Between Site 60 and Croydon Station, the scattered remnant trees (mainly Swamp Gums *Eucalyptus ovata* and Blackwoods *Acacia melanoxylon*) may augment the habitat for some of Site 60's birds and flying insects.

The lower aerial photograph on p. 448 shows that Site 60 narrowly abuts Site 59 ('The Range' estate) and Site 56 (the Brushy Creek corridor). The habitat connections through Site 59 are constrained by residential development but improving through revegetation. The eastern end of Site 60 adjoins the Brushy Creek corridor (Site 56).

Bioregion and habitat types

Site 60 straddles the boundary between the Gippsland Plain bioregion in the west and the Highland – Southern Fall in the east. As seen on the aerial photographs on p. 448, Site 60 includes Valley Heathy Forest (which is strongly associated with the Gippsland Plain) and Valley Grassy Forest (which is more associated with the Highlands - Southern Fall). The bioregional boundary follows the interface between the two, which is where the site meets Dorset Road. The parts of Site 60 west of Dorset Road fall into the Gippsland Plain and the Dandenong Creek catchment. The rest of the site falls into the Highlands - Southern Fall and the Yarra catchment. However, some influence of the Gippsland Plain is seen well east of Dorset Road – particularly the substantial numbers of Mealy Stringybark (*Eucalyptus cephalocarpa*) beside Smith Avenue, with an outlier slightly east of Powell St.

Note that the state government's mapping of Ecological Vegetation Classes (EVCs) is erroneous west of Dorset Road, resulting in an associated error in the mapping of the bioregional boundary.

The following descriptions of EVCs include only the naturally-occurring, indigenous plant species. Some species are likely to have escaped detection due to the times of year of the flora survey.

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion) with tendencies toward Valley Heathy Forest.

Canopy trees: Dominated by Candlebark (*Eucalyptus. rubida*), mostly with Yellow Box (*E melliodora*) or Narrow-leaved Peppermint (*E. radiata*) co-dominant. Mealy Stringybark (*E. cephalocarpa*) and Messmate Stringybark (*E. obliqua*) are also conspicuous beside Smith Avenue. Bundy (*E. goniocalyx*) and Red Stringybark (*E. macrorhyncha*) are scarce.

Lower trees: Cherry Ballart (*Exocarpos cupressiformis*) is abundant east of Powell St. Black Wattle (*Acacia mearnsii*) and Blackwood (*Acacia melanoxylon*) are widespread. A stand of Black Sheoak (*Allocasuarina littoralis*) 80m east of Smith Avenue represents a tendency toward Valley Heathy Forest.

Medium to large shrubs: Sifton Bush (*Cassinia sifton*) is abundant east of Powell St. The only other shrubs present in substantial numbers are Sweet Bursaria (*Bursaria spinosa*) and Narrow-leaf Bitter—pea (*Daviesia leptophylla*).

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*) and Common Flat-pea (*Platylobium obtusangulum*) are fairly abundant, reminiscent of Valley Heathy Forest.

Shrubby herbs: Cotton Fireweed (*Senecio quadridentatus*) is fairly abundant, as usual along railway lines. Rough Fireweed (*S. hispidulus*) is present east of Powell Street.

Ferns: Austral Bracken (*Pteridium esculentum*) is scarce.

Climbers: Purple Coral-pea (*Hardenbergia violacea*) is moderately abundant east of Powell Street.

Creepers: Creeping Bossiaea (*Bossiaea prostrata*) is fairly abundant east of Powell Street. Centella (*Centella cordifolia*) is scarce. Bidgee-widgee (*Acaena novae-zelandiae*) and the wood-sorrel *Oxalis exilis / perennans* were recorded in 1996.

Grasses, rushes and sedges: Dense and rich in species. Soft Tussock-grass (*Poa morrisii*) is a dominant groundcover species in the most natural areas, together with abundant Kangaroo Grass (*Themeda triandra*). Clustered Wallaby-grass (*Rytidosperma racemosum*) is the dominant groundcover in mown areas. Other species that are fairly abundant or widespread include Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-serge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Leafy Wallaby-grass (*Rytidosperma fulvum*) and Bristly Wallaby-grass (*R. setaceum*). Among the less abundant species, the following serve as good ecological indicators: Tall Spear-grass (*Austrostipa pubinodis*), Red-anther (or Silvertop) Wallaby-grass (*R. pallidum*), Slender Wallaby-grass (*R. penicillatum*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Abundant (in the more natural areas) and rich in species. East of Powell Street, Common Raspwort (*Gonocarpus tetragynus*) is a dominant groundcover species and Grass Trigger-plant (*Stylidium armeria*) is abundant. Other species that are fairly abundant or widespread include Sheep's Burr (*Acaena echinata*), Black-anther Flax-lily (*Dianella revoluta*), Creeping Cudweed (*Euchiton japonicus*), Wiry Buttons (*Leptorhynchos tenuifolius*), stinkweeds (*Opercularia ovata* and *O. varia*), Trim Sun-orchid (*Thelymitra* ?*peniculata*) and Yellow Rush-lily (*Tricoryne elatior*). Among the less abundant species, the following serve as good ecological indicators: Pale Grass-lily (*Caesia parviflora*), Matted Flax-lily (*Dianella amoena*), Sheath Star (*Pauridia vaginata*), Common Rice-flower (*Pimelea humilis*) and Tadgell's Bluebell (*Wahlenbergia multicaulis*).

Valley Heathy Forest (EVC 127, **Endangered** in the Gippsland Plain bioregion) west of Dorset Road

Canopy trees: Dominated by Bundy (*Eucalyptus goniocalyx*), probably because that species regenerates well following clearing. Red Stringybark (*E. macrorhyncha*) is the only other canopy species in substantial numbers but the members of that species are sickly and possibly only present due to planting. Mealy Stringybark (*E. cephalocarpa*) and Narrow-leaved Peppermint (*E. radiata*) are scarce and there are two large, dead Messmate Stringybarks (*E. obliqua*).

Lower trees: Blackwood (*A. melanoxylon*) is the only sub-canopy tree species present in substantial numbers. Black Wattle (*Acacia mearnsii*) is scarce and there is a Black Sheoak on the citybound side of the tracks.

Medium to large shrubs: Yarra Burgan (*Kunzea leptospermoides*) was the only shrub species found in this study. In 1996, there was also Sweet Bursaria (*Bursaria spinosa*), Sifton Bush (*Cassinia sifton*), Prickly Tea-tree (*Leptospermum continentale*) and Tree Everlasting (*Ozothamnus ferrugineus*).

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is scarce. Grey Parrot-pea (*Dillwynia cinerascens*) was seen in 1996 but not in this study, possibly due to inability to cross the fences beside the railway line.

Ferns: There is one patch of Austral Bracken (*Pteridium esculentum*).

Climbers: Small-leafed Clematis (*Clematis decipiens*) is fairly abundant.

Creepers: The wood-sorrel *Oxalis exilis / perennans* is scarce and the only creeper seen in this study. Bidgee-Widgee (*Acaena novae-zelandiae*) and Creeping Bossiaea (*Bossiaea prostrata*) were seen in 1996 but not in this study, possibly due to inability to cross the fences beside the railway line.

Grasses, rushes and sedges: forms some dense patches. Clustered Wallaby-grass (*R. racemosum*) is abundant in mown areas. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) are fairly abundant. The following species are scarce: Spiny-headed Mat-rush (*L. longifolia* subsp. *longifolia*), Sword Tussock-grass (*Poa ensiformis*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*) and Kangaroo Grass (*Themeda triandra*). Eight extra species were recorded in 1996 and could well have been overlooked in this study due to the time of year (August) and inability to cross the fences beside the railway line.

Other groundcover: Very depleted. The only conspicuous indigenous species are Black-anther Flax-lily (*Dianella revoluta*) and Yellow Rush-lily (*Tricoryne elatior*). Common Raspwort (*Gonocarpus tetragynus*) is scarce. Pale Flax-lily (*D. longifolia*) and Wiry Buttons (*Leptorhynchos tenuifolius*) were recorded in 1996 and could easily have gone undetected in this study.

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the Highlands - Southern Fall bioregion), possibly better regarded as Swampy Riparian Complex (EVC 126)

Canopy trees: Swamp Gum (*Eucalyptus ovata*) is strongly dominant. There are also a few outlier Candlebarks (*E. rubida*) from the adjacent Valley Grassy Forest.

Lower trees: Blackwood (*Acacia melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are scattered. Silver Wattle (*A. dealbata*) are also present.

Shrubs: Very depleted, represented by one Sifton Bush (*Cassinia sifton*) and four Hop Goodenia (*Goodenia ovata*). In 1996, there was also Sweet Bursaria (*Bursaria spinosa*), Prickly Tea-tree (*Leptospermum continentale*) and Tree Everlasting (*Ozothamnus ferrugineus*).

Ferns: None appear to remain but in 1996 there was Rough Tree-fern (*Cyathea australis*), Mother Shield-fern (*Polystichum proliferum*) and Austral Bracken (*Pteridium esculentum*). The former two species are likely to have been destroyed by development of the abutting 'The Range' housing estate.

Climbers: None seen.

Creepers: None seen.

Grasses, rushes and sedges: This study's winter (August 2019) flora survey found only Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Thatch Saw-sedge (*Gahnia radula*), the latter two of which are scarce. Rich in rushes and sedges. A number of grass species seen in 1996 may easily have gone undetected in this study. Common Reed (*Phragmites australis*) and two species of rush (*Juncus*) seen in 1996 appear to have died out, probably due to development of the abutting 'The Range' housing estate.

Other groundcover: Pale Flax-lily (*Dianella tasmanica*) is scarce and is possibly only present due to proximity to Valley Grassy Forest. No other groundcover species were seen in this study.

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion)

Canopy trees: Swamp Gum (*Eucalyptus ovata*) dominates over Mealy Stringybark (*E. cephalocarpa*). There are three Red Stringybarks (*E. macrorhyncha*) but they have apparently been planted.

Lower trees: Blackwood (*Acacia melanoxylon*) is fairly abundant. There is one Cherry Ballart (*Exocarpos cupressiformis*) and one Swamp Paperbark (*Melaleuca ericifolia*), the latter of which may have been planted.

Shrubs: Yarra Burgan (*Kunzea leptospermoides*) is scarce and there is a single Shiny Cassinia (*Cassinia longifolia*), each of which might have been planted. Prickly Tea-tree (*Leptospermum continentale*) was present in 1996.

Shrubby herbs: Cotton Fireweed (*Senecio quadridentatus*) is fairly abundant, as usual along railway lines.

Ferns: None seen.

Climbers: None seen.

Creepers: None seen.

Grasses, rushes and sedges: One small area is dominated by Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and another by Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*). Thatch Saw-sedge (*Gahnia radula*) is moderately abundant. Sword Tussock-grass (*Poa ensiformis*) and Kangaroo Grass (*Themeda triandra*) are scarce. Other grass species have probably escaped detection in this study due to the time of year (August).

Other groundcover: None seen.

Significant plants

Globally endangered

The Matted Flax-lily (*Dianella amoena*) is listed as 'Endangered' under the federal *Environment Protection and Biodiversity Conservation Act 1999* and the Victorian Government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. The species is scattered across Victoria, Tasmania and possibly New South Wales. A single patch (probably comprising a single plant) was discovered beside the railway line during this study's flora survey. Others may have escaped detection, as no permission was gained to check trackside locations. (Nearby, another plant grows at Croydon Primary School (Site 55) and one used to grow at 'The Range' (Site 59) until it was removed during a residential development 10–15 years ago.)

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. The author recorded its presence (without quantification) near Churchill Rd in 1996. It was not detected in this study but wattle seeds are renowned for persisting for many decades in soil and being able to regenerate when conditions are right.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 60 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – six wild individuals grow in the part of Site 60 east of Dorset Road and twelve possibly-planted individuals grow to the west. Most (but not all) the trees are in poor health;
- *Eucalyptus rubida* (Candlebark) – 132 individuals were counted in this study, all east of Dorset Road. Nearly all are in good health;
- *Pauridia vaginata* (Sheath Star) – a few individuals were observed near Churchill Road in August 2019;
- *Pentapogon quadrifidus* (Five-awned Spear-grass) – Recorded (but not quantified) in 1996 near Churchill Road but not in this study, which is understandable considering that this study's flora survey of that area was in October;
- *Polystichum proliferum* (Mother Shield-fern) – Recorded (but not quantified) in 1996 and apparently no longer present, possibly due to development of the adjacent 'The Range' housing estate;
- *Wahlenbergia multicaulis* (Tadgell's Bluebell) – Seven individuals were recorded near Churchill Road in October 2017 and additional plants might be detected later in the year.

Fauna habitat

- There are some large, old eucalypts, which are of high value as habitat trees;
- The corridor of eucalypts and sub-canopy trees represents suitable habitat for common forest birds, bats, possums and invertebrates – particularly where there are associated shrubs. Revegetation beside Smith Avenue and at Silcock Reserve is improving and extending that habitat;
- The connection with abutting habitat in Sites 56, 59 and 85 amplifies the value of the abovementioned habitat; and
- The forest litter provides food and cover for common invertebrates, some of which then become food for vertebrates such as lizards, bats and birds. It is also important for providing lizards with the cover they need, as discussed in Section 7.1.2 of Volume 1.

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), an area of approximately 0.25 ha on the south side of the tracks near Churchill Road rates 'B' (good condition). A strip measuring approximately 0.3 ha beside Smith Avenue rates 'C' (fair), as does approximately 0.2 ha west of Dorset Road. The remaining 3¼ ha of the site rates 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened plant species

The Matted Flax-lily (*Dianella amoena*) is listed as 'Endangered' under federal legislation. Any known habitat for such a species (including beside the railway line in Site 60) is a site of **National** significance under standard criterion 3.1.1.

Referring to the section above headed 'Significant plants', the site's populations of *Eucalyptus rubida* and *Wahlenbergia multicaulis* appear quite viable. They fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Regionally threatened Ecological Vegetation Classes

The part of the site on the southern side of the tracks extending approximately 75 m each side of Churchill Road meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation in that area is Valley Grassy Forest, which is listed by the state government as 'vulnerable' within the relevant bioregion – the Highlands - Southern Fall. The author is confident that its habitat score would be at least 0.3, were it to be assessed. It follows that the patch meets standard criterion 3.2.3 for a site of State significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 60 facilitates movement of birds and probably flying insects through the local landscape. In this way, the site fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'National' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and

the discovery of the globally-endangered Matted Flax-lily (which had not even been described as a species in 1997).

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people at Silcock Reserve or walking along the site or living close by. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site's vegetation and the presence of birds attracted to the site add to the area's amenity and 'green and leafy' landscape character. That is particularly true of the ridgetop near Churchill Road, with its wildflowers and bushy appearance. The natural ambience is spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals moving to and from the site. Train travellers benefit from the vegetated scenery as they travel.

The natural ambience also encourages people to get exercise by walking or running through the site.

The natural landscape and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Changes in the extent of habitat have been assessed by comparing aerial photographs from 2001, 2011 and 2017.

The greatest change in extent is along the boundary with 'The Range' estate (Site 59), where at least 1,000 m² of native vegetation and wetland habitat has been replaced with weedy grass. It seems likely that the loss occurred in association with the development of 'The Range'.

Elsewhere in the part of the site east of Dorset Road, the death or removal of trees (most of which had been planted) has reduced the extent of treed habitat by a few hundred square metres. That has been partly balanced by increases in the crown sizes of other trees.

At Silcock Reserve, growth of natural and planted trees has expanded the treed area slightly. There has been a loss of native vegetation of roughly 100 m² adjacent to the tracks, west of Dorset Road.

Changes in the species present

Comparing the plant species detected in a 1996 flora survey with those detected in this study, it is apparent that five or six indigenous species that were restricted to swampy ground where the site abuts 'The Range' housing estate have died out. Those species include the locally rare Mother Shield-fern (*Polystichum proliferum*).

Two shrub species appear to have died out, namely Prickly Tea-tree (*Leptospermum continentale*) and Tree Everlasting (*Ozothamnus ferrugineus*), though the latter may be able to regenerate in future.

Two other species have appeared naturally since 1997, namely Shiny Cassinia (*Cassinia longifolia*) and Small-leafed Clematis (*Clematis decipiens*). Both species have greatly expanded their natural range during that period and Site 60 is in part of the expanded range.

Change in the ecological condition of habitat

Comparing the information in the section above headed 'Ecological condition' with the related information in the 1997 report, *'Sites of Biological Significance in Maroondah'*, it is not possible to discern any change. However, the loss of some plant species and the author's observations of the impacts of herbicide spraying on railway embankments suggest that there has been at least a small deterioration in ecological condition in some parts of the site.

Fortunately, the most biologically significant part of the site – near Churchill Road – has shown no signs of deterioration except for herbicide spraying on the lower parts of the railway cutting.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Destruction of native vegetation by indiscriminate herbicide spraying on the railway cutting embankments and along the fence that separates Silcock Reserve from the tracks;
- Possibly the new 'skyrail' proposal to obtain grade separation between the railway line and Manchester Road;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by introduced plants such as Cotoneasters, Montpellier Broom, Sallow Wattle and Kikuyu;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Continued premature death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The site's zoning is:

- 'Public Use Zone – Transport' within the rail reserve;
- 'Public Park and Recreation Zone' at Silcock Reserve; and
- Various residential zones within the road reserves.

There are also the following vegetation controls:

- Schedule 3 of the Significant Landscape Overlay applies from Dorset Road to Arden Street and Schedule 4 applies to the rest of the site;
- The Vegetation Protection Overlay (VPO) applies to most of the site as well as the stretch of rail reserve from Dorset Road to Smith Avenue; and
- The state-wide native vegetation controls of clause 52.17 of the Victoria Planning Provisions apply throughout.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the whole area and instead apply the proposed schedule ESO1 to the area outlined in mid-blue on the aerial photograph on p. 448.

Strategic and statutory planning should also have regard to the role that the vacant, 1.2-hectare property, 173 Dorset Road could play in filling the gap in Site 60 between Dorset Road and Smith Avenue. The property is labelled on the aerial photograph on p. 448. If that property is to be subdivided for residential development (as might be expected), there may be an opportunity for a strip of land next to the railway line to be set aside for revegetation to fill the habitat gap. That would help birds and flying insects to move through the local landscape.

If Council favours that outcome and wishes to increase its planning control for that purpose, it would be appropriate to apply an Environmental Significance Overlay schedule to the property. Either of the proposed ESO1 or ESO2 may be suitable because both provide subdivision controls and hardly any existing vegetation would be affected in either case.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of approximately 5½ hours of ecological survey for this study on 1/10/18, 13/11/18, 23/8/19 and 30/8/19, including: (a) compiling separate lists of indigenous plant species (excluding mosses and liverworts) for five different parts of the site; (b) documenting the details of rare plants and significant trees; and (c) mapping the vegetation and the locations of rare plants;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on the present author's fieldwork in April and May 1996, including a flora survey and incidental fauna observations;
- Two pressed specimens at the National Herbarium of Victoria (MEL 0645351A and MEL 0645352A) of the rare leek-orchid species, *Prasophyllum pyriforme*, collected by orchidologist David L. Jones from the site near Churchill Road in November 1965; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird. Note that the state government's mapping of the extent of native vegetation is unreliable for narrow strips like those in this site. It also shows erroneous EVCs west of Dorset Road.

Site 61. Eastfield Park, Croydon

Biological Significance Level: *State* due to the presence of endangered vegetation types



Aerial photograph taken February 2017

Boundaries

The boundary of Site 61 is the dashed blue outline on the aerial photographed above. It follows property boundaries where yellow can be seen in the gaps between the dashes. The rest of the boundary has been drawn to follow footpaths and the edge of native vegetation. As with all sites in this report, the precise boundary is available as a shapefile for geographic information systems.

Land use and tenure

The north-south strip of land in the site's northeast is part of the road network but it serves as part of Eastfield Park, which makes up the rest of the site. Eastfield Park is a municipal park. The parts that fall inside Site 61 are managed for nature conservation, passive recreation and pedestrian thoroughfare.

General description

Site 61 occupies 5.52 hectares. It can be divided into two parts with a diffuse boundary (shown as an orange line on the aerial photograph) between them:

- The area marked 'Swampy Woodland' on the aerial photograph, coinciding with the alluvial soil of the floodplain of Tarralla Creek; and
- The area marked 'Valley Heathy Forest', which is on a shallow, northeast-facing slope at the foot of a low hill.

The footpath that runs just outside the site's northwestern edge is on a levee constructed to retain floodwater in the Tarralla Creek floodway. The levee and the historical conversion of Tarralla Creek into a floodway and an underground low-flow pipe have caused the land to dry out much more frequently and thoroughly than nature intended. That effect has been exacerbated by the Millennium Drought and other aspects of climate change. As a result, the area of Swampy Woodland (a regionally endangered Ecological Vegetation Class, or EVC) has suffered extensive loss of trees and understorey species. The Valley Heathy Forest (another regionally endangered EVC) on the slope is not as susceptible to the drainage engineering but it has been affected by climate change and eucalypt dieback. The dieback has been documented since at least thirty years ago.

Altogether, eighty-five naturally-occurring, indigenous plant species were detected in the park during this study.

Relationship to other land

Site 61's context relative to nearby sites of biological significance can be seen on the key map on p. 1.

Site 61 abuts the Tarralla Creek habitat corridor (Site 62), which facilitates movement between Site 61 and other habitat sites such as Dorset Recreation Reserve, the Dorset Golf Course, Cheong Park and beyond.

The ecological functions of the Swampy Woodland in Site 61 are dependent on the catchment. Increased subdivision, land development and impermeable surfaces are causing increasing problems of water pollution, pulsed flows and a falling water table. The proposed 'reimagining' of Tarralla Creek immediately upstream of Site 61 may relieve some of these problems but it may also further lower the water table and accelerate the decline of the Swampy Woodland.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation below include only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*), Messmate Stringybark (*E. obliqua*) and Narrow-leaved Peppermint (*E. radiata*). Smaller numbers of Swamp Gums (*E. ovata*) occur as outliers of the adjacent Swampy Woodland.

Lower trees: Dominated by Black Wattle (*Acacia mearnsii*), followed by Blackwood (*A. melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*). A few Swamp Paperbarks (*Melaleuca ericifolia*) occur as outliers of the Swampy Woodland. Silver Wattle (*Acacia dealbata*) and Golden Wattle (*Acacia pycnantha*) are also scarce and may have been planted, as they were not recorded in a 1990 flora survey.

Medium to large shrubs: Abundant and rich in species. Dominated variously by Prickly Currant-bush (*Coprosma quadrifida*), Yarra Burgan (*Kunzea leptospermoides*) or Common Cassinia (*Cassinia aculeata*). The following species are fairly abundant: Myrtle Wattle (*Acacia myrtifolia*), Sweet Bursaria (*Bursaria spinosa*), Hop Bitter-pea (*Daviesia latifolia*), Common Heath (*Epacris impressa*), Prickly Tea-tree (*Leptospermum continentale*) and Tree Everlasting (*Ozothamnus*

ferrugineus). The following species are scarce: Hop Wattle (*Acacia stricta*), Shiny Cassinia (*Cassinia longifolia*), Hop Goodenia (*Goodenia ovata*), Manuka (*Leptospermum scoparium*) and Australian Dusty Miller (*Spyridium parvifolium*). Sifton Bush (*Cassinia sifton*) has also been present in past years.

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant. Grey Parrot-pea (*Dillwynia cinerascens*) is scarce.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) is fairly abundant. Shrubby Fireweed (*Senecio minimus*) and Cotton Fireweed (*Senecio quadridentatus*) were scarce during this study but probably more abundant in other years.

Ferns: Common Maidenhair (*Adiantum aethiopicum*) and Austral Bracken (*Pteridium esculentum*) are localised but not scarce. Screw Fern (*Lindsaea linearis*) was also present in 1995.

Climbers: Common Apple-berry (*Billardiera scandens*) and Mountain Clematis (*Clematis aristata*) are fairly abundant. Downy Dodder-laurel (*Cassytha pubescens*) and Love Creeper (*Comesperma volubile*) are scarce.

Creepers: Rich in species. The wood-sorrel, *Oxalis exilis/perennans* is fairly abundant and the following species are scarce: Bidgee-widgee (*Acaena novae-zelandiae*), Centella (*Centella cordifolia*), Creeping Bossiaea (*Bossiaea prostrata*), Trailing Goodenia (*Goodenia lanata*), Hairy Pennywort (*Hydrocotyle hirta*) and Ivy-leaf Violet (*Viola hederacea*).

Grasses, rushes and sedges: Abundant and rich in species. Dominated by Thatch Saw-sedge (*Gahnia radula*), followed by Slender Sword-sedge (*Lepidosperma gunnii*) and Weeping Grass (*Microlaena stipoides*) The following species are fairly abundant: Tall Spear-grass (*Austrostipa pubinodis*), Veined Spear-grass (*Austrostipa rudis* subsp. *australis* and subsp. *rudis*), Short-stem Sedge (*Carex breviculmis*), Reed Bent-grass (*Deyeuxia quadriseta*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea* and subsp. *filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Soft Tussock-grass (*Poa morrisii*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Clustered Wallaby-grass (*Rytidosperma racemosum*), Common Bog-rush (*Schoenus apogon*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*). The following species are scarce: Hollow Rush (*Juncus amabilis*), Pale Rush (*Juncus pallidus*), Finger Rush (*Juncus subsecundus*), Common Blown Grass (*Lachnagrostis filiformis*), Variable Sword-sedge (*Lepidosperma laterale*) and Slender Tussock-grass (*Poa tenera*). The following additional species have been recorded previously and probably escaped detection in this study due to the time of year (March): Common Love-grass (*Eragrostis brownii*), Mat Grass (*Hemarthria uncinata*), Five-awned Spear-grass (*Pentapogon quadrifidus*), Smooth Wallaby-grass (*Rytidosperma laeve*), Tasmanian Wallaby-grass (*Rytidosperma semiannulare*) and Bristly Wallaby-grass (*Rytidosperma setaceum*).

Mosses and liverworts: Abundant and rich in species, the most abundant being Heath Star Moss (*Campylopus introflexus*) and Green Worms (*Chiloscyphus semiteres*). The others recorded are Common Hypnum (*Hypnum cupressiforme*), Golden Weft-moss (*Thuidiopsis furfurosa*), Broody Swan-neck Moss (*Campylopus clavatus*), *Dicranoloma billarderi*, Pipe-cleaners (*Ptychomnion aciculare*) and Capillary Thread-moss (*Rosulabryum capillare*).

Other groundcover: The following are fairly abundant: Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (*Gonocarpus tetragynus*), Small Poranthera (*Poranthera microphylla*), Grass Trigger-plant (*Stylidium armeria*) and Yellow Rush-lily (*Tricoryne elatior*). The following are scarce: Chocolate Lily (*Arthropodium strictum*), Pale Grass-lily (*Caesia parviflora*), Pale Flax-lily (*Dianella longifolia*), Rosy Hyacinth-orchid (*Dipodium roseum*), Variable Willow-herb (*Epilobium billardiereanum* subsp. *cinereum*) and Cut-leaf Xanthosia (*Xanthosia dissecta*). Previous flora surveys have also recorded Honey-pots (*Acrotriche serrulata*), Small St John's Wort (*Hypericum gramineum*) and Long Purple-flag (*Patersonia occidentalis*).

Swampy Woodland (EVC 937, **Endangered** in the bioregion)

Canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*), with small numbers of Mealy Stringybark (*Eucalyptus cephalocarpa*) and Narrow-leaved Peppermint (*Eucalyptus radiata*).

Sub-canopy trees: Swamp Paperbark (*Melaleuca ericifolia*) once formed a dense thicket but has thinned out to become patchy as a result of drying conditions. Blackwood (*A. melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are now similarly abundant to the paperbark.

Medium to large shrubs: Dominated by Prickly Currant-bush (*Coprosma quadrifida*), which is abundant. Hop Goodenia (*Goodenia ovata*) and Large Kangaroo Apple (*Solanum laciniatum*) are moderately abundant. Yarra Burgan (*Kunzea leptospermoides*) and Tree Everlasting (*Ozothamnus ferrugineus*) are scarce.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Shrubby Fireweed (*Senecio minimus*) are fairly abundant. Annual Fireweed (*Senecio glomeratus*) and Cotton Fireweed (*Senecio quadridentatus*) were scarce during this study's fieldwork but probably more abundant during more favourable conditions.

Small shrubs: None seen in this study's brief survey.

Ferns: Austral Bracken (*Pteridium esculentum*) forms occasional, dense patches. Common Rasp-fern (*Blechnum parrisiae*) is scarce and very localised.

Climbers: Downy Dodder-laurel (*Cassytha pubescens*) and Mountain Clematis (*Clematis aristata*) are fairly abundant. Common Apple-berry (*Billardiera mutabilis*) is scarce. Wonga Vine (*Pandorea pandorana*) is scarce and arguably not indigenous, this far west.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is abundant, Centella (*Centella cordifolia*) somewhat less so, and Kidney-weed (*Dichondra repens*) is scarce.

Grasses, rushes and sedges: Dense and rich in species, dominated variously by Fen Sedge (*Carex gaudichaudiana*), Thatch Saw-sedge (*Gahnia radula*) or Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*). Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Veined Spear-grass (*Austrostipa rudis* subsp. *australis*) and Hollow Rush (*Juncus amabilis*) are also abundant. The following species are fairly abundant or widespread in the site: Weeping Grass (*Microlaena stipoides*), Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Pale Rush (*Juncus pallidus*), Tall Rush (*Juncus procerus*), Slender Wallaby-grass (*Rytidosperma penicillatum*) and Common Bog-rush (*Schoenus apogon*). Hooker Fescue (*Hookerochloa hookeriana*), Tall Sword-sedge (*Lepidosperma* ?*elatius*), Slender Sword-sedge (*Lepidosperma gunnii*), Common Reed (*Phragmites australis*), Slender Tussock-grass (*Poa tenera*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are scarce. A 1995 flora survey also recorded Knob Sedge (*Carex inversa*), Swamp Club-rush (*Isolepis inundata*), Finger Rush (*Juncus subsecundus*), Common Blown Grass (*Lachnagrostis filiformis*), and Common Tussock-grass (*Poa labillardierei*)

Mosses and liverworts: Green Worms (*Chiloscyphus semiteres*) is abundant. Heath Star Moss (*Campylopus introflexus*), Pipe-cleaners (*Ptychomnion aciculare*) and Golden Weft-moss (*Thuidiopsis furfurosa*) are scattered.

Other groundcover: Hairy Willow-herb (*Epilobium hirtigerum*) and Small Poranthera (*Poranthera microphylla*) are seasonally fairly abundant. Pale Flax-lily (*Dianella longifolia*), Tasman Flax-lily (*Dianella tasmanica*) and Yellow Rush-lily (*Tricoryne elatior*) are scarce. A 1995 flora survey also recorded Common Cudweed (*Euchiton involucratus*), Common Raspwort (*Gonocarpus tetragynus*), Slender Knotweed (*Persicaria decipiens*) and Water-pepper (*Persicaria hydropiper*).

Significant plants

Rare (but not otherwise threatened) in Victoria

This study detected at least 65 plants of the subspecies of Veined Spear-grass, *Austrostipa rudis* subsp. *australis* in the Valley Heathy Forest and over 70 in the Swampy Woodland. Others are likely to have gone undetected due to similarity with the common subspecies *rudis* when plants have no fertile material. Subspecies *australis* is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. It is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 61 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Blechnum parrisiae* (Common Rasp-fern) – a diffuse cluster of eight individuals grows c. 30m north of the oval – the only known occurrence in Maroondah. These plants were not recorded in flora surveys before 2018, so they may have established from windborne spores or else have been planted. (Some

other species appear to have been illicitly planted nearby, such as *Grevillea barklyana* and *Pandorea jasminoides*.);

- *Carex gaudichaudiana* (Fen Sedge) – a dominant species of the ground flora in parts of the Swampy Woodland but its density is less than before the Millennium Drought. The only other records from Maroondah this century are at the Healesville Freeway Reservation (Site 64), on Dandenong Creek (in Site 69), at the Little Bungalook Creek floodplain (Site 72a) and at Scott Street Reserve in Heathmont (Site 80);
- *Hookerochloa hookeriana* (Hooker Fescue) – only three appear to have survived the Millennium Drought but they have been joined by over twenty that have been planted since;
- *Pentapogon quadrifidus* var. *quadrifidus* (Five-awned Spear-grass) – recorded in 1995 without an indication of abundance. This species could not have been detected in this study due to the time of year (March). It may well be detected in future. The only other individuals of the species recorded in Maroondah this century are one or two at Yarra Valley Grammar School (Site 22) and five at Bungalook Conservation Reserves (Site 66);
- *Poa tenera* (Slender Tussock-grass) – scarce, in the Swampy Woodland, where vulnerable to drying conditions;
- *Senecio minimus* (Shrubby Fireweed) – fairly abundant in the Swampy Woodland, where vulnerable to drying conditions.

Fauna habitat

- The structure and composition of the vegetation represent suitable habitat for a range of forest birds, bats, possums and invertebrates, somewhat diminished in value by the site's relatively small size;
- The Swampy Woodland supports frogs and aquatic invertebrates, including yabbies. The frogs and invertebrates are a source of prey for other fauna;
- On dry land, the native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

On the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly two-thirds of the Valley Heathy Forest rates 'B' (good), one-quarter 'C' (fair) and the remainder 'D' (poor). In the Swampy Woodland, roughly 15% rates 'B', 60% rates 'C' and the remaining 25% rates 'D'.

The condition of the tree canopy is poor almost throughout.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

Except for some of the site's periphery, the vegetation easily fits the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Both the EVCs present are listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

Referring to the section above headed 'Significant plants', the Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a large population spanning both EVCs. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Referring further to the 'Significant plants' section, Site 61's populations of *Blechnum parrisiae*, *Carex gaudichaudiana*, *Hookerochloa hookeriana*, *Pentapogon quadrifidus*, *Poa tenera* and *Senecio minimus* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition since 1997 of the conservation statuses of Swampy Woodland and Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people within or near the park, such as walkers, cyclists, sportspeople, spectators and neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of park users and those who pass through.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens.

The site's natural ambience also encourages people to get exercise by walking, running or cycling through the area.

The site's vegetation contributes substantially to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

The site's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018* except the elevated land in the southeast.

Changes

Change in the extent of habitat

A comparison of aerial photographs from 2001 and 2017 indicates that there has been an increase in the extent of the site's tree canopy by several hundred square metres due to growth of eucalypt crowns over land that previously had no native vegetation – principally around the perimeter.

Change in the ecological condition of habitat

The 2001 aerial photograph shows no dead eucalypts. A 2011 aerial photograph shows that by the end of the Millennium Drought, a significant fraction of the site's eucalypts had died. The 2017 photograph shows a few additional eucalypts died in a small area in the southeast, whereas eucalypts in the rest of the site had put on growth and very few died. Nevertheless, some of the surviving eucalypts are in poor health. Investigations have not yet determined a likely cause. Previous assessments of eucalypt dieback in the park going back to 1990 have not come up with a satisfactory explanation, either.

Not just eucalypts but also many other plants died during the Millennium Drought. Those deaths have still not been fully redressed through natural regeneration. That can be mainly attributed to the climate and soil being drier now than historically. Some introduced plants have colonised ecological niches left vacant by indigenous species that can no longer thrive in the drier environment. Maroondah City Council's bushland management team is minimising the proliferation of those introduced species.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Prolonged, severe droughts, which are predicted to worsen and become more frequent due to climate change;
- Other causes of tree dieback, which compound the impacts of drought;
- Possible dropping of the water table as a consequence of the proposed 'daylighting' of Tarralla Creek;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;

Strategic planning

The whole site is zoned 'Public Park and Recreation Zone. Removal of native vegetation is regulated throughout under clause 52.17 of the Victoria Planning Provisions. The Vegetation Protection Overlay (VPO) provides additional control over removal of native vegetation in all but the southwestern tip of the site. The VPO also affects the Benson Oval and land to its south and southwest. In addition, the Significant Landscape Overlay regulates removal of trees above a threshold size, whether they are native to Victoria or not.

As discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of State biological significance such as Site 61. It is recommended to remove the VPO entirely and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 61 as mapped on p. 457.

Information sources

The analysis above draws on the following sources of information about the site:

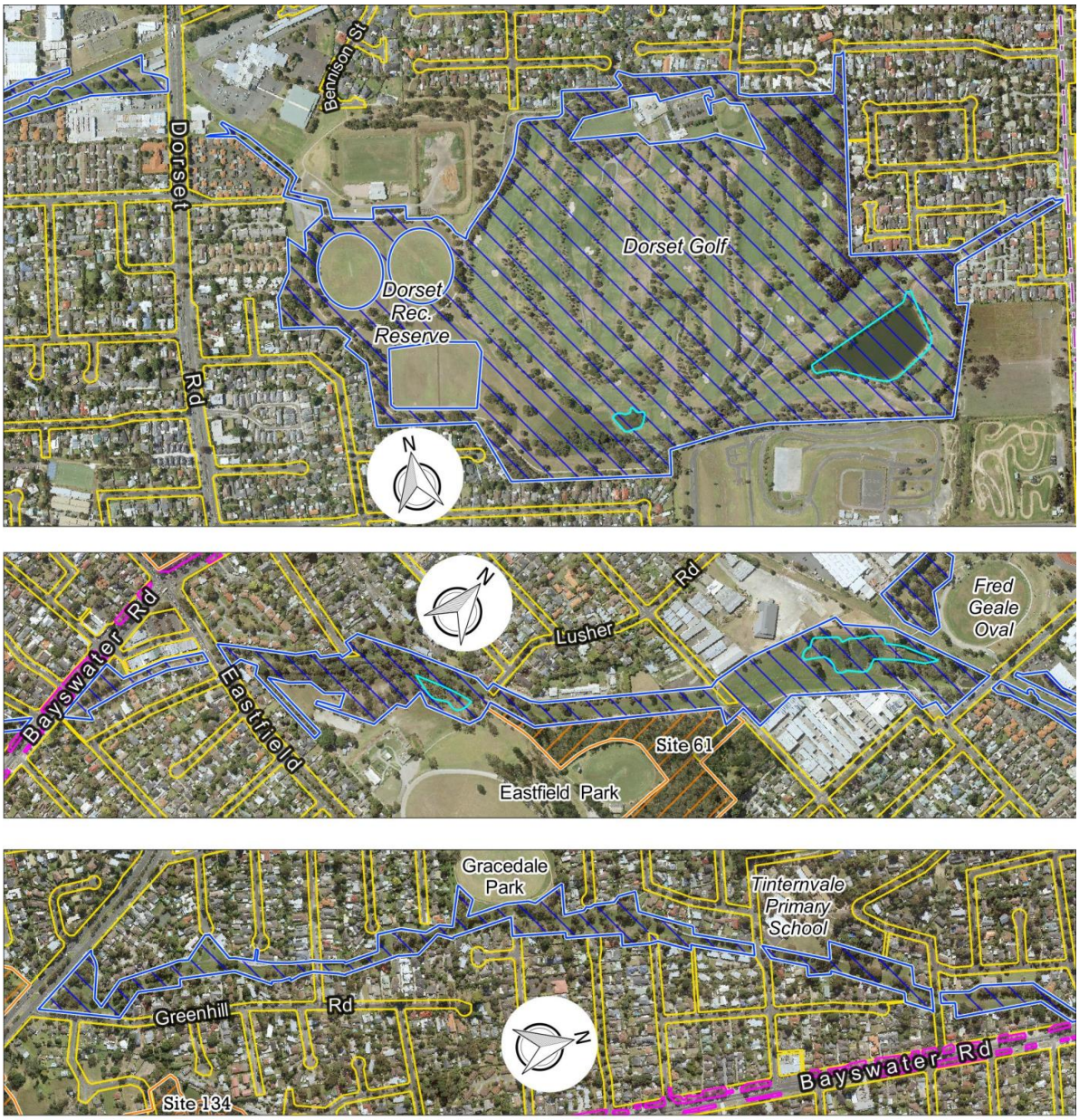
- Nine hours of ecological survey in the site for this study during 22–24 March 2018, including: (a) compiling lists of indigenous and introduced plant species (including mosses and liverworts) for each of the site's two EVCs; (b) documenting the details of rare or scarce plants and significant trees; (c) mapping the vegetation and rare or scarce plants; (d) compiling a list of vertebrate fauna and butterflies, including their abundances; and (e) checking for any other features of the site relevant to this report;
- The author's 1½-hour flora survey of the Valley Heathy Forest on 29/5/13 to assess the vegetation's potential as past or future habitat for the Kilsyth South Spider-orchid;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);

- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated fieldwork during December 1995 to April 1996, including a flora survey, 20-minute bird census, untimed bird census, mammal hair survey, spotlighting, frog call survey and incidental fauna observations;
- *'Eastfield Park Bushland Management Plan 1998'* by G.S. Lorimer for Maroondah City Council. The document was based on the fieldwork of Lorimer *et al*. (1997) plus additional fieldwork, altogether totalling 15–20 hours. Among the document's contents are: (a) lists of vascular plants for the site's two EVCs; (b) population sizes and locations for rare or scarce plant species; (c) detailed descriptions of the site's two EVCs; (d) a map of vegetation types and ecological condition; and (e) assessments of the site's eucalypt dieback and environmental weeds;
- *'An Assessment of the Native Vegetation and Development of Management Prescriptions for Eastfield Park, Croydon, Victoria'* by A.R.G. McMahon, G.W. Carr and G. Race in 1990 for the City of Croydon. The underlying study included a flora survey with eight quadrats, whose locations are wrongly mapped by typically 1½ km in the Victorian Biodiversity Atlas despite a claimed accuracy of 15 m;
- Various bird lists in Birdlife Australia's 'Birdata' database up to 2017;
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird.

Site 62. Tarralla Creek Corridor

Biological Significance Level: *State* at part of Dorset Recreation Reserve due to the presence of a patch of an endangered vegetation type; *Local* elsewhere



The left edge of each of the upper two images matches the right edge of the next image down.

Legend

Roads
Wetlands
Municipal boundary
Site 62
Site 92
Other sites

1:11000
0 100 200 300 400 500 m

Boundaries

Site 62 is outlined and hatched in mid-blue on the aerial photographs above. The boundary is very similar to the original version of Site 62 in the 1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997). As with all sites in this report, the precise boundary is available as a shapefile for geographic information systems.

Site 62 is so diverse in its land use and level of importance for biodiversity that it would ideally be divided into multiple sites, but that would be beyond the capacity of this study.

Land use and tenure

The land is public except for 628 m² of a service station property on the eastern side of Dorset Road.

At the upstream (northeast) end of the site, 'Dorset Golf' is a public golf course with a shared path encircling it. It is owned by Maroondah City Council except for a strip along the southwestern edge, which belongs to Melbourne Water. The abutting Dorset Recreation Reserve is a retarding basin that doubles as a sports facility, but as a result of this study, part of it is now managed for nature conservation. As with the golf course, part of the recreation reserve is owned by council and part by Melbourne Water.

At the downstream end of the recreation reserve, Site 67 continues along a tree-lined floodway into the rear of the service station. The floodway is dry between rain events due to the presence of a low-flow pipe beneath the floodway.

There is a gap from there to the opposite side of Dorset Road, where another tree-lined floodway and low-flow pipe extends to Norton Road. Site 62 includes the floodway, some trees on the abutting O'Shannassy pipe track and a tree plantation on the southern edge of the Swinburne TAFE campus.

There is a major litter trap immediately downstream of Norton Road, followed by a system of vegetated stormwater treatment wetlands. North of the wetlands, the site includes an arboretum next to the Fred Geale Oval.

A floodway with a low-flow pipe extends from the downstream end of the stormwater treatment wetlands all the way to the end of the site at Canterbury Road, where the creek's original course remains. The site includes the floodway and the adjacent Tarralla Creek Trail (a shared path).

The most natural and biologically significant parts of Eastfield Park form Site 61. Site 62 includes other parts of Eastfield Park with indigenous riparian vegetation (natural and planted) beside the floodway. Those parts include a fenced-off semi-natural wetland that was used for horse agistment until c. 2012.

General description

Site 62's ten polygons measure 76.8 hectares. They extend 4.5 km from end to end as the crow flies or 6.2 km along the arc of Tarralla Creek and its floodways. The floodplain falls only 14 m (approximately) over that distance, so the land was quite flood-prone prior to the installation of drains and floodways. Much of the ground within Site 62 is still marshy during half of each year with average rainfall.

Because of the poor natural drainage, nearly all the site's pre-settlement vegetation belonged to the Ecological Vegetation Classes (EVCs) called 'Swampy Woodland' and 'Swampy Riparian Woodland'. Swampy Woodland is represented today in quite modified forms: remnant trees as scattered individuals or small clusters; wetland plants in depressions; groundcovers in mown areas; and revegetation. Swampy Riparian Woodland no longer remains, due to engineering work and the resultant elimination of the governing riparian processes.

Part of the golf course in the site's northeast, and small areas downstream of Bayswater Road, are slightly elevated above the floodplain. Some of these areas retain vestiges of the pre-settlement EVC called 'Valley Heathy Forest'.

The site's most significant vegetation by far is in the part of Dorset Recreation Reserve that lies southwest of Dorset Golf. The vegetation there was regularly mown from around 2000 until this study drew attention

to the abundance of locally rare plant species. Those species include no fewer than ten that fall into the 'critically endangered' category of risk of dying out in Maroondah. One of those species (Brown-back Wallaby-grass) has never been recorded closer than Yarra Glen, 19 km away. Much of the area with rare plants is now mown less frequently and at times of year more favourable to the plants' survival.

A major part of the site's vegetation other than grass has been planted. Roughly half of the plantings are of non-indigenous 'Australian native' trees, planted up to around 1980. Monterey Pines were also planted in substantial numbers. More recent plantings have been overwhelmingly indigenous species, from trees to groundcovers. The contrast between these different types of planting is most stark between Eastfield Road and Lusher Avenue.

The site's wetlands are marked on the aerial photograph on p. 465. The most important ones for rare or uncommon waterbirds are the stormwater treatment wetlands south of the Fred Geale Oval and the large dam at Dorset Golf. All of the wetlands provide habitat for common waterbirds, frogs, aquatic invertebrates and aquatic plants.

Across the whole site, this study detected seventy-seven naturally-occurring, indigenous plant species. Additional species would no doubt be found if the golf course were searched or if a summer survey were done.

At the time of writing, the stormwater treatment wetlands and the section of floodway between Norton Road and Eastfield Road are the subject of plans for the 'Daylighting Tarralla Creek' project. The concept is to substantially change the wetlands and excavate a channel to the depth of the low-flow pipe, which would be removed.

Relationship to other land

The context of Site 62 relative to nearby sites of biological significance can be seen on the key map on p. 1.

Along the course of Tarralla Creek, Site 61 (at Eastfield Park), Dorset Golf and Dorset Recreation Reserve stand out as substantial areas of habitat. For waterbirds, the main areas of habitat in the area are at the golf course, the stormwater treatment wetlands and the nearby Croydon Library pond (Site 135).

On the opposite side of Canterbury Road from the downstream end of Site 62, Site 73 provides an ecological connector with the Bungalook Creek habitat corridor (Site 131) and the Dandenong Creek habitat corridor (Sites 69, 72b and 74–82).

Many species of forest birds can be observed moving along the Tarralla Creek corridor. Some microbats and flying insects may also move along the corridor. For at least some of these species, the movements are probably associated with commuting between the abovementioned substantial areas of habitat.

Pollination that occurs from these movements of birds and insects improves the reproductive success and genetic diversity of plants in all the visited sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) recognises Site 62 as a corridor but gives it a 'low' score for 'Relative corridor conservation priority'.

The ecological functions of Site 62 are dependent on the catchment. Increased subdivision, land development and impermeable surfaces are causing increasing problems of water pollution and pulsed flows. These problems mainly affect the stormwater treatment wetlands, the proposed 'daylighting' of the creek, and locations downstream of the site.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation below include only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*), Messmate Stringybark (*E. obliqua*) and Narrow-leaved Peppermint (*E. radiata*). Only a single Red Stringybark (*E. macrorhyncha*) was found in this study.

Lower trees: Black Wattle (*Acacia mearnsii*), Blackwood (*A. melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are all scarce. Black Sheoak (*Allocasuarina littoralis*) was noted as growing wild at the golf course in the previous (1996) flora survey but it is possible that the ones present now have all been planted.

Medium to large shrubs: Scarce. Species include Hedge Wattle (*Acacia paradoxa*), Sweet Bursaria (*Bursaria spinosa*), Yarra Burgan (*Kunzea leptospermoides*), Prickly Tea-tree (*Leptospermum continentale*) and Manuka (*L. scoparium*).

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) was recorded at the golf course in the previous flora survey in an area that was not inspected in this study, so it might still be there.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches.

Climbers: Common Apple-berry (*Billardiera scandens*) was recorded at the golf course in the previous flora survey in an area that was not inspected in this study, so it might still be there.

Creepers: The wood-sorrel, *Oxalis exilis/perennans* is scarce.

Grasses, rushes and sedges: Species include Veined Spear-grass (*Austrostipa rudis*), Thatch Saw-sedge (*Gahnia radula*), Slender Sword-sedge (*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Soft Tussock-grass (*Poa morrisii*), Red-anther Wallaby-grass (*Rytidosperma pallidum*), Velvet Wallaby-grass (*R. pilosum*), Clustered Wallaby-grass (*R. racemosum*), Bristly Wallaby-grass (*R. setaceum*), Purplish Wallaby-grass (*Rytidosperma tenuius*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: A trace of *Dianella revoluta* (Black-anther Flax-lily) is all that was detected in this study's rather cursory survey.

Swampy Woodland (EVC 937, **Endangered** in the bioregion)

Canopy trees: Dominated by Swamp Gum (*Eucalyptus ovata*) and/or Mealy Stringybark (*Eucalyptus cephalocarpa*).

Sub-canopy trees: Dominated by Silver Wattle (*Acacia dealbata*), Blackwood (*A. melanoxylon*) and Swamp Paperbark (*Melaleuca ericifolia*).

Medium to large shrubs: The main species are Sifton Bush (*Cassinia sifton*), Prickly Currant-bush (*Coprosma quadrifida*), Yarra Burgan (*Kunzea leptospermoides*) and Manuka (*Leptospermum scoparium*). Hedge Wattle (*Acacia paradoxa*), Hop Goodenia (*Goodenia ovata*) and Large Kangaroo Apple (*Solanum laciniatum*) are all scarce.

Small shrubs: None seen in this study's brief survey.

Ferns: Austral Bracken (*Pteridium esculentum*) forms occasional, dense patches.

Climbers: None seen in this study's brief survey.

Creepers: Scarce, represented by Bidgee-widgee (*Acaena novae-zelandiae*), Centella (*Centella cordifolia*), Swamp Isotome (*Isotoma fluviatilis*), Prickfoot (*Eryngium vesiculosum*) and Slender Speedwell (*Veronica gracilis*).

Grasses, rushes and sedges: Dense and rich in species in the most natural parts of the site, where the following species are the most abundant: Slender Aphelia (*Aphelia gracilis*), Common Love-grass (*Eragrostis brownii*), Thatch Saw-sedge (*Gahnia radula*), Toad Rush (*Juncus bufonius*), Weeping Grass (*Microlaena stipoides*), Smooth Wallaby-grass (*Rytidosperma laeve*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Bristly Wallaby-grass (*R. setaceum*), Common Bog-rush (*Schoenus*

apogon), Soft Bog-rush (*Schoenus tesquorum*) and Kangaroo Grass (*Themeda triandra*). The most ecologically informative of the many other species are Brown-back Wallaby-grass (*Rytidosperma duttonianum*) and Tasmanian Wallaby-grass (*Rytidosperma semiannulare*).

Other groundcover: In the most natural areas, the most abundant species are Branched Sundew (*Drosera hookeri*), Slender Onion-orchid (*Microtis parviflora*), Common Onion-orchid (*Microtis unifolia*), Smooth Solenogyne (*Solenogyne dominii*), Hundreds and Thousands (*Stylidium despectum*) and Trim Sun-orchid (*Thelymitra peniculata*). Of the remaining species, the most ecologically informative are Swamp Goodenia (*Goodenia humilis*), Lesser Loosestrife (*Lythrum hyssopifolia*), Amphibious Water-milfoil (*Myriophyllum simulans*) and Long Purple-flag (*Patersonia occidentalis*).

Artificial wetlands and waterbodies (no EVC or conservation status have been assigned by the Victorian Government)

Trees and shrubs: absent.

Ferns: absent.

Grasses, rushes and sedges: The most abundant species in seasonally wet areas are Veined Swamp Wallaby-grass (*Amphibromus nervosus*), Australian Sweet-grass (*Glyceria australis*), Swamp Club-rush (*Isolepis inundata*), Hollow Rush (*Juncus amabilis*), Slender Joint-leaf Rush (*Juncus fockei*), Green Rush (*Juncus gregiflorus*), Broad-leaf Rush (*Juncus planifolius*), Tall Rush (*Juncus procerus*), Broom Rush (*Juncus sarophorus*) and Common Reed (*Phragmites australis*). In permanent water, Tall Spike-rush (*Eleocharis sphacelata*) and Cumbungi (*Typha domingensis*) dominate, with Common Spike-rush (*Eleocharis acuta*) in shallower water.

Other: Lesser Joyweed (*Alternanthera denticulata*) and Slender Knotweed (*Persicaria decipiens*) are abundant and widespread within the site's wetlands. Water Plantain (*Alisma plantago-aquatica*) is more localised. Upright Water-milfoil (*Myriophyllum crispatum*) and Waterwort (*Elatine gratioloides*) are scarce. The population of the following duckweeds fluctuates enormously: Common Duckweed (*Lemna disperma*), Thin Duckweed (*Spirodela punctata*) and Tiny Duckweed (*Wolffia australiana*).

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 62 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amphibromus nervosus* (Veined Swamp Wallaby-grass) – Fairly abundant and widespread in open drains at Dorset Recreation Reserve;
- *Aphelia gracilis* (Slender Aphelia) – hundreds (or probably considerably more) grow widely in poorly-drained areas at Dorset Recreation Reserve. The only other occurrences recorded in Maroondah this century are at Sites 72a and 72b;
- *Comesperma ericinum* (Heath Milkwort) – seen at Dorset Golf in the previous flora survey in 1996 but not seen in the much less thorough inspection in this study;
- *Drosera hookeri* (Branched Sundew) – roughly 10,000 plants grow at Dorset Recreation Reserve, southwest of the golf course, thereby representing a large proportion of the whole population of the species in Maroondah;
- *Empodisma minus* (Spreading Rope-rush) – seen at Dorset Golf in the previous flora survey in 1996 but not seen in the much less thorough inspection in this study;
- *Eryngium vesiculosum* (Prickfoot) – a single patch of an indeterminable number of individuals grows at Dorset Recreation Reserve, southwest of the golf course. The only other occurrence recorded in Maroondah this century is at the Healesville Freeway reservation (Site 64);
- *Eucalyptus macrorhyncha* (Red Stringybark) – a single individual grows near the northwest corner of Dorset Golf. Others on the golf course could easily have escaped attention due to the brevity of this study's inspection;

- *Gonocarpus micranthus* (Creeping Raspwort) – seen at Dorset Golf in the previous flora survey in 1996 but not seen in the much less thorough inspection in this study;
- *Goodenia humilis* (Swamp Goodenia) – approximately 20 were counted in 2019 in a small cluster at Dorset Recreation Reserve, southwest of the golf course. The only other occurrences recorded in Maroondah this century are at Bungalook Conservation Reserves (Site 66) and just outside its boundary in Site 67;
- *Isotoma fluviatilis* (Swamp Isotome) – fairly abundant at Dorset Recreation Reserve, southwest of the golf course;
- *Myriophyllum crispatum* (Upright Water-milfoil) – grows in the wetland near the dead end of Lusher Road, where it is abundant in some years and scarce in others. This species was recorded at only one other site (Site 72a) in this study;
- *Myriophyllum simulans* (Amphibious Water-milfoil) – 5–10 individuals were seen in 2019 in a small cluster at Dorset Recreation Reserve, southwest of the golf course. This species was not found in any other site in this study. The only prior records in Maroondah's history are at Sites 72a and 72b;
- *Rytidosperma duttonianum* (Brown-back Wallaby-grass) – perhaps as few as 5–10 plants grow at Dorset Recreation Reserve, southwest of the golf course. This species appears to have been never recorded closer than Yarra Glen;
- *Schoenus tesquorum* (Soft Bog-rush) – abundant at Dorset Recreation Reserve, southwest of the golf course;
- *Stylidium despectum* (Hundreds and Thousands) –grows southwest of the golf course. The population was estimated as 300 individuals in 2019 but numbers vary greatly from year to year. That is more than at Bungalook Conservation Reserves (Site 66), which has the only other known population of the species in Maroondah. The only other record of the species in metro Melbourne this century is from Langwarrin Flora and Fauna Reserve, in 2013, when noted as 'Localised; uncommon';
- *Wahlenbergia multicaulis* (Tadgell's Bluebell) – seen at Dorset Recreation Reserve in the previous flora survey in 1996 but playing fields now occupy the same area and the species has probably died out in the site.

Significant fauna

- Hardhead (listed as 'vulnerable' in Victoria) – two birds observed by Peter Shanley at Dorset Recreation Reserve or Dorset Golf on 16/11/15, as reported to eBird;
- Nankeen Night Heron (listed as 'near threatened' in Victoria) – one bird observed by James Greer at the stormwater treatment wetlands near Town Park on 29/6/17, as reported to the Atlas of Living Australia;
- White-faced Heron (rare in Maroondah) – one bird seen by the present author at the stormwater treatment wetlands on 6/3/09 and 1/10/11;
- Fairy Martin or Tree Martin (rare in Maroondah) – two birds observed by Peter Shanley at Dorset Recreation Reserve on 23/2/18, as reported to eBird; and
- Snakes (probably Lowland Copperhead, which is rare in Maroondah and the only snake species recorded in recent decades) – reported by golfers at Dorset Golf.

Fauna habitat

- The structure and composition of the treed vegetation between Lusher Road and Eastfield Road represent suitable habitat for a range of forest birds, bats, possums and invertebrates;
- The trees elsewhere in the site represent good habitat for Australian Wood Ducks and urban-adapted birds of forests and woodlands, particularly as a corridor for movement between habitat areas;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The site's waterbodies and open drains provide habitat for aquatic invertebrates, frogs, snakes and waterbirds; and
- The large lake at Dorset Golf appears suitable habitat for the endangered Blue-billed Duck.

Ecological condition

The ecological condition of some of the marshy vegetation southwest of the golf course varies between rating 'B' (good) and 'C' (fair) on the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). Category 'C' also applies to: (a) the banks of the large lake at the golf course; (b) the stormwater treatment wetland system south of Fred Geale Oval; and (c) the left (eastern) bank of the floodway between Lusher Road and 150 m from Eastfield Road. The remaining treed parts of the site seen in this study fit rating 'D' (poor) but substantial parts of the golf course were not inspected. The site also includes substantial areas with negligible habitat and very poor ecological condition.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State in part; Local elsewhere

Regionally threatened Ecological Vegetation Classes

There are at least three substantial areas within Dorset Recreation Reserves where indigenous plants dominate the understorey: (a) approximately 0.3 ha northwest of the hockey/soccer pitches; (b) 0.4 ha east of the soccer/hockey fields; and (c) 0.25 ha almost abutting the last area and extending south of the golf course. Each of these areas fits the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Although the vegetation is mostly treeless, it represents the EVC, 'Swampy Woodland'. That EVC is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the patches meet standard criterion 3.2.3 for a site of **State** significance.

A treed area in the northeast of the golf course near the 7th tee and 8th green was not visited in this study and it may qualify as a 'patch' of Valley Heathy Forest. If so, it would represent State significance on the same basis as above.

No other part of the site seems to qualify as a 'patch' but other parts of the area southwest of the golf course are important to the ecological viability of the identified patch.

Locally threatened plant species

Standard criterion 3.1.5 accords Local significance to any site that is: 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. That description fits Site 62's populations of the following species: *Amphibromus nervosus, Drosera hookeri, Eryngium vesiculosum, Goodenia humilis, Isotoma fluviatilis, Myriophyllum crispatum, Myriophyllum simulans, Rytidosperma duttonianum, Schoenus tesquorum* and *Stylidium despectum*. Justification for these assessments is provided in the section above headed 'Significant plants'.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 62 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to **Local** significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria, changes in vegetation condition, and the state government's recognition since 1997 of the conservation status of Swampy Woodland.

Note that the vegetation that gives the site State significance is confined to parts of Dorset Recreation Reserve and perhaps part of the golf course. It would be appropriate to treat the rest of the site as being of Local significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people within the site (e.g. walkers, cyclists, sportspeople and spectators) and also neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The semi-natural ambience of the site is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors, sportspeople and those who pass through.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens.

The semi-natural ambience also encourages people to get exercise by walking, running or cycling through the site.

The site adds to the 'green and leafy' character of the neighbourhoods within which it is situated.

The site's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018* except the elevated parts of the Dorset Public Golf Course.

Changes

Change in the extent of habitat

The original version of Site 62 (Lorimer *et al.* 1997) included approximately 0.4 ha of native vegetation that has since been almost completely cleared for the Bennison Street residential subdivision, northwest of the golf course. That area has been excised from the site mapped on p. 465.

At the time of the previous flora survey (1996), Dorset Recreation Reserve and its retarding basin were undergoing excavation. The excavations would have destroyed large numbers of rare plants and hectares of the endangered Swampy Woodland habitat.

Elsewhere in the site, examination of aerial photographs shows that between 2001 and 2017, a small number of trees have been removed (mostly due to deaths during the Millennium Drought). The resulting canopy loss has been greatly outweighed by the growth of eucalypt crowns, resulting in new eucalypt cover over land that was just weedy grass. It is impracticable to measure and add up the many small increments to canopy cover.

Change in the ecological condition of habitat

Revegetation on the left bank of the floodway between Lusher Road and Eastfield Road has greatly improved the diversity and structure of the habitat in that area.

The wetland opposite the dead end of Lusher Road was in very poor ecological condition due to heavy grazing until c. 2011 when the author noticed stubs of uncommon plants such as Upright Water-milfoil. Maroondah City Council then arranged for the wetland to be fenced from horses and nurtured by council staff. The wetland is now in very much better ecological condition, but variable from season to season and year to year according to the amount of rainfall.

Similarly, the condition of the marshy vegetation to the east and southeast of the hockey/soccer pitches at Dorset Recreation Reserve improved markedly since mid-2018 when the author alerted Maroondah City

Council to the large number of rare plants there. Council staff modified the mowing regime to favour the indigenous plants, particularly the rare ones.

From the limited amount of prior information about the ecological condition of the site, no other changes have been noticed.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Prolonged, severe droughts, which are predicted to worsen and become more frequent due to climate change;
- Possible dropping of the water table as a consequence of the proposed 'daylighting' of Tarralla Creek;
- Mowing of the regionally-rare Brown-back Wallaby-grass, immediately south of the eastern hockey/soccer pitch at Dorset Recreation Reserve;
- Continuation of water pollution, affecting wetland vegetation, aquatic invertebrates, frogs and waterbirds; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This problem is most serious to the south of the golf course fence at Dorset Recreation Reserve, where there is a concentration of rare plant species with small populations.

Strategic planning

The floodway between Dorset Road and Dorset Recreation Reserve is Zoned 'General Residential Zone'. The zoning of the rest of the site is a complicated mixture of 'Urban Floodway Zone', 'Public Use Zone – Service and Utility' and 'Public Park and Recreation Zone'.

Following Lorimer *et al*. (1997), the removal, destruction or lopping of native vegetation in most of the site is regulated under the Vegetation Protection Overlay (VPO). The VPO also covers some adjacent land. In addition, the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions apply throughout.

Schedule 4 of the Significant Landscape Overlay applies between Norton Road and Bayswater Road except for the arboretum next to the Fred Geale Oval. Schedule 3 of the Significant Landscape Overlay applies from Bayswater Road to Canterbury Road.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to:

- Remove the VPO from Site 62 and adjoining land;
- Apply the proposed schedule ESO1 of the Environmental Significance Overlay to the part of Site 62 upstream of Eastfield Rd, as the biological significance in that stretch relates strongly to indigenous vegetation, including groundcover species; and
- Apply the proposed schedule ESO2 to the remainder of Site 62, because that stretch has hardly any indigenous understorey and the movement of birds along the habitat corridor relies substantially on planted 'Australian native' trees.

While Site 62 is defined by the areas outlined and hatched in mid-blue on the aerial photographs on p. 465, it may be appropriate to expand the overlays beyond Site 62 to simplify the overlay boundaries.

If these recommendations are adopted, it may be appropriate to consider removing SLO3 and SLO4 from Site 62. The main effect would be to remove planning controls over non-Australian trees such as cotoneasters and pines, which are acting as environmental weeds within Site 62.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately fourteen hours of ecological survey in the site for this study during 7/11/16–30/10/19, including: (a) compiling lists of indigenous and introduced plant species (including mosses and liverworts) for different parts of the site; (b) documenting the details of rare or scarce plants and significant trees; (c) mapping the vegetation and rare or scarce plants; (d) a bird census of the part of the site east of Dorset Road on 28/10/18; and (e) checking for any other features of the site relevant to this report;
- The author's incidental records of flora and fauna from the site during 2009 to 2016;
- The author's general observations of the section of the site from Town Park to Canterbury Road as a frequent cyclist along the Tarralla Creek Trail between 2002 and 2016;
- Bird lists in the online eBird resource, the Atlas of Living Australia and Birdlife Australia's 'Birdata' database;
- A specimen of Australian Sweetgrass (*Glyceria australis*) at the National Herbarium of Victoria (MEL 2397320A) collected from Dorset Recreation Reserve by Ian Clarke on 20/10/14;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated fieldwork in January to March 1996, including a flora survey, 20-minute bird census, mammal hair survey, spotlighting, frog call survey and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas other than duplicate representations of some of the primary sources above. The state government's mapping of extant native vegetation is quite inaccurate in this site.

Site 63. Croydon Special Developmental School & Manifold Court Reserve

Biological Significance Level: *State* at the school due to the presence of an endangered vegetation type; *Regional* at the reserve



Boundaries, land use and tenure

As shown with a dashed blue outline above, Site 63 has two sections: the whole of a council reserve (extending to adjacent kerbs) and part of the Croydon Special Developmental School. The purposes of the council reserve are for amenity and pedestrian thoroughfare along a concrete path that runs diagonally through it. Most of the school's part of the site is signposted as a 'bushland reserve' and the rest abuts the western edge of the school's car park. The 'bushland reserve' has asphalt paths winding through it to facilitate use of the area by the school.

The original version of this site in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997) was larger. The council reserve shown near the northwest corner of the aerial photograph above was included in 1997 but it now has so little indigenous understorey that it has been removed from the site. The school's part of the site has been reduced for two reasons: firstly, the car park has greatly expanded westward; and secondly, the northern edge has lost most of its indigenous flora.

General description

The council reserve's part of the site measures 844 m² and the school's part of the site measures 3,824 m². Both parts lie on a gentle gradient of 1:7 facing northeast. The northern edge of the school's part is at the base of the slope, next to a minor drainage line.

The school's part of the site is substantially more natural than the council reserve. In it, this study found 64 indigenous plant species (and two extra subspecies) spanning all vegetation strata. The vegetation is a good example of the endangered Ecological Vegetation Class (EVC) called 'Valley Heathy Forest'. Rare species are present but this study failed to find a nationally significant species (*Platylobium infecundum*) that was recorded in the previous flora survey in 1994.

The council's part of the site is much less natural due to dense planting of Common Tussock-grass (*Poa labillardierei*), presumably in the mistaken belief that it is indigenous to Valley Heathy Forest. Genuinely indigenous species have been planted in much smaller numbers. Twenty-three naturally-occurring, indigenous plant species were detected in this study.

The reserve only qualifies as a site of biological significance because it has a small population of the form of Veined Spear-grass called *Austrostipa rudis* subspecies *australis*, which is listed by the Victorian Government as rare in Victoria.

Relationship to other land

The school has many remnant eucalypts outside Site 63 but with very little indigenous understorey. Those eucalypts supplement Site 63's habitat for birds, bats and invertebrates. There are also many remnant eucalypts in nearby reserves such as Clyde Reserve (25 m north of the school), Pandora Reserve (almost abutting Clyde Reserve) and the council reserve near the northwest corner of the aerial photograph on p. 475. While indigenous eucalypts generally provide the best habitat for indigenous fauna, the neighbourhood's many 'Australian native' trees provide supplementary habitat. Those trees are found at Belmont Park (abutting the school's eastern edge), the former Croydon South Primary School (abutting the school's southwest corner), on nature strips and in residential gardens.

The closest areas with substantial amounts of indigenous understorey are at Woodland Park (Site 124, 280 m to the south) and around the Benson Oval at Eastfield Park (Site 61, 525 m north).

Such a matrix of habitat can support common forest birds, urban-adapted birds, common bats, common lizards and common invertebrates.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only indigenous species that are believed not to have been planted. They were observed in 2019 except where otherwise stated.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Messmate Stringybark (*E. obliqua*), with Narrow-leaved Peppermint (*E. radiata*) almost as abundant at the school. There are also a few Bundy (*E. goniocalyx*) at the school.

Lower trees: Scarce, represented by small numbers of Blackwood (*Acacia melanoxylon*) and a single Black Wattle (*Acacia mearnsii*).

Medium to large shrubs: The only shrub species in the council reserve is Sweet Bursaria (*Bursaria spinosa*), which is abundant there and at the school. The school has also has substantial numbers of Yarra Burgan (*Kunzea leptospermoides*) and small numbers of Prickly Moses (*Acacia verticillata*), Common Cassinia (*Cassinia aculeata*), Sifton Bush (*Cassinia sifton*), Prickly Tea-tree (*Leptospermum continentale*), Tree Everlasting (*Ozothamnus ferrugineus*) and Large Kangaroo Apple (*Solanum laciniatum*). In 1994, Narrow-leaf Bitter-pea (*Daviesia leptophylla*) and Common Heath (*Epacris impressa*) were also present at the school.

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*) is scattered around the school's part of the site and scarce at the council reserve. Common Flat-pea (*Platylobium obtusangulum*) is scarce in both areas. Common Beard-heath (*Leucopogon virgatus*) was present at the school in 1994 but could not be found in this study.

Ferns: There are approximately 24 Screw Ferns (*Lindsaea linearis*) in a small area of the school's 'bushland reserve'. Austral Bracken (*Pteridium esculentum*) was also there in 1994 but was not recorded in this study.

Climbers: Common Apple-berry (*Billardiera mutabilis*) and Mountain Clematis (*Clematis aristata*) are fairly abundant at the school. The school also has some plants of Wonga Vine (*Pandorea pandorana*) and a single Small-leafed Clematis (*Clematis decipiens*), but both of these are questionably indigenous to this part of Maroondah. A Purple Coral-pea (*Hardenbergia violacea*) on the school's fence may well have been planted.

Creepers: Absent from the council reserve. At the school, the wood-sorrel, *Oxalis exilis/perennans*, is fairly abundant, while Creeping Bossiaea (*Bossiaea prostrata*) and Centella (*Centella cordifolia*) are scarce. The previous (1994) flora survey also recorded Trailing Goodenia (*Goodenia lanata*), Ivy-leaf Violet (*Viola hederacea*) and the globally endangered flat-pea, *Platylobium infecundum*.

Grasses, rushes and sedges: Thatch Saw-sedge (*Gahnia radula*) dominates the groundcover at the school and part of the council reserve. (The non-indigenous *Poa labillardierei* has been planted densely in most of the council reserve.) Substantial numbers of two subspecies of Veined Spear-grass (*Austrostipa rudis*) occur in both parts of the site, the rare subspecies *australis* being the more abundant at the school and subspecies *rudis* more abundant in the council reserve. Other species with substantial numbers at the school (and in some cases, the council reserve) are Reed Bent-grass (*Deyeuxia quadriseta*), Toad Rush (*Juncus bufonius*), Broom Rush (*Juncus sarophorus*), Slender Sword-sedge (*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea* and subsp. *filiformis*), Weeping Grass (*Microlaena stipoides*), Soft Tussock-grass (*Poa morrisii*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Clustered Wallaby-grass (*Rytidosperma racemosum*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*). The following species are scarce: Tall Spear-grass (*Austrostipa pubinodis*), Short-stem Sedge (*Carex breviculmis*), Common Plume-grass (*Dichelachne rara*), Mat Grass (*Hemarthria uncinata*), Hollow Rush (*Juncus amabilis*), Pale Rush (*Juncus pallidus*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Smooth Wallaby-grass (*Rytidosperma laeve*), Velvet Wallaby-grass (*Rytidosperma pilosum*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Common Bog-rush (*Schoenus apogon*). In 1994, a pond immediately northeast of the current version of Site 63 contained the following species that appear to have died out there: Swamp Club-rush (*Isolepis inundata*), Loose-flower Rush (*Juncus pauciflorus*), Tall Rush (*Juncus procerus*) and Common Blown Grass (*Lachnagrostis filiformis*). A few additional species were recorded at the school in 1994 and might have gone undetected in this study.

Other groundcover: Chocolate Lily (*Arthropodium strictum*), Common Raspwort (*Gonocarpus tetragynus*) and Milkmaids (*Burchardia umbellata*) are fairly abundant in both parts of the site. Yellow Rush-lily (*Tricoryne elatior*) is fairly abundant at the school. The following species are scarce and mostly confined to the school: Honey-pots (*Acrotriche serrulata*), Pale Flax-lily (*Dianella longifolia*), Black-anther Flax-lily (*Dianella revoluta*), Tasman Flax-lily (*Dianella tasmanica*), Tall Sundew (*Drosera auriculata*), Creeping Cudweed (*Euchiton japonicus*), Slender Bottle-daisy (*Lagenophora sublyrata*), Slender Onion-orchid (*Microtis parviflora*), Broad-leaf Stinkweed (*Opercularia ovata*), Long Purple-flag (*Patersonia occidentalis*), Common Rice-flower (*Pimelea humilis*) and Small Poranthera (*Poranthera microphylla*). The following additional species were recorded in the 1994 flora survey: Pale Grass-lily (*Caesia parviflora*), Button Everlasting (*Coronidium scorpioides*), Hairy Willow-herb (*Epilobium hirtigerum*), Common Cudweed

(*Euchiton involucratus*), Common Hovea (*Hovea heterophylla*), Small St John's Wort (*Hypericum gramineum*), Variable Stinkweed (*Opercularia varia*), Candles (*Stackhousia monogyna*), Grass Trigger-plant (*Stylidium armeria/graminifolium*) and Slender Knotweed (*Persicaria decipiens*). The last of these has died out in the pond that lies immediately northeast of the current version of the site.

Significant plants

Globally endangered

The mat-forming flat-pea, *Platylobium infecundum*, is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. An unstated number of individuals were recorded in the previous (1994) flora survey of the school's bushland. It could not be found in this study, which could be due to the vegetation removal that has occurred since 1994 or perhaps one or more individuals persist, hidden under other plants.

Rare (but not otherwise threatened) in Victoria

At least eighteen plants of the subspecies of Veined Spear-grass, *Austrostipa rudis* subsp. *australis* are scattered through the school and at least four plants grow next to the footpath in the council reserve. Others may have gone undetected due to similarity with the common subspecies *rudis* when plants have no fertile material. Subspecies *australis* is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. It is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

Slender Tussock-grass (*Poa tenera*) can be confidently presumed to be in the 'critically endangered' category of risk of dying out in Maroondah. It was recorded at the school's bushland reserve in 1994 and it could have escaped detection in this study.

Fauna habitat

- The structure and composition of the native vegetation in the school's part of Site 63 represent suitable habitat for common forest birds, urban-adapted birds, common bats, common lizards and common invertebrates. However, the site's small size diminishes its attractiveness to most indigenous bird species;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Ecological condition of Site 63's habitat has been assessed using the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997).

Within the school's part of the site, rating 'B' (good) applies to approximately 0.15 ha, rating 'C' (fair) applies to approximately 0.10 ha and rating 'D' (poor) applies to the remaining 0.13 ha.

The council reserve is divided fairly evenly between ratings 'C' and 'D'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

In the school's part of Site 63, the author measured the area with at least 10% native understorey cover to be 0.25–0.26 hectares. It therefore just meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the school's part of the site meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

Referring to the section above headed 'Significant plants', the Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a population spanning both parts of the site, particularly at the school. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

The flat-pea *Platylobium infecundum* is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. Its global distribution is confined to Victoria. Although it could not be found in this study (as it was in 1994), there is a chance that it simply escaped detection. If it does persist, the site would then meet standard criterion 3.1.2 for a site of National significance.

The reserve's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to different criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest. National significance for the *Platylobium infecundum* was not possible in 1997 because the species was not even scientifically described until 2011.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the school community, people in the council reserve and neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of the school community and nearby residents. Of particular importance to a special developmental school, contact with nature has been demonstrated to help the development of children's minds (Section 1.3 of Volume 1).

The site's vegetation contributes substantially to the neighbourhood's 'green and leafy' character. The vegetation and associated birdlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Aerial photographs from 2001 and 2017 indicate that roughly 600 m² of native vegetation was cleared in that period to enlarge the school's car park. In the same period, approximately 200 m² of undergrowth was cleared to create footpaths through the school's 'bushland reserve', but that did not remove the eucalypt canopy above the paths.

The vegetation removal may explain why this study could not find the globally endangered *Platylobium infecundum* that was previously present.

The aerial photographs show that the area of native vegetation at the council reserve increased by approximately 100 m² due to growth of eucalypt crowns to cover some of the surrounding pavement.

Change in the ecological condition of habitat

Given the sketchy prior information about the site's past ecological condition, and the confounding effect of the removal of vegetation at the school, it is not possible to discern any change.

Threats

This study has identified the following threats to the site's biodiversity (in decreasing order):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of the school's wild, indigenous understorey plants by non-indigenous plants, particularly Kikuyu (*Cenchrus clandestinus*) and Sweet Pittosporum (*Pittosporum undulatum*);
- Displacement of the council reserve's wild, indigenous understorey plants by densely planted Common Tussock-grass (*Poa labillardierei*);
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Possibly future construction of buildings at the school.

Strategic planning

The Croydon Special Developmental School is zoned 'Public Use Zone - Education' and the council reserve is zoned 'Neighbourhood Residential Zone – Schedule 3'. In both areas, trees above a certain size receive planning protection under Schedule 3 of the Significant Landscape Overlay. Within the school, the removal, destruction and lopping of native vegetation (trees to groundcover) is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

Because the school's part of Site 63 is of State biological significance, it is recommended to give it the planning protection of the proposed overlay schedule ESO1 described in Section 11.1.2 of Volume 1.

The other part of the site is of lower biological significance and quite small, at 844 m². Its risk of future development or works appears to be low. On the other hand, the rare spear-grass plants that give the reserve its Regional biological significance currently receive no planning protection. On balance, application of ESO1 appears to be appropriate.

Information sources

The analysis above draws on the following sources of information about the site (all by the present author except the aerial photographs):

- 1¾ hours of ecological survey on 6/11/19 and 17/11/19, including (in part): (a) compilation of a list of the presence and abundances of indigenous plant species (including mosses and liverworts) in each of the two parts of the site; (b) mapping and documenting the details of rare or scarce plants; (c) mapping the edges of vegetation that has at least 10% native understorey cover; and (d) checking for habitat features;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which a flora survey of the Manifold Court reserves was done on 2/4/96;
- A two-page report and plant list titled *'Indigenous plants observed at Croydon Special Development School on 8th November 1994'*; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 64. Healesville Freeway Reservation, Bayswater North

Biological Significance Level: *State* due to the presence of endangered vegetation types and the globally vulnerable Swamp Everlasting



Boundaries

The boundaries of Site 64 are the dashed blue outlines on the aerial photographs above. Where yellow can be seen in the gaps between the dashes, the site boundary corresponds to property boundaries. At Branch Road, the boundary follows the edge of the road formation. From 300 m east of Branch Road to Dorset Road, most of the northern boundary follows the toe of an embankment. The rest of the boundary has been drawn to follow the approximate edge of native vegetation. As with all sites in this report, the precise boundary is available as a shapefile for geographic information systems.

Land use and tenure

The site is part of the reservation for the proposed Healesville Freeway, except for the nature strip of Branch Road, which is a minor municipal road. A strip along the southern edge of the polygon west of Dorset Road contains a floodway and underground low-flow pipe to carry the waters of Bungalook Creek. The land east of Dorset Road is used for horse agistment. The rest of the site receives no active usage other than for walking, children playing, rubbish dumping, graffiti and illegal use of vehicles.

General description

The site occupies 18.9 hectares west of Dorset Road and 3.2 hectares east of Dorset Road. It measures 2.1 km from end to end and 235 m wide at its widest point, near Dorset Road.

The part that lies east of Dorset Road was not part of the original version of Site 64 (Lorimer *et al*. 1997) because its significant vegetation had not been discovered at that time. The area between the two parts of the site also contained a scattering of native vegetation, including the rare Dandenong Range Cinnamon Wattle, until it was cleared for a rock and soil business in c. 2010.

West of Dorset Road

The part of the site west of Dorset Road is on the floodplain of what was Bungalook Creek, before the creek was replaced by a floodway and an underground low-flow pipe. A network of agricultural drains can be seen on the aerial photographs above. Some sections of drains and the floodway harbour indigenous wetland flora and fauna. At least five frog species breed there and Lowland Copperhead snakes hunt there.

The elevation varies by only 4 m across the site from Branch Road to Dorset Road.

Much of the site is treeless due to historical clearing, grazing and drainage works followed by regular slashing in recent decades. Despite that history, the site retains many plant species that are very rare or unique in Maroondah or more widely. Many of those species are in parts of the site that superficially appear to be a grassy wasteland. They are necessarily species adapted to periodic slashing.

One hundred naturally-occurring, indigenous plant species have been recorded in this part of the site.

After Lorimer *et al*. (1997) discovered and documented the site's significant vegetation, the predecessor of the Department of Environment, Land, Water and Planning decided to put a fence around the area that had the greatest concentration of rare plants. The main objective was to keep slashing and vehicles out. However, all the rare plants were adapted to periodic slashing and the cessation of slashing has caused them to become out-competed by regeneration of tea-tree, paperbark and blackberry. The scrub that has resulted from that regeneration is marked on the lower aerial photograph on p. 482. Many of the rare plants growing there in the 1990s could not be found during this study or in recent years. Climate change and the shade and intense water uptake of paperbarks, tea-trees and blackberry have made the habitat unsuitable for the rare plants.

East of Dorset Road

The part of the site that lies east of Dorset Road occupies 3.2 hectares, with a gentle slope averaging 1:20, facing south-southeast. The floodplain of Bungalook Creek abuts its southern edge, now occupied by factories. Some floodplain plant species such as Waterblinks (*Montia fontana*) and Tall Rush (*Juncus procerus*) grow just inside the site boundary. With those exceptions, the vegetation on this slope belongs to the EVC, 'Valley Heathy Forest', which is listed by the state government as regionally endangered.

The present author detected forty-seven naturally-occurring, indigenous plant species in this part of the site in 2015.

Horse grazing and unchecked growth of noxious weeds such as blackberry are suppressing the indigenous flora. Nevertheless, sensitive species such as Cut-leaf Xanthosia (*Xanthosia dissecta*) persist along with a substantial population of the rare grass, *Austrostipa rudis* subsp. *australis*.

Relationship to other land

Site 64's context relative to nearby sites of biological significance can be seen on the key map on p. 1.

At the downstream (western) end, Site 64 adjoins the Bungalook Creek habitat corridor (Site 131), which facilitates movement between Site 64 and habitat sites such as H.E. Parker Reserve (Site 75). Habitat on the floodplain of Little Bungalook Creek at Site 72a lies 520 m to the south of Site 64 but the passage of wildlife and plant seeds between those sites is strongly inhibited by the intervening landscape of factories and a main road. The wetland and woodland habitat at the Canterbury Road Retarding Basin (Site 65) lie

650 m south-southeast of Site 64 but again, factories and a main road impede the passage of wildlife and plant seeds between the sites.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) recommends that Site 61 be given 'Very high relative corridor conservation priority' for improving its capacity to facilitate wildlife movement along the Bungalook Creek floodplain.

The ecological functions of the Site 64 are dependent on the catchment. Land development and increasing impermeable surfaces are causing problems of water pollution, pulsed flows and a falling water table.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation below include only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Swampy Woodland (EVC 937, **Endangered** in the bioregion), including its disclimax forms in the scrub and slashed open areas

Canopy trees: Dominated in the east by Swamp Gum (*Eucalyptus ovata*) and in the west by Mealy Stringybark (*E. cephalocarpa*). Messmate Stringybark (*E. obliqua*) is also present in small numbers near Branch Road.

Sub-canopy trees: Swamp Paperbark (*Melaleuca ericifolia*) forms dense thickets. Blackwood (*Acacia melanoxylon*) is fairly abundant in the treed areas. Cherry Ballart (*Exocarpos cupressiformis*) is scarce.

Medium to large shrubs: Manuka (*Leptospermum scoparium*) is dense in some of the thickets, scattered elsewhere. Prickly Tea-tree (*L. continentale*) is fairly abundant. Prickly Moses (*Acacia verticillata*) and Hop Goodenia (*Goodenia ovata*) are scattered. Tree Everlasting (*Ozothamnus ferrugineus*) is scarce. Golden Spray (*Viminaria juncea*) and Woolly Tea-tree (*Leptospermum lanigerum*) were present in 1996 but appear to have died out.

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) and Cotton Fireweed (*Senecio quadridentatus*) were scarce during this study's fieldwork but probably more abundant during more favourable conditions.

Small shrubs: None recorded.

Ferns or fern allies: Swamp Selaginella (*Selaginella uliginosa*) was recorded in 1996, probably near Dorset Road. It probably died out during the Millennium Drought, as it did in all but one other site in Maroondah.

Climbers: None recorded.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*), Centella (*Centella cordifolia*), Prickfoot (*Eryngium vesiculosum*), Slender Speedwell (*Veronica gracilis*) and the wood-sorrel *Oxalis exilis/perennans* are fairly abundant in certain parts of the site. Shining Buttercup (*Ranunculus glabrifolius*) was present near Dorset Road and south of Valley Court in 1996 and it may still persist.

Grasses, rushes and sedges: Dense and rich in species. Common Reed (*Phragmites australis*) is abundant and locally dominant. The following species are fairly abundant, at least in part of the site: Common Love-grass (*Eragrostis brownii*), Mat Grass (*Hemarthria uncinata*), Hooker Fescue (*Hookerochloa hookeriana*), the club-rush *Isolepis platycarpa*, Toad Rush (*Juncus bufonius*), Common Blown Grass (*Lachnagrostis filiformis*), Smooth Wallaby-grass (*Rytidosperma laeve*), Tasmanian Wallaby-grass (*Rytidosperma semiannulare*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Common Bog-rush (*Schoenus apogon*) and Kangaroo Grass (*Themeda triandra*). Among the less abundant species, the following are good environmental indicators: Pointed Swamp Wallaby-grass (*Amphibromus archeri*), Southern Swamp Wallaby-grass (*Amphibromus* ?*neesii*), Pale Twig-rush (*Baumea acuta*), Fine Twig-rush (*Baumea arthrophylla*), Fen Sedge (*Carex gaudichaudiana*), Pointed Centrolepis (*Centrolepis aristata*), Austral Rush (*Juncus australis*), Five-awned Spear-grass (*Pentapogon quadrifidus*), Slender Tussock-grass (*Poa tenera*) and Soft Bog-rush (*Schoenus tesquorum*).

Other groundcover: The following species were fairly abundant near Dorset Road in 1996 but have since disappeared or diminished greatly due to out-competition when slashing ceased: Golden Cowslips (*Diuris behrii*), Swamp Daisy (*Allittia cardiocarpa*), Wiry Buttons (*Leptorhynchos tenuifolius*), Lesser Loosestrife (*Lythrum hyssopifolia*), Common Onion-orchid (*Microtis unifolia*), Long Purple-flag (*Patersonia occidentalis*) and Trim Sun-orchid (*Thelymitra peniculata*). Among the less abundant species that have been recorded over the years, the following are good environmental indicators: Swamp Goodenia (*Goodenia humilis*), Glandular Brooklime (*Gratiola pubescens*), Running Marsh-flower (*Ornduffia reniformis*), Water-ribbons (*Cycnogeton alcockiae*), Purple Bladderwort (*Utricularia dichotoma*) and Swamp Everlasting (*Xerochrysum palustre*).

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion) – the native vegetation in the part of the site east of Dorset Road

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Messmate Stringybark (*E. obliqua*). There is also one Narrow-leaved Peppermint (*E. radiata*) and two apparent hybrid eucalypts.

Lower trees: Blackwood (*Acacia melanoxylon*) is the only sub-canopy tree species. It is fairly abundant.

Medium to large shrubs: Dominated by Manuka (*Leptospermum scoparium*). Hedge Wattle (*Acacia paradoxa*), Sifton Bush (*Cassinia sifton*) and Prickly Tea-tree (*Leptospermum continentale*) are also abundant. Prickly Moses (*Acacia verticillata*), Sweet Bursaria (*Bursaria spinosa*) and Common Heath (*Epacris impressa*) are moderately abundant. Common Cassinia (*Cassinia aculeata*) and Yarra Burgan (*Kunzea leptospermoides*) are scarce. Golden Spray (*Viminaria juncea*) was present in 1997 and has since died out, perhaps temporarily (as often happens with that species).

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant.

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) and Cotton Fireweed (*Senecio quadridentatus*) were scarce during this study but probably more abundant in other years.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches.

Climbers: Common Apple-berry (*Billardiera scandens*) and Mountain Clematis (*Clematis aristata*) are fairly abundant. Downy Dodder-laurel (*Cassytha pubescens*) and Love Creeper (*Comesperma volubile*) are scarce.

Creepers: Creeping Bossiaea (*Bossiaea prostrata*) and the wood-sorrel, *Oxalis exilis/perennans*, are fairly abundant. Centella (*Centella cordifolia*) and Ivy-leaf Violet (*Viola hederacea*) are scarce.

Grasses, rushes and sedges: Abundant and rich in species. Dominated by Thatch Saw-sedge (*Gahnia radula*). Other species present in substantial number include Veined Spear-grass (*Austrostipa rudis* subsp. *australis*), Common Love-grass (*Eragrostis brownii*), Mat Grass (*Hemarthria uncinata*), Toad Rush (*Juncus bufonius*), Weeping Grass (*Microlaena stipoides*), wallaby-grasses (*Rytidosperma*), Common Bog-rush (*Schoenus apogon*) and Kangaroo Grass (*Themeda triandra*). Among the less abundant species recorded over the years, the following are the most ecologically informative: Austral Rush (*Juncus australis*), Soft Tussock-grass (*Poa morrisii*) and Slender Tussock-grass (*Poa tenera*).

Mosses and liverworts: Golden Weft-moss (*Thuidiopsis furfurosa*) is abundant. Broody Swan-neck Moss (*Campylopus clavatus*) and Green Worms (*Chiloscyphus semiteres*) are fairly abundant. Common Hypnum (*Hypnum cupressiforme*) is scarce.

Other groundcover: Small St John's Wort (*Hypericum gramineum*) and Broad-leaf Stinkweed (*Opercularia ovata*) are abundant. Common Raspwort (*Gonocarpus tetragynus*) and Cut-leaf Xanthosia (*Xanthosia dissecta*) are fairly abundant, as were Wiry Buttons (*Leptorhynchos tenuifolius*) and Long Purple-flag (*Patersonia occidentalis*) prior to the Millennium Drought. The following species are each represented by at most a few individuals: Trim Sun-orchid (*Thelymitra* ?*peniculata*), Pale Grass-lily (*Caesia parviflora*), Common Cotula (*Cotula australis*), Tall Sundew (*Drosera auriculata*), Hairy Willow-herb (*Epilobium hirtigerum*), Water Blinks (*Montia fontana* subsp. *chondrosperma*), Small Poranthera (*Poranthera microphylla*) and Yellow Rush-lily (*Tricoryne elatior*).

Artificial wetland and drains (no EVC or conservation status applicable)

Trees and shrubs: Swamp Paperbark (*Melaleuca ericifolia*) forms dense thickets around the edge of some drains and depressions.

Other: Abundant, including Water-plantain (*Alisma plantago-aquatica*), Tall Sedge (*Carex appressa*), Water-ribbons (*Cycnogeton alcockiae*), Australian Sweet-grass (*Glyceria australis*), Swamp Club-rush (*Isolepis inundata*), numerous *Juncus* species, Slender Knotweed (*Persicaria decipiens*) and Streaked Arrow-grass (*Triglochin striata*).

Significant plants

Vulnerable globally

A single patch of *Xerochrysum palustre* (Swamp Everlasting) – probably a single plant – was discovered by Lorimer *et al*. (1997) in an annually-slashed area roughly 120 m west of Dorset Road. It appears to have been last inspected in 2006, when it was still growing well. Then, with the cessation of slashing, blackberries became so dense that the author has not been able to check whether the everlasting has survived. Competition from the blackberries and other plants raise grave concerns for the everlasting's survival. The everlasting's global distribution is southern Victoria, the headwaters of the Murray River and a few locations in Tasmania.

Vulnerable in Victoria

Fifty individuals of the orchid, *Diuris behrii* (Golden Cowslips), were counted just west of Dorset Road when the author last saw them, in 2008. Dense regeneration of paperbarks, tea-tree and then blackberries has overrun the colony since then due to cessation of slashing. Thinning of the dense scrub may allow the orchids to reappear. The species is mostly found in the western half of Victoria. It also occurs in South Australia, NSW and the ACT.

Rare (but not otherwise threatened) in Victoria

The subspecies of Veined Spear-grass known as *Austrostipa rudis* subsp. *australis* is fairly abundant in the part of Site 64 east of Dorset Road. It is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. It is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 64 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Allittia cardiocarpa* (Swamp Daisy) – scattered just west of Dorset Road and in the part of the site located east of Dorset Road;
- *Amphibromus archeri* (Pointed Swamp Wallaby-grass) – recorded in December 1995 as fairly abundant near Dorset Road and south of Valley Court. Subsequent surveys have not been at times of the year conducive to finding it again. This species often disappears for years before regenerating after fire or other environmental disturbance;
- *Baumea acuta* (Pale Twig-rush) – a patch was recorded near Dorset Road in 1995 and 2006. There is a substantial chance that it persists there, despite blackberries having become abundant;
- *Baumea arthrophylla* (Fine Twig-rush) – patches grow south of Valley Court, near Dorset Road and perhaps elsewhere – the main strongholds of the species in Maroondah;
- ?*Brachyscome diversifolia* (Tall Daisy) – a single individual believed to be this species (with some doubt) was seen by the author in 2008, just west of Dorset Road. This is the only record of the species in Maroondah's history, hence the doubt;
- *Carex gaudichaudiana* (Fen Sedge) – a localised patch was recorded in 1995 and 2007 near Dorset Road and another south of Valley Court in 1995. It may persist, as it is a fairly persistent species. The only other records from Maroondah this century are at Eastfield Park (Site 61), on Dandenong Creek (in Site 69), on the Little Bungalook Creek floodplain (Site 72a) and at Scott Street Reserve in Heathmont (Site 80);
- *Centrolepis aristata* (Pointed Centrolepis) – recorded as scarce in 1995 and 1996. No subsequent intensive flora survey of the same location appears to have been conducted at a suitable time of year, so the species may still be present;

- *Cycnogeton alcockiae* (a water-ribbons) – moderately common in the 1990s in drains west of Dorset Road but unable to be found since, perhaps due to slashing and obscuration by other plants. The only other occurrence recorded in Maroondah's history was at Bungalook Conservation Reserves, where it died out in the 1990s;
- *Drosera pygmaea* (Tiny Sundew) – as for *Centrolepis aristata*;
- *Drosera hookeri* – more than 100 individuals were counted at 51 Bayfield Road (part of the original Site 64) just before the property was developed;
- *Eryngium vesiculosum* (Prickfoot) – abundant south of Valley Court and possibly still abundant beneath blackberries near Dorset Road. The only other records in Maroondah's history are of one patch at Dorset Recreation Reserve and a patch at Bungalook Conservation Reserves (where it appears to have died out);
- *Gonocarpus micranthus* subsp. *micranthus* (Creeping Raspwort) – abundant in the original version of Site 61 at 51 Bayfield Road prior to residential development there. Clearing for the development of the site has caused that area to be excised from the site;
- *Goodenia humilis* (Swamp Goodenia) – recorded near Dorset Road until 2006. Subsequent attempts to find it have been thwarted by blackberries due to the cessation of slashing. Also abundant at 51 Bayfield Road until that site was developed;
- *Gratiola pubescens* (Glandular Brooklime) – as above;
- *Hookerochloa hookeriana* (Hooker Fescue) – abundant in an area near Dorset Road until at least 2006. Subsequent attempts to find it have been thwarted by blackberries, which have flourished since the cessation of slashing;
- *Hypoxis hygrometrica* var. *hygrometrica* (Golden Weather-glass) – recorded as scarce in 1995–1996, possibly still present;
- *Leptospermum lanigerum* (Woolly Tea-tree) – recorded as present in 1995–1996 but unable to be found in this study, perhaps in part due to proliferation of paperbark, tea-tree and blackberry;
- *Ornduffia reniformis* (Running Marsh-flower) – recorded as scarce in 1995–1996, possibly still present;
- *Pentapogon quadrifidus* (Five-awned Spear-grass) – recorded as scarce in 1995–1996, possibly still present;
- *Poa tenera* (Slender Tussock-grass) – recorded as scarce in several locations on both sides of Dorset Road prior to the peak of the Millennium Drought but not since, so possibly died out;
- *Ranunculus glabrifolius* (Shining Buttercup) – a substantial patch grew near Dorset Road until at least 2008. Subsequent attempts to find it have been thwarted by blackberries due to the cessation of slashing. Another patch south of Valley Court was not visible when this study searched for it;
- *Schoenus tesquorum* (Soft Bog-rush) – recorded at several locations west of Dorset Road until 2000 and possibly still present but overlooked due to similarity to the more common *Schoenus apogon*;
- *Selaginella uliginosa* (Swamp Selaginella) – recorded west of Dorset Road (precise location unspecified) in 1995. Probably died out during the Millennium Drought;
- *Senecio campylocarpus* (Floodplain Fireweed) – recorded west of Dorset Road in 2007. This species has a 'boom and bust' ecology;
- *Senecio minimus* (Shrubby Fireweed) – scattered throughout in small numbers most years, probably more abundant in good years;
- *Sphaerolobium minus* (Globe-pea) – at least five individuals were present in the original version of Site 61 at 51 Bayfield Road prior to residential development there. Clearing for the development of the site has caused that area to be excised from the site;
- *Thelionema caespitosum* (Tufted Blue-lily) – as above;
- *Utricularia dichotoma* (Purple Bladderwort) – recorded as scarce near Dorset Road in 1995. The habitat there is now too overgrown to allow this species to remain alive but it may have the capacity to regenerate in a wet year if the scrub is thinned; and
- *Viminaria juncea* (Golden Spray) – scattered throughout the site in the 1990s, then died out in the Millennium Drought. This species is often seen to regenerate from seeds stored in the soil decades after the parent population dies out.

Significant fauna

The following species recorded at Site 64 are rare in Maroondah:

- Black-shouldered Kite;
- Golden-headed Cisticola; and
- Striped Marsh Frog – an estimated eleven individuals were heard by the author in March 2009, south of The Place. There has been no subsequent fauna survey during suitable conditions to hear the frogs call.

Fauna habitat

- The structure and composition of the treed vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates;
- The drains, floodway and depressions provide habitat for waterbirds, frogs and aquatic invertebrates, including yabbies. The frogs and invertebrates are a source of prey for other fauna such as herons;
- The open areas with sparsely scattered trees are used by reptiles (e.g. Lowland Copperhead), frogs and birds of open country such as Golden-headed Cisticolas and Black-shouldered Kites. The raptors are presumably hunting rodents, reptiles and perhaps frogs;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

On the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), about half of the scrub near Dorset Road is in condition 'B' (good), with 50–80% of the plant species expected in pristine vegetation of equivalent size and type. Rating 'B' also applies to an area south of Valley Court and the core of the area east of Dorset Road. The floodway rates 'D' (poor). Most of the rest of the site rates 'C' (fair).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

At least three parts of Site 61 meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. One patch is located midway between Branch Road and Dorset Road; another in and around the scrub just west of Dorset Road; and the last in the middle of the site's eastern polygon. An area 100 m east of Branch Road is probably also a 'patch' but further fieldwork would be required for confirmation. Both the EVCs present in these patches are listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

Details of threatened plant species are provided in the section above headed 'Significant plants'.

The patch of vegetation just west of Dorset Road is known habitat for the Swamp Everlasting (*Xerochrysum palustre*), which is listed as 'vulnerable' under federal legislation and in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. The species is not endemic to Victoria. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

The same patch of vegetation is known habitat of Golden Cowslips (*Diuris behrii*), which is listed as 'vulnerable' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. The species is not endemic to Victoria. This represents Regional significance under standard criterion 3.1.2.

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* is fairly abundant in the part of Site 64 situated east of Dorset Road. The subspecies is not endemic to Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Twenty-eight plant species appear in the section above headed 'Critically endangered in Maroondah'. The overwhelming majority of them fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 61 is regarded as a habitat corridor by the *Maroondah Habitat Corridor Strategy* (Context 2005). It fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

To the extent that the habitat link is currently weak in the site's grassy, open expanses, the following description from standard criterion 1.3.3 applies: "Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor… Site (or one of a group of such sites) to form a strategic corridor of local importance and scale". That description applies to a site of Local significance.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the recognition since 1997 of the conservation statuses of Swampy Woodland, Valley Heathy Forest and the Swamp Everlasting.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. Transpiration of moisture by the grassy, open vegetation of the floodplain also moderates air temperature. These effects of microclimate moderation benefit people visiting the site or living nearby. Horses agisted east of Dorset Road also benefit.

As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

Near Branch Road, children regularly play in the treed area and at the depressions in the floodway when they hold water and tadpoles. Such experiences are expected to contribute to the children's development, as discussed in Section 1.3 of Volume 1. The semi-natural ambience of that area is expected to contribute to the enjoyment, health, wellbeing and quality of life of those children as well as adults who visit.

The riparian location of the part of the site west of Dorset Road has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the part of the site west of Dorset Road is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

As mentioned above, the area between Site 64's two polygons contained a scattering of native vegetation until it was cleared for a rock and soil business in c. 2010. Based on aerial photographs from 2001 and 2017, it appears that roughly 0.1–0.2 ha of habitat was destroyed.

Residential development of 51 Bayfield Rd in 2000 caused the destruction of 0.4 ha of native vegetation, which included substantial populations of species that are critically endangered with dying out in Maroondah – e.g. *Gonocarpus micranthus*, *Sphaerolobium minus* and *Thelionema caespitosum*. The author arranged transplantation of as many plants as possible to the retarding basin at Bungalook Conservation Reserves (Site 66). The transplanted plants flourished there until late in the Millennium Drought, when they started to die out. Many of them have now disappeared, attributable to ongoing dry conditions. A fire may regenerate them.

Change in species and ecological condition

The section above headed 'Significant plants' highlights the many examples of plant species that were seen before the Millennium Drought but not since.

Approximately 100 m west of Dorset Road, quadrat N04003 and its immediate surroundings had the highest concentration of rare and threatened plants in the site in 1995–6. With the cessation of slashing, the quadrat became overrun by dense paperbark, tea-tree and blackberry and many of the rare plants disappeared. Some of those species may be obscured or subsist as seeds or tubers underground, capable of recovering if the scrub is thinned again.

South of Valley Court, in quadrat N04004, seventeen indigenous plant species were lost between 1997 and 2018. The species lost are those most adapted to wetlands or floodplain depressions, such as *Alisma plantago-aquatica* and the regionally rare *Amphibromus archeri* and *Triglochin alcockiae*. The four new indigenous species to appear in the quadrat are common species of dry land. These changes reflect the impacts of the Millennium Drought and a significant long-term decline in soil moisture – both consequences of climate change. The quadrat was selected to be representative of a much larger part of the treeless area west of Dorset Road.

The amount of fieldwork for this study and that of Lorimer *et al*. (1997) is inadequate to draw further conclusions about changes in the site's ecological condition.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Construction of the proposed Healesville Freeway, which would destroy the whole site;
- Continuing unchecked growth of paperbark, tea-tree and blackberry in the fenced area next to Dorset Road;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents. Drying of the floodplain, particularly during severe droughts, is the most serious aspect;
- Continuing unchecked growth of Monterey Pine, Sweet Pittosporum and other environmental weeds in the forest near Branch Road;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;

Strategic planning

2½ hectares of Site 64 at the western end is zoned 'Neighbourhood Residential – Schedule 4'. The rest of the site is zoned 'Industrial 1 Zone'.

Removal of native vegetation is regulated throughout under clause 52.17 of the Victoria Planning Provisions. The Vegetation Protection Overlay (VPO) provides additional control over removal of native vegetation in most of the part of the site situated west of Dorset Road. The VPO also affects a medium-density residential estate at 51 Bayfield Road, which was developed after the VPO was applied.

As discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of State biological significance such as Site 64. Nor is it appropriate for 51 Bayfield Road. It is recommended to remove the VPO entirely and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 64 as mapped on p. 482.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately four hours of ecological survey in the site for this study, including a detailed assessment of quadrat N04004;
- The author's regular visits to the western end of the site (and occasionally further east) as a local resident during 2002–2016;
- The author's flora surveys of the part of the site east of Dorset Road on 12/7/97, 9/10/13, 19/9/15 and 10/10/15. The surveys included a quadrat, compilation of species lists with abundances of each species, incidental fauna records and assessments of the impact of grazing and introduced plants;
- The author's searches (in vain) for *Triglochin alcockiae* during several Januaries during 2010-2015;
- The author's observations of birds, frogs and butterflies on 15/3/08, 18/3/09 and 22/10/14;
- Flora data from the vicinity of the rare Swamp Everlasting, collected by Dylan Osler on 31/1/06 for the purpose of monitoring the Swamp Everlasting (available in the Victorian Biodiversity Atlas);
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Botanical Assessment of 51 Bayfield Rd, Bayswater North'*, by the present author in 2000. The fieldwork that supported this report involved three hours of detailed flora survey, documenting the locations and populations counts of numerous plant species. The report led to transplantation of many slabs of soil and plants to Bungalook Conservation Reserves. The plants were monitored annually for approximately ten years and re-surveyed for this study;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated fieldwork during December 1995 to March 1996, including two quadrats, compilation of plant lists, a 20-minute bird census, an untimed bird census, spotlighting, frog call survey and incidental fauna observations;
- Pressed plant specimens at the National Herbarium of Victoria collected by herbarium staff, Dylan Osler and the present author – see 'Australia's Virtual Herbarium' online;
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird. The state government's mapping of the distribution and type of native vegetation in the site is quite inaccurate.

Site 65. Canterbury Road Retarding Basin, Bayswater North

Biological Significance Level: *Regional* due to the presence of a rare subspecies of grass and perhaps also for threatened waterbirds



Boundaries, land use and tenure

Site 65 comprises the Melbourne Water retarding basin property at 41–45 Canterbury Road, Bayswater North and the small reserve to the immediate west (Lot RES1 LP206692). The boundary coincides with property boundaries. The site's two properties are managed as a unit but are zoned differently.

The original version of Site 65 in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) included the wetland area that became the Skye Court residential estate straight after. As that area no longer has any wetland or biological significance, it is excluded from the site recognised here.

General description

Site 65 occupies 6.3 hectares.

Prior to the area being settled, Bungalook Creek flowed northwest through the site. The site was part of a swampy floodplain except for a north-facing slope in a narrow band to the south and southwest of where an artificial lake is now situated.

The creek has been replaced by an artificial channel that discharges into the lake before flowing into a pipe at the western end of the lake. The lake is also fed by two drains shown on the aerial photograph above, which are, in turn, connected to stormwater pipes. The lake has become well vegetated with indigenous wetland plants, which provide good habitat for waterbirds (including some threatened species).

A levee has been constructed around most of the site's perimeter to detain floodwater. The levee and other excavations led to the replacement of the site's most significant wetland habitat with the Skye Court housing development around 1998.

An artificial hillock north of the lake (marked on the aerial photograph above) long predates the levee. It is several metres high and was presumably created from soil excavated to make the lake. The many large pines that now grow on the hillock were probably planted there. Among the pines are many indigenous plants, the vast majority of which must have regenerated naturally straight after the hillock was created.

During June to September 2018, this study detected a total of fifty-four naturally-occurring, indigenous plant species across the site.

At that time, the boggy, mown expanse northeast of the lake was populated with large numbers of tiny, locally or regionally rare plant species such as Slender Aphelia (*Aphelia gracilis*) and Waterblinks (*Montia fontana*). The site was then fenced off for many months for major excavation works with heavy machinery. It is unknown what effect the works had on the significant flora.

Relationship to other land

Part of the biological significance of Site 65 relates to the role of its native vegetation as part of a cluster of sites of biological significance, including Site 66 (Bungalook Conservation Reserves), Site 67 (Cloverlea Drive, Tereddan Drive and 295 Colchester Road), Site 68 (Eastwood Golf Course) and habitat over the municipal boundary with the Shire of Yarra Ranges. Those sites are contiguous with each other and their closest point is 150 m to the east of Site 65.

An important consideration for Site 65 is that waterbirds are less dependent on continuity of habitat than most other fauna. They are generally prepared to cross substantial distances over inhospitable landscapes in search of wetland habitat. Within 2 km of the lake at Site 65 are substantial lakes or dams at Site 66, Site 68, Site 70 (Appletree Hill Reserve), Site 72b (Connolly Crescent Reserve) and Site 62 (at Dorset Golf Course). The lake at Liverpool Road Retarding Basin in Boronia is 2.3 km away. Waterbirds are expected to move frequently between these waterbodies and Site 65.

Birds of reedbeds and marshlands such as Golden-headed Cisticolas and Australian Reed-warbler are expected to move between all the sites just mentioned as well as Site 64 (the Healesville Freeway reservation), 0.7–1.8 km away.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives a 'Very High' score for 'Relative corridor conservation priority' to the habitat corridor described as 'Bungalook Creek upstream of Canterbury Road', with Site 65 at one end of it.

The movements of birds and insects between sites is important not only for the needs of the animals but also for the pollen and seeds that the animals may disperse as they go.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation below include only indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Swampy Woodland (EVC 937, **Endangered** in the bioregion), representing all the treed parts of the site.

Canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*), with a few Mealy Stringybark (*E. cephalocarpa*) and Messmate Stringybark (*E. obliqua*).

Sub-canopy trees: Dominated by Swamp Paperbark (*Melaleuca ericifolia*), with Blackwood (*Acacia melanoxylon*) co-dominant on the artificial hillock and fairly abundant elsewhere. On the hillock, Cherry Ballart (*Exocarpos cupressiformis*) is also fairly abundant and Black Wattle (*A. mearnsii*) is very scarce.

Medium to large shrubs: Abundant on the hillock but greatly depleted elsewhere. On the hillock, Hedge Wattle (*Acacia paradoxa*) is dominant and the following species are fairly abundant or widespread: Hop Wattle (*A. stricta*), Sifton Bush (*Cassinia sifton*), Hop Goodenia (*Goodenia ovata*) and Prickly Tea-tree (*Leptospermum continentale*). Elsewhere, Sifton Bush and Hop Goodenia are more localised and there is a single Yellow Hakea (*Hakea nodosa*).

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is the only species recorded.

Ferns: None.

Climbers: None.

Creepers: Confined to the hillock, where Bidgee-widgee is fairly abundant and the wood-sorrel, *Oxalis exilis/perennans*, is scarce.

Grasses, rushes and sedges: Indigenous species are only present on the hillock, where they are abundant and rich in species. There, Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) is dominant and Clustered Wallaby-grass (*Rytidosperma racemosum*) is fairly abundant. The rare subspecies, *Austrostipa rudis* subsp. *australis* is also fairly abundant, as are Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Common Tussock-grass (*Poa labillardierei*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Kangaroo Grass (*Themeda triandra*). Pale Rush (*Juncus pallidus*) is scarce.

Other groundcover: Almost absent other than common mosses and liverworts. In the previous flora survey (in 1996) but not this one, the following were recorded: Trim Sun-orchid (*Thelymitra peniculata*), Hairy Willow-herb (*Epilobium hirtigerum*), Common Raspwort (*Gonocarpus tetragynus*), Wiry Buttons (*Leptorhynchos tenuifolius*) and Native Flax (*Linum marginale*).

Marshy mown area northeast of the lake (no EVC or conservation status applicable)

Trees and shrubs: None.

Grasses, rushes and sedges: Dominated by Common Bog-rush (*Schoenus apogon*). Toad Rush (*Juncus bufonius*) and the club-rush, *Isolepis platycarpa*, and abundant. Kangaroo Grass (*Themeda triandra*) is scarce.

Other: There are roughly one thousand Water Blinks (*Montia fontana* subsp. *chondrosperma*). Common Onion-orchid (*Microtis unifolia*) and Trim Sun-orchid (*Thelymitra peniculata*) are also abundant. Slender Aphelia (*Aphelia gracilis*), Common Breutelia (*Breutelia affinis*) and Lesser Loosestrife (*Lythrum hyssopifolia*) are fairly abundant. Creeping Cudweed (*Euchiton* ?*japonicus*) is scarce.

Artificial wetland and drains (no EVC or conservation status applicable)

Trees and shrubs: Swamp Paperbark (*Melaleuca ericifolia*) forms dense thickets around the edge of the lake.

Grasses, rushes and sedges: Different parts of the lake are dominated by Tall Spike-rush (*Eleocharis sphacelata*), Common Reed (*Phragmites australis*) or the cumbungi, *Typha orientalis*. Broom Rush (*Juncus sarophorus*) forms dense strips around parts of the lake's edge. Another cumbungi, *T. domingensis*, is fairly abundant around the edge, as are Swamp Club-rush (*Isolepis inundata*),

Common Blown Grass (*Lachnagrostis filiformis*), Streaked Arrow-grass (*Triglochin striata*) and Slender Joint-leaf Rush (*Juncus fockei*). Hollow Rush (*J. amabilis*) and Austral Rush (*J. australis*) are scarce. Toad Rush (*J. bufonius*) appears sporadically.

Other: The following species are fairly abundant: Water Plantain (*Alisma plantago-aquatica*), Lesser Joyweed (*Alternanthera denticulata*) and Slender Knotweed (*Persicaria decipiens*). Swamp Crassula (*Crassula helmsii*), Hairy Willow-herb (*Epilobium hirtigerum*), Common Duckweed (*Lemna disperma*) and Lesser Loosestrife (*Lythrum hyssopifolia*) appear sporadically.

Significant plants

Rare (but not otherwise threatened) in Victoria

A subspecies of Veined Spear-grass (namely *Austrostipa rudis* subsp. *australis*) is fairly abundant on the artificial hillock. The subspecies is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. It is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at the Canterbury Road Retarding Basin can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Aphelia gracilis* (Slender Aphelia) – fairly abundant in at least one small location on the marshy mown area northeast of the lake, and possibly much more abundant and widespread but not detected in this study's fairly brief survey (which was at an imperfect time of year);
- *Hakea nodosa* (Yellow Hakea) – a single plant grows south of the lake but it might have been planted there;
- *Poa tenera* (Slender Tussock-grass) – recorded beside the Bungalook Creek Drain in the previous (1996) flora survey; possibly not detected in this study due to the brevity of the survey and the time of year.

Other

The population of between 1,000 and 10,000 *Montia fontana* subsp. *chondrosperma* (Waterblinks) is by far the largest known in the Melbourne region. Although it is unclear whether the species falls into the 'critically endangered' category of risk of dying out in Maroondah, it is certainly rare in the region and probably threatened by climate change.

Significant fauna

So few fauna observations have been recorded from the site that the following two observations should be regarded as probably a poor representation of the full diversity and frequency of significant bird occurrences at the site:

- Hardhead (listed as 'vulnerable' in Victoria) – one bird was recorded by Emma Bond on 27/7/14; and
- Eastern Great Egret (listed as 'vulnerable' in Victoria and as threatened under the *Flora and Fauna Guarantee Act*) – one bird was observed by the present author in c. 2011.

Fauna habitat

- The lake supports waterbirds, reed-loving birds, frogs and aquatic invertebrates. The frogs and invertebrates are a source of prey for other fauna;
- The structure and composition of the treed vegetation and paperbark thickets represent suitable habitat for common forest birds, bats, possums and invertebrates. That habitat benefits from the fertility and high moisture availability of the alluvial soil, which favours high production of carbohydrates by plants and hence strengthens the base of the food chain;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There are some large, old eucalypts, which are of high value as habitat trees;

- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The site's location on the habitat corridor of Bungalook Creek amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the lake is good – rating 'B' on the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The rating is 'C' (fair) on the hillock, in the treed area to the west of the lake and in most of the marshy, mown area to the northeast of the lake. The rest of the treed areas fall into rating 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Regional

Rare or threatened plant species

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* has an apparently quite viable population on the hillock. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Referring to the section above headed 'Significant plants', Site 65's populations of *Aphelia gracilis* and *Montia fontana* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Threatened fauna species

Referring to the section above headed 'Significant fauna', Site 65 is known to provide habitat for two 'vulnerable'-listed waterbird species. The paucity of data means that the site might host those species frequently or rarely. If the occurrences are more than rare events, the site meets standard criterion 3.1.2 for a site of Regional significance.

Ecological corridor

The section above headed 'Relationship to other land' describes how Site 65 is ecologically connected with the Bungalook Creek habitat corridor, particularly Sites 66 to 68. Those connections mean that Site 65 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Sites fitting that description are deemed by the criteria to represent Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Swampy Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. The lake also moderates the microclimate through its thermal mass and evaporation. These effects of microclimate moderation benefit people visiting or passing through the site or living in neighbouring homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the lake and drains helps to stabilise the banks and remove water pollution.

The site's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into surrounding streets and gardens.

The natural ambience also encourages people to get exercise by walking through the site.

The site's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

As described on p. 492, the original version of Site 65 in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) included habitat that became the Skye Court estate almost immediately. The land development destroyed approximately 0.15 hectares of habitat.

Examination of aerial photographs shows that between 2001 and 2017, many eucalypt crowns expanded to cover ground that had no native vegetation in 2001. That represents an increase in the extent of arboreal habitat but it is impracticable to measure and add up the many small contributions. The aerial photographs do not reveal any reduction of the extent of habitat elsewhere in the site.

Change in the ecological condition of habitat

The aerial photograph from 2001 shows substantially less vegetation in the lake than now. In addition, the number of indigenous wetland plant species almost doubled between 1996 and this study (2018). The ecological condition of the aquatic habitat has improved significantly over the past two decades.

The ecological condition of the hillock appears to have declined slightly over the same period, with a small decrease in the number of indigenous plant species.

The ecological condition of the marshy mown area northeast of the lake appears to have improved between the 1996 flora survey and this study in 2018. The earthworks in 2018–2019 mentioned above in the section headed 'General description' would be expected to have caused a decline, but no reassessment has been conducted to check.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued drying of the site's winter-sodden soils due to climate change and the legacy effects of past drainage works, leading to decline of the associated indigenous flora and its dependent fauna;
- Mowing of the marshy area to the northeast of the lake either too frequently or when conditions are boggy, which could destroy some of the rare plants and promote their replacement by opportunistic introduced species such as Brown-top Bent (*Agrostis capillaris*);

- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Sediment filling the lake, followed by sediment removal work that would also remove the wetland vegetation on which the site's waterbirds rely.

Strategic planning

The Melbourne Water property is zoned 'Public Use Zone – Service and Utility'. Removal, lopping and destruction of native vegetation on the property is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions and also under the Vegetation Protection Overlay (VPO), which arose from the work of Lorimer *et al*. (1997). Trees above a threshold size (native or not) are protected under Schedule 4 of the Significant Landscape Overlay (SLO4).

The small reserve that makes up the rest of the site is zoned 'General Residential Zone – Schedule 1'. Its vegetation is covered by SLO4 but not the VPO or clause 52.17.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO and instead apply the proposed schedule ESO1 to the whole of Site 65 as outlined in mid-blue on the aerial photograph on p. 492.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of approximately four hours of fieldwork by the author for this study on 11/6/18, 8/9/19 and 19/10/18, including: (a) compiling a list of indigenous and introduced plant species (including mosses and liverworts) and their abundances for each of four parts of the site; (b) documenting the details of rare or scarce plants; (c) mapping the vegetation and rare plants; and (d) checking for any other features of the site relevant to this report;
- A list on eBird of birds observed by Emma Bond on 27/7/14, including one Hardhead;
- The author's observation of a Great Egret in c. 2011;
- Records in the Victorian Biodiversity Atlas of Shortfin Eel and Common Long-necked Tortoise by Danielle Stokeld in January 2011;
- A record in the Victorian Biodiversity Atlas of Shortfin Eel by John McGuckin in August 2001;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) , for which the relevant fieldwork comprised: (a) a flora survey by the present author on 22/3/96, mapping the vegetation and compiling a list of indigenous plant species (without abundances) for each of six areas; (b) incidental fauna observations during the flora survey; and (c) spotlighting and frog call survey on the evening of 16/2/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

Site 66. Bungalook Conservation Reserves, Kilsyth South

Biological Significance Level: *National* due to two threatened plant species known from nowhere else



Aerial photograph taken February 2017

Legend

- Site 66
- Other sites as labelled
- Property boundaries
- Boundaries between EVCs (veg'n types)

N

0 50 100 150 200 m

Boundaries

Site 66 is outlined above in mid-blue. The site boundary follows property boundaries except in the labelled church land and along Tereddan Drive.

The boundary between Sites 66 and 67 south of Tereddan Drive has been shifted one lot east compared with 1997's *'Sites of Biological Significance in Maroondah'* report. That is because 6 Tereddan Drive was purchased by Maroondah City Council in the 2000s to become part of Bungalook Conservation Reserves.

Summary

Bungalook Conservation Reserves comprise a council reserve, a Trust for Nature property and a Melbourne Water retarding basin property. The land is fairly flat and includes a floodplain, lake and forest. It has the highest biological significance of anywhere in Maroondah.

From a biologist's perspective, the site is nationally significant due to the presence of two extremely threatened plant species known from nowhere else on Earth – the Kilsyth South Spider-orchid and an undescribed species in the Porphyry Wallaby-grass group. Even without those species, the site would be of State significance for the presence of another rare plant species and also for the presence of two endangered Ecological Vegetation Classes. There are several other features of regional significance. Excluding the small number of planted species, over 350 indigenous plant species have been recorded in the site since 1990, including over 250 during the unexhaustive survey of the present study. Fifty-three plant species that are rated as 'critically endangered' with dying out in Maroondah were seen in 2017–2018 and five more the previous spring. Dexters' Bush (Site 77) is the only other site in Maroondah where more than half of the species specifically adapted to winter-sodden floodplain soil (Table 5 in Volume 1) remain since the Millennium Drought.

The reserves are also home to the rare Swamp Skink, a wealth of birdlife and butterflies, echidnas and a large population of the native Swamp Rat, which is rare in Maroondah and for many kilometres around.

A large, ancient Silver-leafed Stringybark on the Trust for Nature property is listed in the Heritage overlay of the Maroondah Planning System.

The site's unusually rich plant and animal life, combined with its peacefulness, birdsong, water and secluded areas, offer the deepest and most authentic natural experiences in Maroondah.

The Millennium Drought caused the permanent loss of a significant but proportionally small number of plant species. In other respects, the ecological condition of the habitat in the council reserve and the Trust for Nature property has improved over the past twenty years due to active management. Some of the habitat on the Melbourne Water land has improved due to maturation of vegetation. On other parts of the Melbourne Water land, there is an ongoing, substantial decline in the Porphyry Wallaby-grass, other rare plants and the overall condition of habitat. The declines are due to herbicide use, drainage works, adverse mowing practices, silt filling the lake and proliferation of a garden variety of the South African plant, *Aristea ecklonii*.

Land use, land management & tenure

Referring to the image above, the 6.6-hectare council land is managed by Maroondah City Council as a conservation reserve. The 2.2-hectare Trust for Nature land is also managed for nature conservation. The 8.2-hectare Melbourne Water land includes: (a) a retarding basin and lake in the northwest, which are principally managed for flood mitigation; and (b) the strip of land extending east from the retarding basin, within which a channel was dug in 1988 to take the waters of Bungalook Creek. The 0.4 ha of church land is mostly vacant but includes a broadcasting studio at its western end. The whole site occupies 17.7 ha.

Vegetation management in the reserves is done by Council, Melbourne Water and the Friends of Bungalook Conservation Reserves (a volunteer group).

The CFA conducts prescribed burns every second year or so on the council land and the Trust for Nature land, in a mosaic designed so that each section is burned at intervals of at least 20 years.

The red boundary on the aerial photograph above also encloses part of a church property, including a building, mown grass and forest. The forest is periodically used for storing debris.

General description

The Melbourne Water land and the Trust for Nature property are on the alluvial floodplain of Bungalook Creek. Old contour maps show that Bungalook Creek once had no clear course through the area, instead

spilling over the floodplain. A drainage line flowed through Eastwood Golf Course and just north of Tereddan Drive through the Trust for Nature property.

The area was then subdivided in 1987–88. Most of the Melbourne Water land was cleared and excavated to construct the retarding basin, the lake and the drain situated immediately north of the Tereddan Dr subdivision. A pipe was laid westward from the retarding basin to the Canterbury Road Retarding Basin (Site 65) to increase the rate of drainage. The drainage line from Eastwood Golf Course was cleared, filled in and replaced by a pipe along the southern edge of the floodplain, where Tereddan Drive was constructed. These efforts to dry out the land caused the regional extinction of at least one plant species (the Heron Bristle-rush, *Chorizandra cymbaria*, and possibly the water-ribbons, *Cycnogeton alcockiae*). Despite the drainage works and climate change, the alluvial soil of the floodplain is still saturated for most of winter in most years, and it still supports the endangered Swampy Woodland EVC. Many of the distinctive species of Swampy Woodland are now on the edge of their tolerance of dryness. For example, the previously abundant Glandular Daisy-bush (*Olearia glandulosa*) and Rosemary Everlasting (*Ozothamnus rosmarinifolius*) are reduced to one plant each – the only ones left in Maroondah. However, all other examples of Swampy Woodland in metro Melbourne have been affected even worse by drainage works, leaving Bungalook Conservation Reserves as probably the region's best remaining example of Swampy Woodland. (However, the nearby Appletree Hill Reserve (Site 70) and Healesville Freeway Reservation (Site 64) retain some species that have been lost from Bungalook Conservation Reserves, as does Liverpool Road Retarding Basin in Boronia.)

Swampy Woodland extends northward from the alignment of Tereddan Drive. To its south, the Council reserve is on lower Devonian volcanic geology of the Dandenong Ranges formation. The land has a very slight slope, so water drains slowly and keeps the soil quite moist through winter and spring. The soil is very loose and in the council reserve and Trust for Nature land, it is effectively cultivated by abundant ants and Swamp Rats. These unusual conditions have led to a vegetation type that combines some species of Swampy Woodland (e.g. the Short Purple-flag *Patersonia fragilis* and Yellow Hakea *Hakea nodosa*) with those of the endangered, orchid-rich Valley Heathy Forest. The most elevated land, near the southern site boundary, supports Lowland Forest.

The lake at Bungalook Conservation Reserves contains significant wetland plants. However, so much silt has been washed into the lake that the volume and average depth have reduced by perhaps 90% since construction in 1988. As a result, the previously abundant waterbirds are now scarce and the Black-fronted Dotterels that used to live on the shore have gone.

The floodway abutting Ormond Place is included in the site because despite its superficial appearance and frequent mowing, its vegetation is predominantly indigenous and includes large numbers of the regionally rare Slender Aphelia (*Aphelia gracilis*) and smaller numbers of Waterblinks (*Montia fontana*).

The drainage reserve that forms this site's narrow easterly 'arm' is vegetated partly from natural regeneration and partly from planting by the Friends of Bungalook Conservation Reserves. There is circumstantial evidence that the continuous tree canopy along the drainage reserve probably facilitates movement of birds and native mammals between the site and forest to the east, including the Dandenong Ranges National Park. The drainage reserve once extended to Liverpool Rd, providing a better ecological connection, but the Liverpool Rd frontage was sold to a private purchaser in the 1990s and its vegetation was removed.

Across the whole of Bungalook Conservation Reserves, this study detected 253 naturally-occurring, indigenous plant species.

The part of the church property marked within the red outline on the aerial photograph on p. 499 is mostly of no particular environmental significance except for the risk it may pose to the reserves in the event of its subdivision. The forest in the eastern part of the church land provides basic habitat and ecological buffering for the reserves.

One particularly large and ancient Silver-leafed Stringybark (*Eucalyptus cephalocarpa*) on the Trust for Nature property is listed in *'Notable Trees of Maroondah'* by Moss and Lorimer (1996) and protected under the Heritage Overlay of the Maroondah Planning Scheme (as tree HO64).

The diversity and naturalness of the habitat in this site, together with its proximity to other sites of biological significance and the Dandenong Ranges National Park, contribute to the remarkable diversity of indigenous flora and the abundance of wildlife. There are resident Echidnas, Swamp Skinks, large numbers of Swamp Rats, and many birds and butterflies. Many of the plant and animal species are rare.

Relationship to other land

The site's eastern extremity is less than 100 m from a remnant eucalypt canopy along Liverpool Rd (Site 95). From there, there are almost unbroken corridors of native vegetation to the forests of the Dandenong Ranges National Park via Glasgow Rd and Bungalook Creek. There is also a somewhat less continuous tree cover through the abutting Site 67 and treed properties to the national park. The fairly recent arrival of Swamp Rats at Bungalook Conservation Reserves and beside Bungalook Creek on the other side of Liverpool Rd suggests that those animals may have migrated along the creek corridor.

Bungalook Conservation Reserves lies only 127 m from Eastwood Golf Course (Site 68), which contains waterbird habitat, patches of natural forest with understorey, and strips of eucalypts. It seems likely that native mammals, birds, lizards, frogs and insects move between these sites. The Eunice Court Reserve was created specifically to provide a wider connection of tree canopy between Bungalook Conservation Reserves and Eastwood Golf Course but that intention has not been fully achieved.

Appletree Hill Reserve (Site 70) abuts the southwestern corner of Eastwood Golf Course. It offers a potential route for wildlife movement further south through semi-rural land to Dandenong Creek and the Liverpool Road Retarding Basin. Appletree Hill Reserve and the floodplain parts of Bungalook Conservation Reserves would once have had very similar vegetation but their different histories since colonisation have left them each with some plant species that have been lost from the other. In this way, the pair have complementary conservation values and each provides a window into what the other may once have been like, and how to restore those features. The same can be said to some degree for the Healesville Freeway Reservation (Site 64), despite its history of extensive clearing and drainage works.

In the 1990s, the author often observed waterbirds flying between Bungalook Conservation Reserves and the Canterbury Road Retarding Basin (Site 65), 250 m away. Siltation of the lake has greatly reduced the numbers of waterbirds at Bungalook Conservation Reserves but it is likely that some waterbirds still commute between there and Canterbury Road Retarding Basin. Forest birds may also use that route. Most of the observed movements have been via the Autodesk property abutting the northern part of the retarding basin's western boundary, labelled on the aerial photograph on p. 499 as 'Site 67'. The corridor may one day resume its former importance for birds if the lake at Bungalook Conservation Reserves is dredged.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation below include only the more abundant or ecologically informative indigenous plant species. It is hoped that the full set of flora data will be made available online. 'EVC' means 'Ecological Vegetation Class'.

Lowland Forest (EVC 16, **Vulnerable** in the bioregion). This study's survey in April 2018 found one hybrid and 101 naturally occurring, indigenous plant species in the Lowland Forest, including the following ten species that are 'critically endangered' with dying out in Maroondah: *Asperula conferta, Corybas diemenicus, Empodisma minus, Frullania falciloba, Hakea decurrens, Hakea nodosa, Hakea ulicina, Lepidosperma filiforme, Poa tenera* and *Senecio minimus*. This study did not detect some species that have been seen in recent years but most or all of those species will probably be seen again when checked at a better time of year.

Dominant canopy trees: *Eucalyptus obliqua, Eucalyptus radiata*.

Dominant lower trees: *Acacia melanoxylon*, *Exocarpos cupressiformis*.

Dominant shrubs: *Cassinia aculeata, Bursaria spinosa, Platylobium obtusangulum* and *Pultenaea gunnii*. The presence of *Banksia marginata*, *Persoonia juniperina* and all three local *Hakea* species is typical of the usual abundance of the Protea family in Lowland Forest.

Climbers: *Billardiera mutabilis* and *Cassytha melantha* are in moderate numbers. *Cassytha pubescens* is scarce.

Ferns: *Pteridium esculentum* is one of the understorey dominants. *Lindsaea linearis* is moderately abundant.

Groundcover: Distinctively, *Tetrarrhena juncea* is abundant; so is *Gahnia radula*. Other characteristic species of Lowland Forest include *Rytidosperma pallidum*, *Xanthorrhoea minor* and *Xanthosia dissecta*.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion). 158 wild, indigenous plant species were observed during 2017–2018. They included the extremely threatened Kilsyth South Spider-orchid and three species listed as 'Rare but not otherwise threatened' in Victoria, namely *Acacia stictophylla*, *Pterostylis* × *ingens* and *Pterostylis clivosa*. The following 28 additional species seen in 2017–2018 are 'critically endangered' with dying out in Maroondah: *Acianthus caudatus, Almaleea subumbellata, Amyema pendula, Banksia marginata, Caladenia carnea* (a form with large, deep pink flowers), *Caladenia catenata* (the only record in Maroondah), *Caladenia congesta, Calochilus campestre, Calochilus robertsonii, Calochlaena dubia, Comesperma ericinum, Corunastylis despectans, Cryptostylis leptochila, Deyeuxia densa, Empodisma minus, Festuca asperula, Hakea decurrens, Hakea nodosa, Hakea ulicina, Lagenophora stipitata, Lepidosperma filiforme, Muellerina eucalyptoides, Patersonia fragilis, Pentapogon quadrifidus, Persoonia juniperina, Poa tenera, Senecio minimus, Sphaerolobium minus, Thelionema caespitosum, Thelymitra ixioides/juncifolia, Thelymitra rubra* and *Wahlenbergia gymnoclada*. Sixteen of the species seen in 2017–2018 are rare throughout the region covered by the textbook *'Flora of Melbourne'*, as judged by fewer than ten locations in the region where the species is known or suspected to persist. This study did not detect some species that have been seen in recent years but most or all of those species will probably be seen again when checked at a better time of year.

Dominant canopy trees: *Eucalyptus cephalocarpa, Eucalyptus radiata*.

Dominant lower trees: *Exocarpos cupressiformis*, with fewer *Acacia melanoxylon*.

Medium to large shrubs: Patchy in density. The dominant species vary between *Bursaria spinosa, Cassinia aculeata, Olearia lirata* and *Pultenaea gunnii*. *Hakea nodosa* is moderately common, as in the rest of the site. The presence of *Acacia genistifolia* is unique in the part of Maroondah that lies south of Maroondah Highway.

Climbers: *Billardiera mutabilis* and *Cassytha pubescens* are in moderate numbers.

Ferns: *Pteridium esculentum* is one of the understorey dominants. *Lindsaea linearis* is moderately abundant. Other ferns are scarce.

Groundcover: Outside the patches of *Pteridium esculentum*, the dominant species vary between *Gahnia radula, Tetrarrhena juncea, Rytidosperma pallidum* and *Lepidosperma gunnii*. Other abundant species include *Acrotriche serrulata, Austrostipa rudis, Burchardia umbellata, Dianella tasmanica, Dillwynia cinerascens, Gonocarpus tetragynus, Goodenia lanata, Platylobium obtusangulum, Poa morrisii, Pterostylis nutans. Thysanotus patersonii, Thysanotus tuberosus, Tricoryne elatior, Xanthorrhoea minor* and *Xanthosia dissecta*. Orchids are abundant, including many species that are rare in metro Melbourne. Some of the ground flora species, such as the abundant *Tetrarrhena juncea*, evoke the Lowland Forest that abuts to the south, while some others, such as *Patersonia fragilis* and *Selaginella uliginosa*, evoke the Swampy Woodland that abuts to the north.

Swampy Woodland (EVC 937, **Endangered** in the bioregion). 168 wild, indigenous plant species were observed during 2017–2018. They included the Kilsyth South Spider-orchid and an undescribed species in the Porphyry Wallaby-grass group, both of which are known from nowhere else on Earth. There was also an abundance of *Austrostipa rudis* subsp. *australis*, which is listed as 'Rare but not otherwise threatened' in Victoria. The following 29 additional species seen in 2017–2018 are 'critically endangered' with dying out in Maroondah: *Almaleea subumbellata, Amphibromus archeri, Amyema pendula, Aphelia gracilis, Baumea acuta, Baumea arthrophylla, Centrolepis aristata, Centrolepis strigosa, Empodisma minus, Frullania falciloba, Goodenia elongata, Goodenia humilis, Hakea nodosa,*

Hookerochloa hookeriana, Hypoxis hygrometrica, Lepidosperma filiforme, Leptospermum lanigerum, Olearia glandulosa, Ornduffia reniformis, Ozothamnus rosmarinifolius, Patersonia fragilis, Persoonia juniperina, Poa tenera, Pomaderris racemosa, Ranunculus glabrifolius, Schoenus lepidosperma, Schoenus tesquorum, Senecio minimus, Sphaerolobium minus and *Thelionema caespitosum*. Eighteen of the species seen in 2017–2018 are rare throughout the region covered by the textbook *'Flora of Melbourne'*. This study did not detect some species that have been seen in recent years but most or all of those species will probably be seen again when checked at a better time of year.

Dominant canopy trees: *Eucalyptus ovata, Eucalyptus cephalocarpa*.

Dominant lower trees: There are thickets of *Melaleuca ericifolia* and *Leptospermum scoparium*, but most of the latter died during the Millennium Drought and have regenerated poorly. *Exocarpos cupressiformis* and *Acacia melanoxylon* are scattered liberally throughout.

Medium to large shrubs: Sparse to dense, dominated by *Kunzea leptospermoides*. Notably, *Hakea nodosa* is fairly abundant, as are *Epacris impressa, Olearia lirata* and *Ozothamnus ferrugineus*. *Leptospermum lanigerum*, *Olearia glandulosa* and *Ozothamnus rosmarinifolius* were present in moderate numbers in the 1990s but their populations are now down to 2, 1 and 1, respectively (the only wild plants of these species left in Maroondah). Other species that are distinctive of Swampy Woodland include *Hakea nodosa* is moderately common, as in the rest of the site. The presence of *Acacia genistifolia* is unique in Maroondah, south of Maroondah Highway.

Climbers: *Billardiera mutabilis* is abundant. *Pandorea pandorana* has recently naturalised in the Swampy Woodland and is starting to pose a serious threat to indigenous plants by smothering them.

Ferns: *Pteridium esculentum* and *Lindsaea linearis* are moderately abundant.

Groundcover: Dominated variously by *Austrostipa rudis*, *Empodisma minus, Gahnia radula, Goodenia ovata*, *Lomandra longifolia* subsp. *exilis*, *Lomandra longifolia* subsp. *longifolia* or *Rytidosperma setaceum*. *Bossiaea prostrata, Burchardia umbellata, Dianella tasmanica, Hemarthria uncinata, Leptorhynchos tenuifolius, Patersonia occidentalis, Rytidosperma semiannulare, Schoenus apogon* and *Xanthorrhoea minor* are abundant. The following species seen in 2017–2018 are characteristic of the EVC: *Almaleea subumbellata, Aphelia gracilis, Centella cordifolia*, *Centipeda elatinoides*, *Centrolepis aristata, Centrolepis strigosa, Eragrostis brownii*, *Gahnia sieberiana*, *Hookerochloa hookeriana*, *Lepidosperma filiforme*, *Patersonia fragilis*, *Schoenus lepidosperma*, *Schoenus tesquorum*, *Sphaerolobium minus*, *Stylidium despectum*, *Villarsia reniformis* and *Xanthosia dissecta*. The following additional species are also distinctive of Swampy Woodland but have not been seen at this site in recent years: *Allittia cardiocarpa*, *Amphibromus archeri*, *Baumea rubiginosa, Baumea tetragona, Drosera pygmaea*, *Gonocarpus micranthus*, *Gratiola pubescens* and *Utricularia dichotoma*. Orchids are scarce other than *Thelymitra peniculata*, which is very abundant around the retarding basin. The South African garden escapee, *Aristea ecklonii*, now dominates a substantial area around the retarding basin and is steadily displacing indigenous plants, including rare ones.

Artificial lake, non-perennial stream & stream channel (No EVC number). This study's survey in November 2017 and December 2018 found 24 wild, indigenous, aquatic and semi-aquatic plant species plus one hybrid. One of these (*Juncus flavidus*) is 'critically endangered' with dying out in Maroondah. These areas contain no eucalypts, excluding overhanging crowns. Shrubs and vines are also absent.

Small trees: In places, thickets of *Melaleuca ericifolia* encroach from the adjacent Swampy Woodland.

Herbaceous flora: Dominated variously by *Juncus* species, *Typha* species, *Ludwigia peploides, Epilobium hirtigerum* and *Persicaria decipiens*. The floating species, *Azolla rubra* and *Lemna disperma*, can occasionally be found on the lake.

Significant plants

The following table lists species seen at Bungalook Conservation Reserves in 2018 that are classed as rare or threatened throughout Victoria.

Scientific name	Common name	Threat rating	Population size
Caladenia sp. aff. *venusta* (Kilsyth South)	Kilsyth South Spider-orchid	Critically endangered, federally; Threatened under FFG Act (Vic); Endangered (DELWP)	5 – the total global population
Acacia stictophylla	Dandenong Range Cinnamon Wattle	Rare in Victoria (DELWP)	Only a few
Austrostipa rudis subsp. *australis*	Veined Spear-grass	Rare in Victoria (DELWP)	Hundreds
Pterostylis clivosa	Red-tipped Greenhood	Rare in Victoria (DELWP)	100–300
Pterostylis × *ingens*	Sharp Greenhood	Rare in Victoria (DELWP)	200–250 clones
Rytidosperma aff. *caespitosum* (South-west Swamps)	Porphyry Wallaby-grass	Poorly known (DELWP)	100–200 in 2016; c. 80 in 2019

The last name in the table represents a group of undescribed species. Within that group, the single species that occurs at Bungalook Conservation Reserves is not known to occur anywhere else on Earth. The author has inspected all specimens catalogued as '*Rytidosperma* aff. *caespitosum* (South West Swamps)' at the National Herbarium of Victoria, as well as specimens catalogued under the most similar species in the National Herbarium of South Australia. He has also searched in the field within the known range of all members of the Porphyry Wallaby-grass group. The only match found so far is a 19th Century specimen of Baron Sir Ferdinand von Mueller with the locality recorded as 'Dandenong Range', which would have been taken to include Kilsyth South at the time. All other known members of the Porphyry Wallaby-grass group grow (or grew) between McLaren Vale near Adelaide and Portland, Victoria.

Leaving aside the species listed in the table above, fifty-seven of the reserves' other naturally occurring plant species seen in 2016–2019 are rated as 'critically endangered' with dying out in Maroondah. These species are listed under the heading 'Habitat types' above for each type of habitat in which they occur. Council and the Friends of Bungalook Conservation Reserves have successfully increased the rate of natural regeneration of three of these species: *Hakea decurrens*, *Hakea nodosa* and *Hakea ulicina*. Self-sustaining populations of two other species in the 'critically endangered' category – *Amphibromus nervosus* and *Myriophyllum simulans* – have been introduced to the lake from further downstream near Dorset Rd.

Significant fauna

The following table lists species seen at Bungalook Conservation Reserves that are classed as rare or threatened throughout Victoria.

Common name	Scientific name	Threat rating	Status
Great Egret	*Ardea alba*	Threatened under FFG Act (Vic); Vulnerable (DELWP)	Last seen 2012; probably still forages occasionally
Powerful Owl	*Ninox strenua*	Threatened under FFG Act (Vic); Vulnerable (DELWP)	Last seen c. 1993; probably still hunts occasionally
Swamp Skink	*Lissolepis coventryi*	Threatened under FFG Act (Vic); Vulnerable (DELWP)	Abundant; Trapped all around the lake in 2016 and seen sunning on the levee

Bungalook Conservation Reserves stands out in Maroondah for the richness of its birdlife. It also stands out for the number of fauna species that are not recorded elsewhere in Maroondah or only rarely, including:

- Swamp Rat – a large population with extensive tunnel networks;
- White-necked Heron – an occasional visitor forages in the lake;
- Australian Owlet-nightjar – probably resident;
- White-eared Honeyeater – abundant residents in the 1990s, now occasional visitors;
- Scarlet Honeyeater (or Scarlet Myzomela) – has become an annual migrant in recent years;
- Scarlet Robin – an annual migrant;
- Varied Sittella – an occasional visitor;
- Grey Shrike-thrush – resident;
- Leaden and/or Satin Flycatcher – annual migrant;
- Dusky Woodswallow – occasional visitor;
- Mistletoebird – resident, the only place in Maroondah where it can still be seen any day;
- Lowland Copperhead – reported once every few years;
- Imperial Jezebel butterfly – rarely seen but perhaps overlooked, considering the abundance of mistletoe;
- Silky Hairstreak butterfly – the only know record of the species in Maroondah's history was the author's observation (with photographs) in the council reserve in 2016;
- Peacock Spider 1 (*Maratus volans*) – reported once.

Fauna habitat

- Approximately 16 ha of contiguous forest with diverse understorey within the site, abutting other (less natural) forest with connection to the Dandenong Ranges, provides good habitat for numerous forest vertebrates and invertebrates;
- Dense, tangled groundcover provides excellent habitat for the abundant Swamp Rats;
- There are many large eucalypts with hollows that suit roosting or nesting of certain birds and mammals;
- The lake and surrounding swampy land provide habitat for Swamp Skinks, abundant frogs, waterbirds and aquatic invertebrates;
- Abundant mistletoes around the retarding basin provide Maroondah's best habitat for Mistletoebirds and Imperial Jezebel butterflies.

Ecological condition

Native vegetation is strongly suppressed within firebreaks along the council land's southern boundary and part of the western boundary. It is also strongly suppressed by mowing next to houses fronting Ormond Place and Regency Drive, and in the irregularly shaped council land in the site's southwestern corner, abutting Chandra Avenue and Clarkedale Rise. The vehicle track between the turning circle of Tereddan Drive and the retarding basin levee has no vegetation on it.

The remaining 5 ha of the council land (or 75% of it) is in very good ecological condition with rich flora and fauna and few introduced species. That also applies to 90% (or 1.8 ha) of the Trust for Nature land. The rest of the council land and Trust for Nature land is in good ecological condition, as is 95% of the Melbourne Water land. The remaining 5% of the Melbourne Water land is in poor ecological condition.

Interestingly, the soil of the council land experiences an unusual amount of 'cultivation' by ants during the warmer months and Swamp Rats throughout the year. While walking through the area, one often finds one's feet sinking into the highly aerated soil. The 'cultivation' probably stimulates a lot of seed germination but it also kills some plants. The last Kilsyth South Spider-orchid plant to vanish (in 2017) appears to have succumbed to an ant's nest whose entrance was located exactly where the plant was last seen.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened flora and fauna

The most significant attribute of Bungalook Conservation Reserves is the presence of at least two plants of the Kilsyth South Spider-orchid, representing the total known wild population of that species on Earth. (There are also three plants in pots at the Royal Botanic Gardens, Melbourne). The species has the highest possible level of legal protection at federal and state level (Section 5.1.4 of Volume 1), which even restrains unauthorised people from approaching the plants because of the risk that trampling will kill any tiny seedlings that germinate. The species has been found on the Council land and the Trust for Nature property. There is also similar habitat on the Melbourne Water land, where the species may one day be found or planted. There is a major project to monitor, pollinate and germinate the species.

Being the only known site of such a highly threatened species gives the site **National** significance under each of the standard criteria 2.2, 3.1.1, 3.1.2, 3.2.5, 5.1.3 and 5.2.

As discussed above, the site supports a species within the Porphyry Wallaby-grass group, which comprises at least three distinct species (one of them not seen for over fifty years). The closest known location where any of the three species has been found is near Portland, over 300 km away. No other location where any of the three species has been recorded is in the same EVC as Bungalook Conservation Reserves. The species is not known outside Victoria. These characteristics give Bungalook Conservation Reserves **National** significance under standard criterion 3.1.2. Recent herbicide spraying, drainage works and inappropriate mowing have greatly reduced the population size and viability of the site's Porphyry Wallaby-grasses.

The council reserve supports dozens of the Red-tipped Greenhood (*Pterostylis clivosa*), which is listed as rare (but not otherwise threatened) in Victoria. That species does not occur outside Victoria. Those characteristics meet standard criterion 3.1.2 for a site of State significance. However, the National significance arising from the Kilsyth South Spider-orchid and the Porphyry Wallaby-grass overrides any lower level of significance associated with other natural assets.

The Melbourne Water land supports hundreds of *Austrostipa rudis* subsp. *australis* (a subspecies of Veined Spear-grass), which is listed as rare (but not otherwise threatened) in Victoria. There are also smaller numbers on the Trust for Nature property. The subspecies also occurs in Tasmania. These characteristics meet standard criterion 3.1.2 for a site of Regional significance.

The council land contains very few individuals of the Dandenong Range Cinnamon Wattle (*Acacia stictophylla*). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

The council land contains a colony of hundreds of the Sharp Greenhood (*Pterostylis* × *ingens*), which is listed by the Department of Environment, Land, Water and Planning as rare in Victoria. The hybrid also occurs in NSW. Despite the size of the colony, it should probably not be regarded as 'an important site' for the hybrid. Under such circumstances, criterion 3.1.2 rates a site as Regional significance.

The reserves support a viable population of the Swamp Skink, which is listed as threatened under the *Flora and Fauna Guarantee Act 1988* and listed as 'vulnerable' by the Department of Environment, Land, Water and Planning. The species also occurs in South Australia and New South Wales. These characteristics meet standard criterion 3.1.2 for a site of Regional significance.

The other species listed as 'Significant fauna' above, and all the locally threatened plant species listed under the heading 'Plant species', give the site Local significance under standard criterion 3.1.5 (except perhaps a few species that may not have viable populations).

Regionally threatened Ecological Vegetation Class

The reserves include 7 ha of 'endangered' EVCs in very good ecological condition and 7–8 ha in good ecological condition. As a consequence, the site meets standard criterion 3.2.3 for a site of at least State significance. However, as noted above, the National significance arising from the Kilsyth South Spider-orchid and the Porphyry Wallaby-grass overrides any lower level of significance associated with other natural assets.

Richness and diversity

This study's unexhaustive survey of the 4 ha of Valley Heathy Forest on the council land detected 149 wild, indigenous, vascular plant species and ten indigenous bryophyte species. As that survey was conducted mostly in May 2018, with a minority of the area surveyed in November 2017, it is inevitable that a significant number of seasonal species were overlooked. The aggregate number of wild, indigenous, vascular plant species recorded from the present study and previous surveys is 179. This is far more than any other area of Valley Heathy Forest in Maroondah. The only site of Valley Heathy Forest in Knox with a similar number of species is the Bateman Street Bush, with 210 species in nearly three times the area. There do not appear to be any data for the number of plant species in other areas of Valley Heathy Forest outside Maroondah and Knox. Nevertheless, the author draws from his extensive experience with the EVC to conclude that the Valley Heathy Forest at Bungalook Conservation Reserves has 'unusually high native species richness (for a given habitat type…)' within the Gippsland Plain bioregion to meet standard criterion 2.1 for a site of Regional significance.

The site's 'National' rating differs from the 'State' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The lake's vegetation and aquatic invertebrates help reduce water pollution in Bungalook Creek and Dandenong Creek.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve as well as immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

A large, ancient Silver-leafed Stringybark on the Trust for Nature property is listed in the Heritage overlay of the Maroondah Planning System.

The parts of the reserves owned by Maroondah City Council and the Trust for Nature represent the best surviving representations of pre-European vegetation of the vast floodplains of the upper Dandenong Creek catchment. The unusually rich plant and animal life throughout the whole site, combined with the peacefulness and secluded areas, offer the deepest and most authentic natural experiences in Maroondah (though Hochkins Ridge Nature Conservation Reserve comes close).

The site's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the part of the site north of Tereddan Drive is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Changes in the species present

The following indigenous plant species have not been observed at Bungalook Conservation Reserves for many years and are presumed to have died out since 1997:

Acacia mucronata
Baumea rubiginosa
Centipeda elatinoides
Centrolepis fascicularis
Chorizandra cymbaria
Chrysocephalum semipapposum
Cycnogeton alcockiae
Dianella longifolia × *Thelionema caespitosum*
Eryngium vesiculosum
Gonocarpus humilis
Gratiola peruviana
Gratiola pubescens
Pauridia vaginata
Poa clelandii
Poa ensiformis
Selaginella uliginosa
Tetratheca ciliata
Utricularia dichotoma

The following indigenous plant species were not observed at Bungalook Conservation Reserves until recent years and are presumed to have arrived by natural means since 1997:

Alisma plantago-aquatica
Amyema quandang
Azolla rubra
Calochlaena dubia
Cassinia longifolia
Clematis aristata
Clematis decipiens
Coprosma quadrifida
Glossodia major
Juncus australis
Juncus flavidus
Lemna disperma
Ludwigia peploides
Persicaria decipiens
Phragmites australis
Pomaderris aspera
Pomaderris racemosa
Rytidosperma racemosum
Senecio campylocarpus
Solanum laciniatum

The following fauna species were resident or regular visitors at Bungalook Conservation Reserves in 1997 and are presumed to have died out, relocated or ceased to visit since then:

Australasian Grebe
Little Pied Cormorant
Black-shouldered Kite
Black-fronted Dotterel
Masked Lapwing
Pallid Cuckoo
Bell Miner
White-plumed Honeyeater
Eastern Shrike-tit
Golden-headed Cisticola

The following fauna species were not observed at Bungalook Conservation Reserves in the 1990s and are believed to have since established themselves as residents or regular visitors:

Little Corella
Australian King-Parrot
Noisy Miner
New Holland Honeyeater
Scarlet Honeyeater
Short-beaked Echidna
Swamp Rat

From a global perspective, the most important change at Bungalook Conservation Reserves in the past twenty years has been the decline of the Kilsyth South Spider-orchid to just two plants – the only wild members of the species on Earth. In the early 1990s there were 15–20 individuals on land that was privately owned at the time. By the late 1990s, most of the population was deliberately destroyed, including approximately twelve in one incident. The population has drifted lower since that period due to attrition and lack of reproduction, except that hand-pollination has produced many seeds. The seeds have resulted in three plants in pots at the Royal Botanic Gardens.

The destruction of a substantial fraction of the Porphyry Wallaby-grass since 2017 also represents a change of global significance.

Section 5.1.3 of Volume 1 describes how the regionally rare Heron Bristle-rush *Chorizandra cymbaria* died out on the Trust for Nature property in the 1990s due to the land being drained in the 1980s and the creek being replaced with a pipe. The same happened to the regionally rare water-ribbons, *Triglochin alcockiae*. As mentioned above, there are other plant species that suffered major declines during the Millennium Drought and have not recovered. These observations are all symptomatic of a general drying of the land since it was subdivided and drained in the late 1980s. The trend has been exacerbated by the abovementioned installation of a drainage trench by Melbourne Water in 2017 through habitat of rare swamp-dwelling plants near Ormond Place.

Change in the extent of habitat

Since the investigation for the *Sites of Biological Significance in Maroondah* report (Lorimer *et al.* 1997), there has been little change in the extent of habitat within the reserves. Small losses south of the lake and for firebreaks in the south have been almost balanced by regeneration elsewhere, particularly the north of the Trust for Nature property.

Change in the ecological condition of habitat

Apart from the drying of the land, there has been a general improvement over thirty years in the ecological condition of the vegetation on the land owned by Maroondah City Council and the Trust for Nature. The cover of introduced plants has reduced to a tiny fraction of 1%.

On the Melbourne Water land, the vegetation on the levee has developed from bare clay in 1989 into generally good habitat with trees, shrubs and ground flora, including rare species. However, the presence of trees on a levee creates a risk of the levee failing during a flood. Over the past fifteen years (approximately), the South African plant, *Aristea ecklonii*, has been forming dense groundcover over increasing areas of the retarding basin and its surrounds, seriously displacing indigenous plants and wildlife habitat.

Also on the Melbourne Water property, the drying of the floodplain has seriously deteriorated the ecological condition of the habitat. This affects many plant species that are in the 'critically endangered' category of risk of dying out in Maroondah.

Over twenty years, the lake has lost most of its volume and much of its habitat value due to sedimentation. As a result, Cumbungi (*Typha domingensis* and *Typha orientalis*) has increased from trace amounts to now covering most of the southern half of the lake. The intractable wetland weeds, Jointed Rush and Square-stem St John's Wort (or St Peter's Wort) have become abundant, the latter occurring mainly over the past decade.

The flat area south of the lake was once slashed each summer and it contained a mixture of indigenous and introduced plants. That area has not been slashed for well over a decade, allowing rank growth of introduced grass to accumulate and displace most indigenous plants, including the locally rare Swamp Daisy (*Allittia cardiocarpa*).

Most trees in the forested areas of the Melbourne Water land were young in 1987–88 when the retarding basin and Bungalook Creek drain were constructed. There are now many mature trees and the initially denuded banks of the drain are now well vegetated.

Threats

The identified threats to biodiversity in Bungalook Conservation Reserves are (in approximately decreasing order):

- Global extinction of the Kilsyth South Spider-orchid due to inbreeding or failed reproduction (despite concerted efforts to overcome these problems);
- Global extinction of the species of Porphyry Wallaby-grass that occurs on the site due to: (a) herbicide use; (b) harmful mowing; and (c) the installation in 2017 of a drain to dry out the winter-sodden habitat on which the species relies;
- Regional or local extinction of other rare plants due to the recent drain installation just mentioned;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Regional or local extinction of rare plants due to prolonged, severe drought, which the CSIRO predicts to occur more frequently in future. The Millennium Drought led to major declines in species that have not been reversed since, such as Glandular Daisy-bush (*Olearia glandulosa*), Prickfoot (*Eryngium vesiculosum*) and Swamp Selaginella (*Selaginella uliginosa*);
- Squashing of rare plants into mud by mowers operating around the retarding basin when the ground is boggy;

- Displacement of habitat (including rare plants and Swamp Skink habitat) by the South African plant, *Aristea ecklonii*, which is rapidly spreading unchecked around the retarding basin and smothering almost all other ground flora in its path;
- Displacement of rare plants by a dense cover of introduced plants (particularly Paspalum) south of the lake, due to cessation of slashing. (This also represents a significant fire hazard.);
- Seed collectors and plant collectors, a number of whom have been caught removing seeds and cuttings from species that cannot afford to lose that material;
- Orchid enthusiasts, who are observed each spring trampling vegetation while approaching and photographing orchids, particularly the Kilsyth South Spider-orchid; and
- The potential arrival of a serious plant disease, e.g. Cinnamon Fungus.

Strategic planning

The whole site is affected by the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. Nearly all of it is outside the Urban Growth Boundary and covered by the Vegetation Protection Overlay (VPO).

Consistent with Section 11.1.2 of Volume 1, it is recommended to remove the VPO and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in red on the aerial photograph on p. 499. This includes some church land, whose possible future subdivision could threaten the nationally significant habitat on the abutting land.

Recommended actions

Eunice Court Reserve was created specifically to provide a wider connection of tree canopy between Bungalook Conservation Reserves and Eastwood Golf Course. It would be desirable to plant more trees there to achieve that objective. Understorey should be kept fairly sparse for the sake of fire safety.

Information sources

This site analysis is mostly based on a moderately intensive ecological survey during this study as well as numerous previous flora and fauna surveys and reports by the author and co-workers at intervals since 1988. It also takes into account additional survey data in:

- A fauna list in the Victorian Biodiversity Atlas (VBA) from 1988, of doubtful authorship;
- 'Site Assessment (Flora) – Kilsyth South (Lot 8 Tereddan Drive' by Jeff Yugovic of the Dept of Conservation, Forests and Lands in 1989;
- 'Vegetation and Management of Tereddan Drive Reserve, Kilsyth South, Victoria' by Ecological Horticulture Pty Ltd in 1992;
- 'Significance of Vegetation at Lot 10, Tereddan Drive, Kilsyth South and Potential Impacts of Clearing' by G.W. Carr of Ecology Australia Pty Ltd in October 1998;
- Verbal reports (and an associated 2001 VBA record) from herpetologist Nick Clemann of observations of Swamp Skinks around the retarding basin;
- Observations of Goldfish and Shortfin Eel by John McGuckin in 2004 (from the VBA);
- 'Colchester Road Retarding Basin, Kilsyth South - Significant flora mapping and management recommendations' by F. Sutton and G.W. Carr of Ecology Australia Pty Ltd in 2015;
- 'Sites of Biodiversity Significance: Colchester Road Retarding Basin, Kilsyth South – Biodiversity Conservation and Site Management Plan' by F. Sutton, J. Urlus and D. Quinn of Ecology Australia Pty Ltd in 2016;
- Observations by Asha Billing, Brenna Billing and Roger Shaw during their work in the reserves in 2017–2019; and
- eBird.

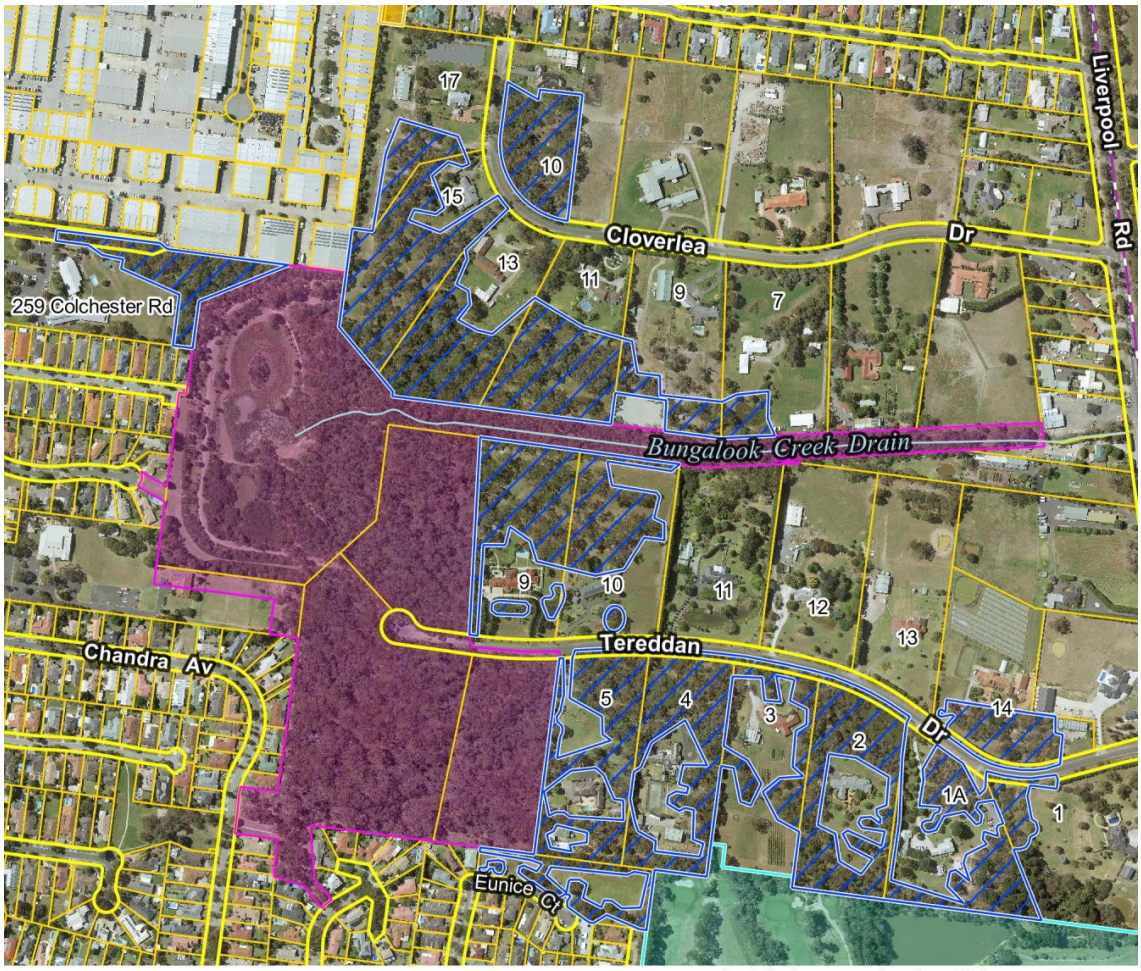
The VBA contains several additional records mapped within the site. Some of them are of planted species but do not state that fact. The others have been wrongly mapped.

Acknowledgment

Thanks to Asha Billing, Brenna Billing and Roger Shaw for providing useful fauna observations.

Site 67. Cloverlea & Tereddan Drives, Kilsyth South

Biological Significance Level: *State* due to the presence of endangered vegetation types



Aerial photograph taken February 2017

Legend

Property boundaries
Municipal boundary
Site 66
Site 67
Site 68
Site 127

N

1:7000

0 50 100 150 200 250 m

Boundary

Site 67 is outlined and hatched in mid-blue on the aerial photograph above, with nine separate polygons. It includes all the native vegetation that makes a material contribution to the biological significance of the composite of Sites 66–68.

As with all sites in this volume, the precise boundary is available as a shapefile for geographic information systems.

The original version of Site 67 in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) differed in its inclusion of 6 and 7 Tereddan Drive. Those properties were vacant private land at the time and have since been reserved as part of Bungalook Conservation Reserves (Site 66). Sites 66 and 67 have

only every been treated as separate sites because of the differences between public and private land. To maintain that distinction, 6 and 7 Tereddan Drive are here transferred to Site 66.

Land use and tenure

The site's westernmost polygon is mostly within the 'Autodesk' commercial property at 259 Colchester Road but it also includes part of an abutting unused road reserve along its the northern edge.

The site's southwestern extremity comprises revegetation on the council reserve at 6–10 Eunice Court. The land was reserved specifically to provide a wildlife corridor between Bungalook Conservation Reserves (Site 66) and Eastwood Golf Course (Site 68).

Part of the road verge of Tereddan Drive (a council road) forms a tiny fraction of the site.

The rest of the site comprises vegetated parts of residential properties of typically two hectares each. Many of those residences are also business addresses.

General description

Site 67's nine polygons occupy a total of 16.6 hectares.

The parts south of Tereddan Drive, and also 14 Tereddan Drive, have soil derived from Lower Devonian rhyolite, which is part of the volcanic rock that forms the Dandenong Ranges. The only other sites in this volume with rhyolite-derived soil are parts of Sites 66 and 68. The slopes in this southern part of the site have gentle gradients mostly between 1:16 (facing west) and 1:25 (facing north). The associated native vegetation is of a type (or Ecological Vegetation Class) called 'Valley Heathy Forest', which is listed as endangered. The understorey is substantially altered from a natural state.

The rest of the site is on the floodplain of Bungalook Creek. The gradient is 1:80, falling to the west. The soil is alluvium washed down by the creek. The natural vegetation type on the alluvium is called 'Swampy Woodland', which is also listed as endangered. The amount and condition of native understorey is very variable. Even in the areas with the greatest amounts of indigenous understorey (13 & 15 Cloverlea Drive and 259 Colchester Road), the indigenous plants are being supressed by mowing or robust 'environmental weeds' such as Gorse and Sweet Pittosporum.

As this study did not enter private land in Site 67, information about the site's flora and fauna must rely on information from the previous survey of flora and fauna (in 1996) and what can be seen from the roads and Bungalook Conservation Reserves (Site 66). Despite the restricted access, this study still detected eighty-four naturally-occurring, indigenous plant species within the site.

Relationship to other land

Much of the biological significance of Site 67 relates to the role of its native vegetation as:

- An ecological 'buffer' to Sites 66 (Bungalook Conservation Reserves) and 68 (Eastwood Golf Course); and
- Connecting habitat to facilitate movement of wildlife, pollen and seeds between those sites and further afield.

Eunice Court Reserve was reserved specifically to provide a habitat corridor between (Site 66) and (Site 68). Maroondah City Council planted indigenous species on part of the land soon after it was reserved but around half of the reserve is left as mown lawn.

Site 67's westernmost polygon is only 150 m from habitat at the Canterbury Road Retarding Basin property (Site 65). There are some eucalypts between those two sites, which is expected to increase the willingness of some birds and flying insects to fly from one site to the other.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives 'Very High' scores for 'Relative corridor conservation priority' to three alignments through Site 67:

- Vegetation beside the Bungalook Creek Drain and through the site's westernmost polygon;
- Vegetation on the Tereddan Drive properties; and
- Vegetation on Eunice Court Reserve.

The movements of birds and insects between sites is important not only for the needs of the animals but also for the pollen and seeds that the animals may disperse as they go.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation below include only indigenous plant species. Because the private land was not entered in this study, some of the small, inconspicuous species below are included on the basis of the 1996 survey, when private land was visited. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion), southward from Tereddan Drive, excluding the very front of 4 and 5 Tereddan Drive.

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Narrow-leaved Peppermint (*E. radiata*). Bundy (*E. goniocalyx*) is more localised. Red Stringybark (*E. macrorhyncha*) was moderately abundant in 1996 but has been reduced to one somewhat sickly tree and a dead tree. Notably, many of the eucalypts support Drooping Mistletoe (*Amyema pendula*), which is rare in Maroondah.

Sub-canopy trees: Cherry Ballart (*Exocarpos cupressiformis*) is fairly abundant.

Medium to large shrubs: Yarra Burgan (*Kunzea leptospermoides*) forms a thicket in part of the site. The only other shrub species seen from the public realm are Sweet Bursaria (*Bursaria spinosa*), Sifton Bush (*Cassinia sifton*) and Manuka (*Leptospermum scoparium*) but the following additional species were recorded in 1996: Hedge Wattle (*Acacia paradoxa*), Hop Wattle (*Acacia stricta*), Common Cassinia (*Cassinia aculeata*), Common Heath (*Epacris impressa*), Tree Everlasting (*Ozothamnus ferrugineus*), Elderberry Panax (*Polyscias sambucifolia*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is scarce.

Ferns: None seen from the public realm in this study but Austral Bracken (*Pteridium esculentum*) was recorded in the 1996 flora survey.

Climbers: None seen from the public realm in this study but Common Apple-berry (*Billardiera mutabilis*) and Coarse Dodder-laurel (*Cassytha melantha*) were seen in 1996.

Creepers: Trailing Goodenia (*Goodenia lanata*) is fairly abundant but localised. A few Creeping Bossiaea (*Bossiaea prostrata*) and Centella (*Centella cordifolia*) are visible from the public realm. Ivy-leaf Violet (*Viola hederacea*) and the Wood-sorrel (*Oxalis exilis/perennans*) were also recorded in 1996.

Grasses, rushes and sedges: Thatch Saw-sedge (*Gahnia radula*) is dominant in part of the area. Other abundant species include the rare Veined Spear-grass (*Austrostipa rudis* subsp. *australis*), as well as Smooth Wallaby-grass (*Rytidosperma laeve*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and (in damp places) Common Bog-rush (*Schoenus apogon*). The following species are fairly abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Mat Grass (*Hemarthria uncinata* var. *uncinata*), Toad Rush (*Juncus bufonius*), Weeping Grass (*Microlaena stipoides*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Velvet Wallaby-grass (*Rytidosperma pilosum*), Clustered Wallaby-grass (*Rytidosperma racemosum*) and Bristly Wallaby-grass (*Rytidosperma setaceum*). From the public realm, the following additional species appear to be scarce: Reed Bent-grass (*Deyeuxia quadriseta*), Pale Rush (*Juncus pallidus*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Leafy Wallaby-grass (*Rytidosperma fulvum*) and Forest Wire-grass (*Tetrarrhena juncea*). The following additional species were recording in 1996: Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Soft Tussock-grass (*Poa morrisii*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*) and Kangaroo Grass (*Themeda triandra*).

Other groundcover: Small Poranthera (*Poranthera microphylla*) is abundant and widespread. Common Raspwort (*Gonocarpus tetragynus*) and Lesser Loosestrife (*Lythrum hyssopifolia*) are fairly

abundant. Slender Onion-orchid (*Microtis parviflora*) and Yellow Rush-lily (*Tricoryne elatior*) are scarce in the areas visible from the public realm. In 1996, the following additional species were recorded: Milkmaids (*Burchardia umbellata*), Button Everlasting (*Coronidium scorpioides*), Variable Willow-herb (*Epilobium billardiereanum* subsp. *cinereum*), Common Cudweed (*Euchiton involucratus*), Swamp Goodenia (*Goodenia humilis*), Small St John's Wort (*Hypericum gramineum*), Slender Bottle-daisy (*Lagenophora sublyrata*), Native Flax (*Linum marginale*), Tall Lobelia (*Lobelia gibbosa group*), Variable Stinkweed (*Opercularia varia*), Long Purple-flag (*Patersonia occidentalis*), Common Rice-flower (*Pimelea humilis*), Common Fringe-lily (*Thysanotus tuberosus*) and Cut-leaf Xanthosia (*Xanthosia dissecta*).

The following species are fairly abundant (but localised in some cases): Spreading Crassula (*Crassula decumbens*), Tall Sundew (*Drosera auriculata*), Creeping Cudweed (*Euchiton japonicus*), Common Raspwort (*Gonocarpus tetragynus*), Slender Onion-orchid (*Microtis parviflora*), Smooth Solenogyne (*Solenogyne dominii*), Grass Trigger-plant (*Stylidium armeria*) and Trim Sun-orchid (*Thelymitra peniculata*). Water Plantain (*Alisma plantago-aquatica*) is fairly abundant in some puddles on 15 Cloverlea Drive. The following species are scarce in the areas visible from the public realm: Black-anther Flax-lily (*Dianella revoluta*), Tasman Flax-lily (*Dianella tasmanica*), Rosy Hyacinth-orchid (*Dipodium roseum*), Swamp Goodenia (*Goodenia humilis*), Lesser Loosestrife (*Lythrum hyssopifolia*), Variable Stinkweed (*Opercularia varia*), Long Purple-flag (*Patersonia occidentalis*) and Cut-leaf Xanthosia (*Xanthosia dissecta*).

Swampy Woodland (EVC 937, **Endangered** in the bioregion), north of Tereddan Drive

Canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*) and/or Mealy Stringybark (*Eucalyptus cephalocarpa*). Narrow-leaved Peppermint (*E. radiata*) is scarce.

Sub-canopy trees: Dominated by Blackwood (*Acacia melanoxylon*). Cherry Ballart (*Exocarpos cupressiformis*) is also fairly abundant. Black Sheoak (*Allocasuarina littoralis*) and Swamp Paperbark (*Melaleuca ericifolia*) are scarce.

Medium to large shrubs: In areas that aren't mown, Hop Goodenia (*Goodenia ovata*) is dense and Common Cassinia (*Cassinia aculeata*), Manuka (*Leptospermum scoparium*) and Tree Everlasting (*Ozothamnus ferrugineus*) are also fairly abundant. Hop Wattle (*Acacia stricta*), Prickly Moses (*Acacia verticillata*) and Sifton Bush (*Cassinia sifton*) are all scarce. Heath Milkwort *(Comesperma ericinum*) was present on 5 Tereddan Drive in 1996 but its habitat has since been destroyed.

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*) and Common Flat-pea (*Platylobium obtusangulum*) are both scarce. Wiry Bush-pea (*Almaleea subumbellata*) was present on 5 Tereddan Drive in 1996 but its habitat has since been destroyed.

Ferns: Austral Bracken (*Pteridium esculentum*) forms occasional, dense patches.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is scarce.

Creepers: Centella (*Centella cordifolia*) is scattered thinly. Creeping Raspwort (*Gonocarpus micranthus*) appears to be rather localised but the number of individuals is substantial. Bidgee-widgee (*Acaena novae-zelandiae*) and the wood-sorrel, *Oxalis exilis/perennans*, are scarce in the areas visible from the public realm.

Grasses, rushes and sedges: Weeping Grass (*Microlaena stipoides*) is the dominant indigenous ground flora species in mown areas and Thatch Saw-sedge (*Gahnia radula*) takes that role in the absence of mowing. Smooth Wallaby-grass (*Rytidosperma laeve*) and Bristly Wallaby-grass (*R. setaceum*) are also abundant. Both the rare and common subspecies of Veined Spear-grass (*Austrostipa rudis*) are fairly abundant, as are Slender Aphelia (*Aphelia gracilis*), Common Love-grass (*Eragrostis brownii*), Toad Rush (*Juncus bufonius*), Pale Rush (*Juncus pallidus*), Slender Wallaby-grass (*Rytidosperma penicillatum*) and the club-rush (*Isolepis platycarpa*). The following species are scarce in the areas visible from the public realm: Reed Bent-grass (*Deyeuxia quadriseta*), Short-stem Sedge (*Carex breviculmis*), Common Plume-grass (*Dichelachne rara*), Red-fruit Saw-sedge (*Gahnia sieberiana*), Hollow Rush (*Juncus amabilis*), Green Rush (*Juncus gregiflorus*), Broad-leaf Rush (*Juncus planifolius*), Broom Rush (*Juncus sarophorus*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Slender Tussock-grass

(*Poa tenera*) and Small Grass-tree (*Xanthorrhoea minor*). Mat Grass (*Hemarthria uncinata*) and Common Reed (*Phragmites australis*) were recorded in 1996 and probably still present.

Other groundcover: Small Poranthera (*Poranthera microphylla*) is abundant and widespread. The following species are fairly abundant (but localised in some cases): Spreading Crassula (*Crassula decumbens*), Tall Sundew (*Drosera auriculata*), Creeping Cudweed (*Euchiton japonicus*), Common Raspwort (*Gonocarpus tetragynus*), Slender Onion-orchid (*Microtis parviflora*), Smooth Solenogyne (*Solenogyne dominii*), Grass Trigger-plant (*Stylidium armeria*) and Trim Sun-orchid (*Thelymitra peniculata*). Water Plantain (*Alisma plantago-aquatica*) is fairly abundant in some puddles on 15 Cloverlea Drive. The following species are scarce in the areas visible from the public realm: Black-anther Flax-lily (*Dianella revoluta*), Tasman Flax-lily (*Dianella tasmanica*), Rosy Hyacinth-orchid (*Dipodium roseum*), Swamp Goodenia (*Goodenia humilis*), Lesser Loosestrife (*Lythrum hyssopifolia*), Variable Stinkweed (*Opercularia varia*), Long Purple-flag (*Patersonia occidentalis*) and Cut-leaf Xanthosia (*Xanthosia dissecta*). Leafless Globe-pea (*Sphaerolobium minus*) and Tufted Blue-lily (*Thelionema caespitosum*) were recorded in 1996 but their habitat has since been destroyed.

Significant plants

Rare (but not otherwise threatened) in Victoria

Over 100 (and perhaps many hundreds) of the Veined Spear-grass subspecies, *Austrostipa rudis* subsp. *australis*, are widespread within Site 67. The subspecies is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. It is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 67 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Many of the records date to the last flora survey of the area, which was in 1996.

- *Selaginella uliginosa* (Swamp Selaginella) – recorded at 5 Tereddan Drive in 1996 but its habitat has since been cleared;
- *Almaleea subumbellata* (Wiry Bush-pea) – as above;
- *Amyema pendula* (Drooping Mistletoe) – at least four grow in the site's westernmost polygon, at least three on 15 Cloverlea Drive and at least thirty-five on 1A, 2 and 14 Tereddan Drive. Others are very likely to be present out of sight from the public realm. This is by far the largest population of the species in Maroondah;
- *Aphelia gracilis* (Slender Aphelia) – apparently fairly abundant in the floodway on 15 Cloverlea Drive – one of only four sites in Maroondah;
- *Comesperma ericinum* (Heath Milkwort) – recorded at 5 Tereddan Drive in 1996 but its habitat has since been cleared;
- *Deyeuxia densa* (Heath Bent-grass) – recorded in 1996 on the nature strip of 14 Tereddan Drive;
- *Empodisma minus* (Spreading Rope-rush) – recorded in 1996 on at least two properties. Not visible from the public realm but quite likely still present;
- *Eucalyptus macrorhyncha* (Red Stringybark) – only one living and one dead tree remain visible from the public realm;
- *Gonocarpus micranthus* (Creeping Raspwort) – scores of individuals occur at the rear of 13 and 15 Cloverlea Drive and others may be present out of public view. This is the only population of the species found in this study or anywhere in Maroondah since 2012;
- *Goodenia humilis* (Swamp Goodenia) – very few are visible from the public realm but more may be present out of public view;
- *Hakea nodosa* (Yellow Hakea) – recorded at 5 Tereddan Drive in 1996 but its habitat has since been cleared;
- *Lobelia browniana/gibbosa* (Tall Lobelia) – as above;

- *Ozothamnus rosmarinifolius* (Rosemary Everlasting) – recorded as fairly abundant in 1979 but not found in 1996 and unlikely to persist but an occasional plant might germinate under the right conditions;
- *Poa tenera* (Slender Tussock-grass) – about five were seen at the rear of 13 and 15 Cloverlea Drive and others may be present out of public view. This species was seen in only six other sites during this study, and the five individuals in Site 67 is greater than the others except Bungalook Conservation Reserves;
- *Sphaerolobium minus* (Globe-pea) – recorded at 5 Tereddan Drive in 1996 but its habitat has since been cleared;
- *Thelionema caespitosum* (Tufted Blue-lily) – as above.

Significant fauna

Most of the significant birds other than waterbirds recorded at Bungalook Conservation Reserves (Site 66) are very likely to make use of treed habitat in Site 67, including during movements to and from the Dandenong Ranges. An example is the White-winged Triller, which had not been recorded in Maroondah for 111 years until 2019 when three birds were seen in Bungalook Conservation Reserves, making small excursions into Site 67.

Swamp Rats are likely to be present on land close to Bungalook Conservation Reserves, where they have become abundant in the past five years.

Fauna habitat

- Ponds and dams on some of the properties provide habitat for common waterbirds, frogs and aquatic invertebrates;
- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats and invertebrates;
- The site's large population of mistletoes is very important for the persistence of the Mistletoebird and Imperial Jezebel butterfly in Maroondah, as mistletoes are rare in Maroondah and those fauna species are critically reliant on mistletoes for food;
- Tree hollows offer roost sites or nest sites for some animals;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The site's landscape context relative to Bungalook Conservation Reserves (Site 66) and Eastwood Golf Course (Site 68) greatly amplifies the benefit of habitat in Site 67; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the vegetation varies between categories 'C' (fair) and 'D' (poor) on the A–D scale of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). Apportionment among the categories cannot be done without inspecting all the private properties, which was not possible in this study.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

Some areas of Valley Heathy Forest and Swampy Woodland easily meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Both those EVCs are listed by the state government as 'endangered'. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Rare or threatened species

The section above headed 'Significant plants' provides details of populations of rare or threatened plant species.

Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a large, clearly viable population in the site. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Among the site's plant species that fall into the 'critically endangered' category of risk of dying out in Maroondah, *Amyema pendula*, *Aphelia gracilis* and *Gonocarpus micranthus* all fit the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating. It is likely that some other species in the section above headed 'Significant plants' also satisfy standard criterion 3.1.5 for Local significance.

There is too little information about the site's fauna to determine whether any faunal species meet the standard criteria for significance.

Ecological corridor

For the reasons discussed in the section above headed 'Relationship to other land', Site 67 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". That gives the site Local significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit all the site's residents as well as adjacent homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

Site 67's natural ambience is expected to be beneficial to the health, wellbeing, childhood development and quality of life of the residents. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals that Site 67 helps to attract (in conjunction with the abutting sites).

The site's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the part of the site between Tereddan Drive and Cloverlea Drive is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

The site's vegetation provides a 'green and leafy', semi-rural character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparison of aerial photographs taken in 2001 and 2017 indicates that the following approximate areas of native vegetation have been removed:

- 1,200 m² on 5 Tereddan Drive (the most significant vegetation in the site until its removal);
- 800 m² on 14 Tereddan Drive;
- 4,000 m² of 9 Cloverlea Drive; and
- 1,800 m² on 13 Cloverlea Drive.

These losses have been partially offset by tree crowns enlarging to cover parts of the site that were bare in 2001. It is impracticable to add up the many small instances of enlarging crowns.

Threats

This study has identified the following threats to the site's biodiversity:

- Possible future residential subdivision, should the Urban Growth Boundary be enlarged;
- Other developments such as construction of outbuildings and equestrian facilities;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by introduced plants, including weeds and expanded gardens;
- Exacerbation of the preceding problem by cultivation and fertilisers;
- Drying of the floodplain due to climate change;
- Further piecemeal illegal clearing; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Zoning within Site 67 is as follows:

- 'Industrial 1 Zone' in the westernmost polygon (parts of 259 Colchester Road and its abutting unused road reservation);
- 'Neighbourhood Residential Zone – Schedule 3' at Eunice Court Reserve (in the site's southwest); and
- 'Green Wedge A Zone' elsewhere.

Removal of native vegetation within the entire site is regulated by the state-wide planning controls of clause 52.17 of the Victorian Planning Provisions. Additional controls regarding native vegetation apply in most of the site (and some adjacent areas) under the Vegetation Protection Overlay (VPO). The VPO was introduced as an outcome of the 1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997). In addition, removal of trees (native or not) above a threshold size is regulated by the Significant Landscape Overlay throughout the site except in the westernmost polygon.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to:

- Remove the VPO from the site and its surroundings; and
- Apply the proposed schedule ESO1 of the Environmental Significance Overlay to the entire site, i.e. the areas outlined and hatched in mid-blue on the aerial photograph on p. 513.

It would be open to Maroondah City Council to enlarge the area of ESO1 to conform with property boundaries or simplify the boundary, where appropriate.

Recommended actions

Eunice Court Reserve was created specifically to provide a wider connection of tree canopy between Bungalook Conservation Reserves (Site 66) and Eastwood Golf Course (Site 68). It would be desirable to plant more trees there to achieve that objective. Understorey should be kept fairly sparse for the sake of fire safety.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately 3½ hours of site inspection for this study, including: (a) compiling lists of plant species and their abundances in each of the two EVCs; (b) mapping the location of rare or scarce plant species; (c) checking for fauna habitat such as large trees; and (d) checking for other features relevant to this report;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site included a flora survey and incidental fauna observations;
- *'A Review of the Sites of Botanical Significance in the Upper Yarra Valley and Dandenong Ranges Region'* by A.R.G. McMahon, D. Frood, S.E. Bedggood and G.W. Carr (1989) – Upper Yarra Valley and Dandenong Ranges Authority Report No. 26;
- *'Sites of Botanical Significance in the Upper Yarra Region'* by P.K. Gullan, D.M. Parkes, A.G. Morton and M.J. Bartley (1979) – Victorian Ministry of Conservation; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Site 68. Eastwood Golf Course, Kilsyth South

Biological Significance Level: *National* due to the presence of an endangered plant species



Aerial photograph taken February 2017

Legend

Property boundaries
Municipal boundary
Site 66
Site 67
Site 68
Site 70
Site 133

N

1:7000

0 50 100 150 200 250 m

Boundaries, land use and tenure

The boundary of Site 68 is outlined in mid-blue above. It includes the whole of the Eastwood Golf Course property and parts of the adjacent verge of Liverpool Road. As with all sites in this volume, the precise boundary is available as a shapefile for geographic information systems.

The property is a private golf course with a lawn bowls facility. Liverpool Road is classified as a municipal road. There is a 2 m-wide gravel path along the road verge.

The original version of Site 68 in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) did not include the road verge, which was treated instead as part of Site 95. The change has been made because of changes to Site 95, as explained on p. 668. It was not seen as helpful to continue distinguishing between the golf course and its road verge, whose habitat values are closely interrelated.

General description

Site 68 measures 47.7 hectares. It is centred on a hill, with a minor gully flowing northwest and a minor gully flowing south into the Little Bungalook Creek drain, which flows westward along the golf course's southern edge. The slope on the hill is typically 1:12.

Unlike most of Maroondah, the hill is geologically part of the Dandenong Ranges. Its soil derives from Lower Devonian rhyolite, which is a volcanic rock. The only other sites in this volume with rhyolite-derived soil are parts of Sites 66 and 67. The geology has played a key role in determining the site's natural vegetation.

There is a layer of alluvium deposited over the rhyolite along the gullies and the Little Bungalook Creek valley. The natural vegetation type on the alluvium is called 'Swampy Woodland'. There are seven artificial waterbodies on the golf course, ranging in size from less than 200 m² to 7,800 m². The waterbodies provide habitat for waterbirds and indigenous wetland plants.

All the site's native vegetation has been substantially modified by past clearing and planting. Some of the planted species (e.g. pines) and some other introduced species have gone wild and are competing strongly with the indigenous plants. That competition probably contributed to the many deaths of remnant eucalypts and Variable Sallow Wattles (a locally rare species) during the Millennium Drought.

Straddling the driveway, there are two dams embedded within a 0.1-hectare patch of semi-natural forest. In a narrow band around the southern dam is Swampy Woodland, identifiable by its Swamp Gums *(Eucalyptus ovata*). Abutting the Swampy Woodland is Lowland Forest, which grades to Valley Heathy Forest at higher elevations.

The rest of the golf course's indigenous vegetation is in the roughs, particularly in the northwest. It includes hundreds of remnant trees intermingled with planted trees. There are indigenous groundcover species that mostly receive periodic mowing, which prevents the establishment of shrubs. Among the groundcover species is the globally endangered flat-pea, *Platylobium infecundum*.

The plant species present on the verge of Liverpool Road largely match those of the forest around the golf course. The condition of the road verge's vegetation is patchy due to the history of excavations and slashing. The least modified parts are fairly rich in species and contain at least four patches of *Platylobium infecundum*. There are also signs of indigenous Swamp Rat tunnels and associated tell-tale dead stems of saw-sedges.

Although this study only inspected a small part of the golf course, it still detected seventy-seven naturally-occurring, indigenous plant species.

Relationship to other land

As seen on the aerial photograph on p. 522, Site 68 abuts Site 67 to the north and Sites 70 and 133 to the southwest. Site 67 provides a direct habitat connection to Bungalook Conservation Reserves (Site 66) and to the Dandenong Ranges via Glasgow Road and Bungalook Creek. Sites 70 and 133 provide habitat that extends halfway to the Dandenong Creek habitat corridor. Only 80 m further south lies the extensive, significant habitat of the Liverpool Road Retarding Basin and abutting Sugarloaf Hill (Knox Sites of Biological Significance 22 & 23 respectively – see Lorimer 2010).

Waterbirds seen at Eastwood Golf Course are likely to also visit waterbodies at Sites 66 and 70 in Maroondah, Liverpool Road Retarding Basin in Knox and farmlets c. ½ km to the east of the golf course in the municipality of Yarra Ranges.

Site 68 is therefore well connected with other habitat for movement of indigenous fauna.

The *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives the golf course a 'Very High' score for 'Relative corridor conservation priority' on the basis of faunal movement between Bungalook Creek and Dandenong Creek.

Pollination that occurs from movements of birds and insects between Site 68 and other sites improves the reproductive success and genetic diversity of plants in all the visited sites. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

Bioregion: Gippsland Plain

Habitat types

The descriptions of Ecological Vegetation Classes (EVCs) below include only the more abundant or ecologically informative indigenous plant species. The brevity of this study's site inspection means that some fairly abundant (but localised) species may have gone undetected. 'EVC' means 'Ecological Vegetation Class'.

Lowland Forest (EVC 16, **Vulnerable** in the bioregion), grading to
Valley Heathy Forest (EVC 127, **Endangered** in the bioregion) at higher elevations

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*). Bundy (*E. goniocalyx*) is co-dominant at higher elevations, where Red Stringybark (*E. macrorhyncha*) is also fairly abundant. Mealy Stringybark (*E. cephalocarpa*), Narrow-leaved Peppermint (*E. radiata*) and Swamp Gum (*E. ovata*) are scarce.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*). Golden Wattle (*A. pycnantha*) is also fairly abundant. Silver Wattle (*A. dealbata*) is scarce.

Medium to Large shrubs: Dominated variously by Sweet Bursaria (*Bursaria spinosa*), Hop Goodenia (*Goodenia ovata*), Yarra Burgan (*Kunzea leptospermoides*) or Victorian Christmas-bush (*Prostanthera lasianthos*). The following species are also fairly abundant or widespread within the site: Hop Wattle (*Acacia stricta*), Common Cassinia (*Cassinia aculeata*), Sifton Bush (*Cassinia sifton*) and Prickly Currant-bush (*Coprosma quadrifida*). The following species are scarce in the areas inspected in this study: Hedge Wattle (*Acacia paradoxa*), Common Correa (*Correa* ?*reflexa*), Common Heath (*Epacris impressa*), Prickly Tea-tree (*Leptospermum continentale*), Manuka (*Leptospermum scoparium*), Elderberry Panax (*Polyscias sambucifolia*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: None seen.

Ferns: Austral Bracken (*Pteridium esculentum*) is fairly abundant.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is fairly abundant. Mountain Clematis (*Clematis aristata*), Love Creeper (*Comesperma volubile*) and Twining Glycine (*Glycine clandestina*) are scarce in the areas inspected in this study.

Creepers: Kidney-weed (*Dichondra repens*) and Wood-sorrel (*Oxalis exilis/perennans*) are widespread and fairly abundant. There are a number of patches of the globally-endangered flat-pea (*Platylobium infecundum*). Earlier flora surveys also detected Bidgee-widgee (*Acaena novae-zelandiae*), Trailing Goodenia (*Goodenia lanata*), Hairy Pennywort (*Hydrocotyle hirta*) and Ivy-leaf Violet (*Viola hederacea*)

Grasses, rushes and sedges: Abundant and rich in species, the most abundant being Thatch Saw-sedge (*Gahnia radula*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Clustered Wallaby-grass (*Rytidosperma racemosum*) and Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*). The following species are also fairly abundant: Tall Spear-grass (*Austrostipa pubinodis*), Short-stem Sedge (*Carex breviculmis*), Red-fruit Saw-sedge (*Gahnia sieberiana*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Weeping Grass (*Microlaena stipoides*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Forest Wire-grass (*Tetrarrhena juncea*). Soft Tussock-grass (*Poa morrisii*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Slender Wallaby-grass (*R. penicillatum*) and Small Grass-tree (*Xanthorrhoea minor*) are less abundant but good ecological indicators.

Other groundcover: Black-anther Flax-lily (*Dianella revoluta*) and Tasman Flax-lily (*Dianella tasmanica*) are fairly abundant. The following species are scarce: Honey-pots (*Acrotriche serrulata*), Pale Flax-lily (*Dianella longifolia*), Common Cudweed (*Euchiton* ?*involucratus*), Common

Raspwort (*Gonocarpus tetragynus*), Slender Bottle-daisy (*Lagenophora sublyrata*), Broad-leaf Stinkweed (*Opercularia ovata*), Variable Stinkweed (*Opercularia varia*) and Grass Trigger-plant (*Stylidium armeria*).

Swampy Woodland (EVC 937, **Endangered** in the bioregion).

Canopy trees: Dominated by Swamp Gum (*Eucalyptus ovata*). Messmate Stringybark (*E. obliqua*) is scarce.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*) and Swamp Paperbark (*Melaleuca ericifolia*). Cherry Ballart (*Exocarpos cupressiformis*) is also fairly abundant.

Medium to Large shrubs: Greatly depleted. The only species in substantial numbers seen in this study was Hop Goodenia (*Goodenia ovata*). Only small numbers of Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*) and Manuka (*Leptospermum scoparium*) were seen.

Small shrubs: None seen.

Ferns: Austral Bracken (*Pteridium esculentum*) dominates substantial areas.

Climbers: None seen.

Creepers: Centella (*Centella cordifolia*) is scarce.

Grasses, rushes and sedges: Dominated variously by Thatch Saw-sedge (*Gahnia radula*) or Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*). Red-fruit Saw-sedge (*G. sieberiana*), Tall Rush (*Juncus procerus*) and Weeping Grass (*Microlaena stipoides*) are also fairly abundant. Other species are scarce.

Other groundcover: Tasman Flax-lily (*Dianella tasmanica*) is the only other groundcover species seen in this study's inspection to have a substantial population.

Artificial waterbodies (No EVC number or conservation status)

Trees and shrubs: None.

Ferns: One plant of Bat's Wing Fern (*Histiopteris incisa*) was seen.

Herbaceous flora: Tall Spike-rush (*Eleocharis sphacelata*) and Cumbungi (*Typha* ?*domingensis*) dominate parts of some waterbodies. The following species are also fairly abundant: Red-fruit Saw-sedge (*Gahnia sieberiana*), Swamp Club-rush (*Isolepis inundata*), Tall Rush (*Juncus procerus*) and Slender Knotweed (*Persicaria decipiens*). Water Plantain (*Alisma plantago-aquatica*) is scarce in the areas inspected in this study. Common Duckweed (*Lemna* ?*disperma*) has been known to colonise the waterbodies in season.

Significant plants

Globally endangered

The mat-forming flat-pea, *Platylobium infecundum*, is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. Three patches (each comprising one or more plants) grow on the verge of Liverpool Road and an unknown number of plants were recorded between the 12th and 13th fairways when last inspected (in 2012). Others may well have gone undetected elsewhere around the golf course.

Rare (but not otherwise threatened)

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. The species was recorded in 1996 in the patch of bushland on the northern side of the driveway. It was not found there in 2018. Its disappearance is probably due to displacement by woody 'environmental weeds', which have become very dense there since 1996. It is possible that the species persists in part of the course not inspected in this study.

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Acacia mucronata* subsp. *longifolia* (Narrow-leaf Wattle) – abundant in 1996 within the patch of bushland on the northern side of the driveway but not found there in 2018, probably for the same reasons discussed above for *A. stictophylla*;
- *Amyema pendula* (Drooping Mistletoe) – recorded in 1996, number and location not recorded. It is fairly likely that it has not survived, as the vast majority died out in Maroondah during the Millennium Drought;
- *Baumea tetragona* (Square Twig-rush) – recorded in 1996 beside the dam on the southern side of the driveway. It was not found in this study but could have escaped detection;
- *Eucalyptus macrorhyncha* (Red Stringybark) – fairly abundant on the verge of Liverpool Road and quite possibly fairly abundant around the golf course but not detected there in this study's incomplete inspection;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – recorded in 1996 within the patch of bushland on the northern side of the driveway but not found there in 2018, perhaps due to the brevity of this study's inspection;
- *Poa tenera* (Slender Tussock-grass) – recorded near the driveway in 1996 and possibly still present but overlooked in this study's July inspection;
- *Senecio minimus* (Shrubby Fireweed) – only a few were detected in this study's brief inspection but quite possibly fairly abundant elsewhere on the golf course or in more favourable years; and
- *Veronica calycina* (Hairy Speedwell) – recorded in 1996 within the patch of bushland on the northern side of the driveway but not found there in 2018. This species has not been recorded anywhere in Maroondah since 1996, so it has probably died out at the golf course.

Other

A single plant of *Histiopteris incisa* (Bat's Wing Fern) grows in the small dam on the northern side of the driveway. The only other record of the species in Maroondah's history is from 1887 (a herbarium specimen of Charles French Jnr from Croydon). Despite the extreme local rarity, the species' risk of dying out in Maroondah is hard to determine because of its ability to colonise new areas by spores carried over long distances on the wind. The species is common in ferny parts of the Dandenong Ranges.

Significant fauna

- Blue-billed Duck – 'A male and two females by dam next to first green surrounded by Pacific Black Ducks' observed by David Spicer on 5/3/14;
- White-necked Heron – one individual observed by David Spicer on 30/1/14; and
- Buff-banded Rail – one individual observed by David Spicer on each of 24/3/10 and 5/8/13;
- Yellow-faced Honeyeater – one individual observed by Ron Willemsen on 4/10/2019; and
- Swamp Rat – suspected to be resident, judging by an apparent tunnel and dead *Gahnia radula* leaves on the road verge. The only other known occurrence of the species in Maroondah is at nearby Bungalook Conservation Reserves (Site 66).

Fauna habitat features

- The waterbodies provide habitat for aquatic invertebrates, frogs and waterbirds. The frogs and invertebrates are a source of prey for other fauna;
- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates but the value of this habitat is diminished by lack of shrubs;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The site's good habitat connectivity amplifies the habitat values above.

Ecological condition

On the A–D scale of ecological condition used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997), 0.4 ha of the road verge rates 'C' (fair) and 0.15 ha rates 'D' (poor).

This study's inspection of the golf course was far too brief and incomplete to make a meaningful assessment of the ecological condition of the whole the site. The parts of the property that were inspected fell into ratings 'C' and 'D'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants in Site 68.

The flat-pea *Platylobium infecundum* is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. Its global distribution is confined to Victoria. At least four patches of the species grow on the verge of Liverpool Road and other plants are fairly likely to persist in the roughs of the golf course. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance.

The standard criteria do not provide for a site to have different levels of significance in different parts, as would be appropriate in this case. A reasonable approach would be to confine the National significance rating to the habitat that supports the continued existence of the *Platylobium* plants and provides buffering from threats to their existence. Such an approach would require more fieldwork than has been done for this study.

The site's populations of *Eucalyptus macrorhyncha* (Red Stringybark) and *Histiopteris incisa* (Bat's Wing Fern) fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating. This study's brief site inspection was inadequate to exclude the possibility that other plant species on the golf course fit the same criterion.

Threatened fauna

Standard criterion 3.1.2 accords State significance to 'all sites with populations of a taxon listed as critically endangered or endangered and not endemic to Victoria'. The Blue-billed Duck is such a species. It has been reported at the golf course only twice but may well be present much more often. Without further investigation of the amount of usage that Blue-billed Ducks make of the course, it is unclear whether it should be taken to represent State significance.

Regionally threatened Ecological Vegetation Classes

Unless the native vegetation in the roughs in the northwest of the golf course has deteriorated significantly since the author's inspection of it in 2012, it meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the vegetation meets standard criterion 3.2.3 for a site of State significance.

The site's 'National' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of *Platylobium infecundum*, which had not even been described as a species in 1997. The 'State' significance of the Blue-billed Duck habitat and the patch of Valley Heathy

Forest exceeds the former 'Municipal' rating due to differences in the criteria and the state government's recognition in c. 2002 of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit golfers, lawn bowlers, neighbours and people using the path beside Liverpool Road. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the waterbodies helps to remove water pollution, including nutrients from the golf course.

The natural ambience of the course is expected to add to the enjoyment, health and quality of life of golfers, lawn bowlers, visitors and users of the path along Liverpool Road.

Those benefits are spread into surrounding areas by birds, butterflies and other animals moving to and from the site.

The natural ambience of the site also encourages people to get exercise through golf or lawn bowls.

The location of the southern part of the golf course beside a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the south of the course is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

The site's vegetation contributes to the area's semi-rural 'green and leafy' character. It also preserves something of the area's natural landscape. The native vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Aerial photographs from 2001, 2011 and 2017 show a marked increase in the average size of eucalypt crowns since 2001. Many of the crowns now arch further over the fairways than in 2001, resulting in an increase in the extent of arboreal habitat. It is impracticable to add up the many small increases to determine a total increase. The increase is at least partly balanced by removal of eucalypts.

Change in the ecological condition of habitat

The abovementioned aerial photographs show that many remnant eucalypts died between 2001 and 2011, corresponding to the Millennium Drought. The spate of deaths has not continued since 2011.

The ecological condition of the understorey in the patch of forest on the northern side of the driveway has declined markedly since the author's flora survey in 1996. The decline has been associated with the loss of several rare plant species such as *Acacia stictophylla* and *Acacia mucronata*. Some of the decline may have been due to the Millennium Drought but the main cause appears to be displacement of indigenous plants by robust introduced species such as pines and Sweet Pittosporum (*Pittosporum undulatum*).

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by introduced plants;
- Resumption of eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Potential future widening of Liverpool Road; and
- Continuing loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;

Strategic planning

The golf course is zoned 'Green Wedge A Zone' and the road reservation of Liverpool Road is zoned 'Road Zone – Category 2'.

Removal of native vegetation within the entire site is regulated by the state-wide planning controls of clause 52.17 of the Victorian Planning Provisions. Additional controls regarding native vegetation apply on the whole golf course under the Vegetation Protection Overlay (VPO). The VPO was introduced as an outcome of the 1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997).

In addition, removal of trees (native or not) above a threshold size is regulated under Schedule 1 of the Significant Landscape Overlay.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO from the golf course and apply the proposed schedule ESO1 of the Environmental Significance Overlay to the area outlined in mid-blue on the aerial photograph on p. 522.

Information sources

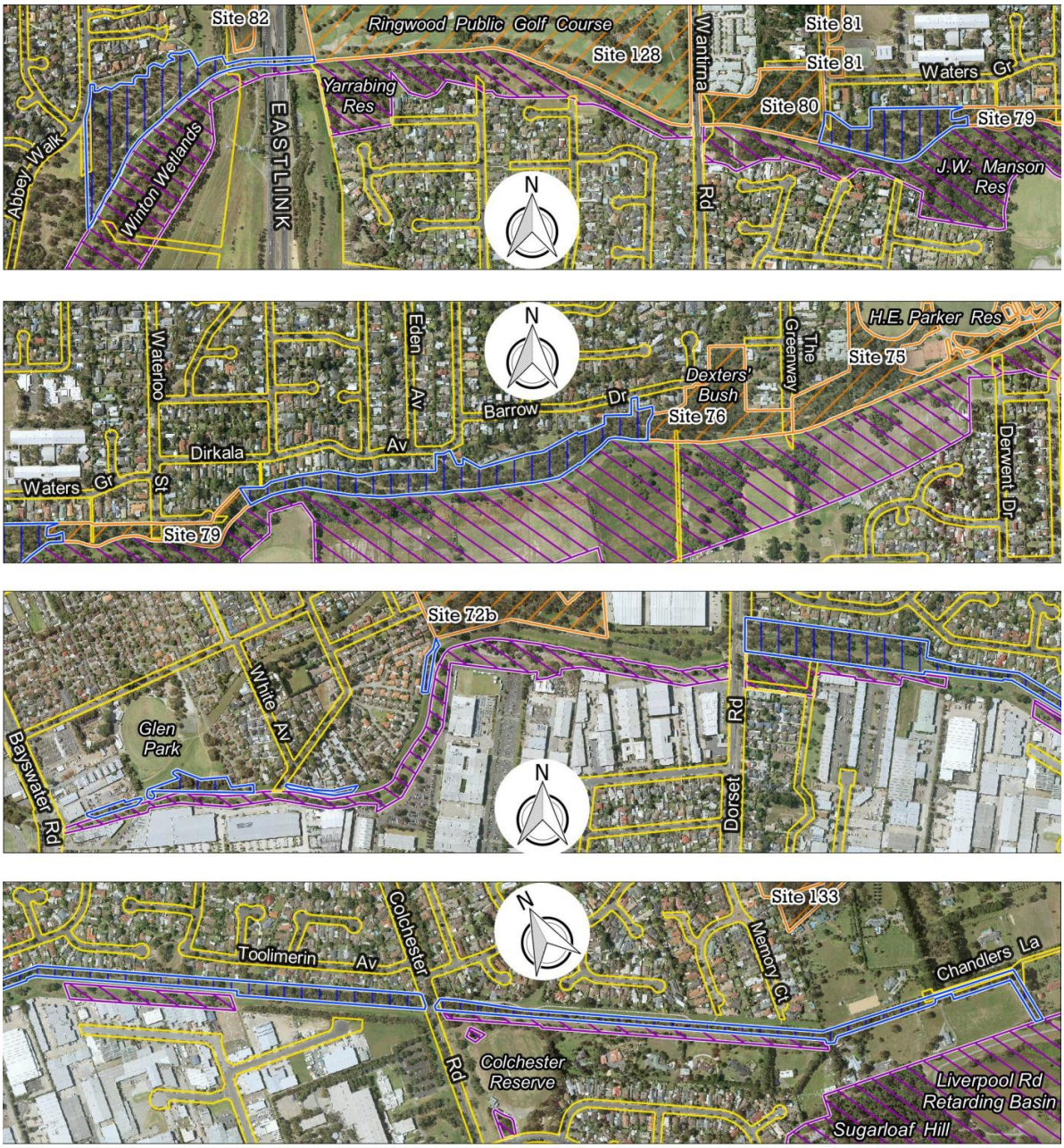
The analysis above draws on the following sources of information about the site:

- 2½ hours of ecological survey of the whole road verge and a small part of the golf course for this study on 29/7/18, including: (a) compiling a list of indigenous plant species (including mosses and liverworts) in each of six parts of the site; (b) documenting and mapping the details of rare or scarce plants; (c) incidental fauna records; and (d) checking for any other features relevant to this report;
- An inspection of part of the golf course with members of its management team on 8/10/12, during which a list of indigenous, vascular plant species was compiled;
- eBird records by Ron Willemsen on 4/10/19;
- 'Birdline Australia' records by David Spicer between 24/3/10 and 5/3/14;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the site included fieldwork by the present author on 29/3/96 and 27/10/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the Atlas of Living Australia or the Victorian Biodiversity Atlas. Note that the state government's mapping of Ecological Vegetation Types in the site is incorrect.

Site 69. Dandenong Creek Corridor Links

Biological Significance Level: *State* in parts due to endangered vegetation types;
Local elsewhere due to locally threatened plants and as a habitat corridor



The right edge of top map overlaps the left edge of the second, and the same for the third map overlapping the fourth. There is a gap of 870 m between the second and third maps. The aerial photographs were taken in February 2017.

Legend

Roads
Site 69
Other sites in Maroondah
Sites in Knox

1:12000
0 100 200 300 400 500 m

Boundaries

Site 69 comprises the nine polygons with blue outlines and hatching on the aerial photographs on the previous page. Most polygons are bounded on one side by the municipal boundary between Maroondah and Knox. In most cases, the abutting land on the Knox side is recognised as a site of biological significance by Lorimer (2010) and in the Knox Planning Scheme. The boundaries of Site 69 that do not coincide with the municipal boundary are drawn to approximate the edge of native vegetation, rounded out slightly in some cases to coincide with property boundaries. The site does not extend into private land.

Some parts of the boundary can be seen in more detail in the aerial photographs of abutting sites: Site 72b (p. 562), Site 73 (p. 568), Site 76 (p. 596), Site 79 (p. 607), Site 80 (p. 613) and Site 82 (p. 627).

As with all sites in this volume, the precise site boundaries are available in a shapefile for geographic information systems.

Land use & tenure

The land is all public land; specifically, drainage reserve, council reserves and a narrow strip of the road reserve of Chandlers Lane in Kilsyth South. Apart from the road reserve, land in the site is variously Crown land or owned by Maroondah City Council or (in small areas) Knox City Council. The bed and banks of Dandenong Creek come under the management authority and responsibility of Melbourne Water. The rest of the land is managed in varying proportions by Melbourne Water and Maroondah City Council.

Site description

Site 69's nine polygons total 17.7 hectares in area and extend 8.8 km in a straight line between where Dandenong Creek enters Maroondah and where it exits. The entry is in Kilsyth South at the outlet from the Liverpool Road Retarding Basin. The exit is in Vermont near Abbey Walk.

The site's polygons provide habitat links between sites that are in better ecological condition than Site 69 and generally broader. Some sections of Site 69 are of State significance, even if considered in isolation; others are significant only for their role in encouraging movement of wildlife, pollen and seeds along the Dandenong Creek corridor.

Dandenong Creek, itself, no longer follows a natural course anywhere in Maroondah. By 1970, the whole of the natural channel had been replaced by a piecewise-straight drain.

Much of the drain is in the form of a 'barrel drain': an underground pipe that carries the creek's base flow, a surface channel to carry floodwater, and regularly spaced pits that connect the pipe to the channel. The channel is mostly kept mown and the pits cause the channel to dry up rapidly after rain. Consequently, these sections of the creek carry very few indigenous plants or animals, so they are omitted from Site 69. However, patches and strips of revegetation alongside the barrel drains are included in Site 69 because of the likelihood that the vegetation encourages some birds and flying insects to move along the corridor.

For 1.6 km at the upstream end of Site 69, there is a channel over 75 years old (as it can be seen on a 1945 aerial photograph). The channel is too steep-sided to be mown and it does not have drainage pits to dry the channel out rapidly. As a result, a range of indigenous and introduced plant species of stream banks and wetlands can be found, including trees. shrubs, climbers, creepers, ferns and wetland plants. Among the shrubs and climbers are the last wild plants of Hemp Bush (*Gynatrix pulchella*) and Forest Bindweed (*Calystegia marginata*) in Maroondah. The contrast with the barrel-drain sections of the creek is stark.

In 2018, the problems of barrel drains led to Melbourne Water 'daylighting' an 830-metre length of pipe within Sites 74 & 75. 'Daylighting' involves digging out the low-flow pipe and constructing a new, deeper, meandering channel to carry the creek's flow. The consequences for the water table and its dependent flora and fauna are unknown.

Further downstream, there is a perennial flow of water because there is no low-flow pipe. Hardy water-birds such as Wood Ducks and Pacific Black Ducks abound there. Rarer birds such as the Buff-banded Rail can also be seen sometimes. The banks are populated with a stable mixture of sparse indigenous plants

(e.g. *Persicaria* species) and abundant introduced plants such as Kikuyu (*Cenchrus clandestinus*) and Wandering Trad (*Tradescantia fluminensis*). Beyond the channel, there is a patchy cover of remnant trees and planted trees – indigenous and Australian native. Some patches also have planted shrubs and occasionally planted indigenous groundcover. Naturally-occurring indigenous understorey is scarce but patches can be seen near the footbridge between Abbey Walk and Winton Wetlands.

Across the whole site, this study's non-exhaustive botanical survey detected sixty naturally-occurring, indigenous plant species.

Relationship to other land

The landscape context of Site 69 should be considered in conjunction with other habitat on both sides of the Maroondah / Knox municipal boundary, which follows Dandenong Creek. Knox's sites of biological significance are shown with purple outlines and hatching on the aerial photographs on p. 530 and are described in detail by Lorimer (2010). If not for the two municipal councils' separate administration of land use, most sites that adjoin across the municipal boundary would be merged.

The aerial photographs show that Site 69 and some of Knox's sites of biological significance link many other sites of biological significance in Maroondah, which are shown with orange outlines and hatching. Those other Maroondah sites contain habitat in better ecological condition than Site 69 and most of them are not as narrow. They represent 'nodes' along the Dandenong Creek corridor. Site 69 facilitates movement of birds, flying insects and other mobile fauna between the nodes. The fauna sometimes carries pollen or seeds, improving the viability of the affected plants.

In addition, the habitat of Site 69 is important for some fauna to move over larger distances than the size of Maroondah. As an extreme example, Shortfin Eels found in The Basin migrate there from their spawning ground in the Coral Sea to the Dandenong Ranges via Dandenong Creek and hence via Site 69. The eels must then retrace the migration to spawn.

The *'Maroondah Habitat Corridor Strategy'* (Context 2005) gives the Dandenong Creek corridor a 'Very high relative corridor conservation priority'.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation composition below include only the more abundant of the naturally-occurring, indigenous plant species except where stated otherwise. 'EVC' means 'Ecological Vegetation Class'.

Riparian Forest (EVC 18, **'Vulnerable'** in the Gippsland Plain bioregion). This EVC has been heavily modified in Site 69 by engineering works – particularly the straightening and barrel-draining of Dandenong Creek. It now functions more like Swampy Riparian Woodland and the presence of remnant Manna Gums (*Eucalyptus viminalis*) is the only clear distinction between the two. However, Manna Gums also extend into the Herb-rich Foothill Forest near Dexters Bush (Site 76) and the Simpsons Court Escarpment (Site 79).

Herb-rich Foothill Forest (EVC 23, **Vulnerable** in the Gippsland Plain bioregion)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) followed by Manna Gum (*E. viminalis*) or Narrow-leaved Peppermint (*E. radiata*).

Lower trees: Dominated variously by Silver Wattle (*Acacia dealbata*), Cherry Ballart (*Exocarpos cupressiformis*) or Blackwood (*A. melanoxylon*).

Medium to large shrubs: Greatly depleted, the most abundant species being Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*), Yarra Burgan (*Kunzea leptospermoides*) and Victorian Christmas-bush (*Prostanthera lasianthos*).

Small shrubs: None seen in this study.

Shrubby herbs: Fireweeds (*Senecio* species) are present in widely varying abundance.

Ferns: Austral Bracken (*Pteridium esculentum*) is the only fern species detected.

Climbers: None seen in this study.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is the only species recorded in this study.

Grasses, rushes and sedges: The most abundant indigenous species are Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*) and Clustered Wallaby-grass (*Rytidosperma racemosum*).

Other groundcover: Very scarce but Trim Sun-orchid (*Thelymitra* ?*peniculata*) and Slender Onion-orchid (*Microtis parviflora*) have been recorded.

Swampy Riparian Woodland (EVC 83, **Endangered** in the Gippsland Plain bioregion)

Dominant canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*), followed by Mealy Stringybark (*Eucalyptus cephalocarpa*).

Lower trees: Dominated by Swamp Paperbark (*Melaleuca ericifolia*) and Blackwood (*Acacia melanoxylon*); also with substantial numbers of Hazel Pomaderris (*Pomaderris aspera*) in the more natural areas.

Medium to large shrubs: Introduced shrubs have replaced most of the indigenous shrubs. The most abundant of the latter is Hemp Bush (*Gynatrix pulchella*), followed by Large Kangaroo Apple (*Solanum laciniatum*).

Small shrub: None recorded.

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) and Cotton Fireweed (*S. quadridentatus*) are scattered thinly, mainly in the eastern quarter of the site.

Ferns: Austral Bracken (*Pteridium esculentum*) forms extensive, dense patches.

Climbers: Forest Bindweed (*Calystegia marginata*) is fairly abundant in the most natural areas, which are in the eastern quarter of the site.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is fairly abundant on the banks and Angled Lobelia (*Lobelia anceps*) is moderately common in depressions in the channel in the uppermost 500 m of the site.

Grasses, rushes and sedges: Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Common Reed (*Phragmites australis*) dominate the grassy species of the banks. Tall Sedge (*Carex appressa*) dominates sections of the creek bed, where Green Rush (*Juncus gregiflorus*) is also fairly abundant.

Other groundcover: In the upper reaches, the creek supports large numbers of Slender Knotweed (*Persicaria decipiens*) and Lesser Joyweed (*Alternanthera denticulata*), as well as substantial numbers of Water Plantain (*Alisma plantago-aquatica*).

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion)

Canopy trees: Dominated by Swamp Gum (*Eucalyptus ovata*). Mealy Stringybark (*E. cephalocarpa*) and Narrow-leaved Peppermint are also present.

Swamp Paperbark (*Melaleuca ericifolia*) forms a patch of scrub at the site's western end as a result of regrowth following clearing, where eucalypts have not regenerated well.

Lower trees: Patchy, but the following species are fairly abundant overall: Silver Wattle (*Acacia dealbata*), Black Wattle (*A. mearnsii*), Blackwood (*A. melanoxylon*), Cherry Ballart (*Exocarpos cupressiformis*) and Swamp Paperbark (*Melaleuca ericifolia*).

Medium to large shrubs: Greatly depleted. The only species present in substantial numbers is Prickly Currant-bush (*Coprosma quadrifida*).

Small shrubs: None seen.

Shrubby herbs: Cotton Fireweed (*Senecio quadridentatus*) was scattered thinly at the time of this study's survey but numbers will fluctuate greatly from year to year.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches.

Climber: None seen.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is scarce.

Grasses, rushes and sedges: The most abundant indigenous species are Veined Spear-grass (*Austrostipa rudis*), Thatch Saw-sedge (*Gahnia radula*), Hollow Rush (*Juncus amabilis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Common Reed

(*Phragmites australis*), Common Bog-rush (*Schoenus apogon*) and a sword-sedge intermediate between *Lepidosperma elatius* and *L. laterale*. However, the groundcover in much of the site is dominated by introduced grasses.

Other groundcover: Severely depleted. In this study, the only species found in significant numbers were Robust Willow-herb (*Epilobium billardiereanum* subsp. *intermedium*) and Hairy Willow-herb (*Epilobium hirtigerum*).

Wetland (EVC 74, **Endangered** in the Gippsland Plain bioregion)

Woody plants: Swamp Paperbark (*Melaleuca ericifolia*) grows around the edges of some of the wetlands.

Climbers: None.

Ferns: None.

Creepers: None.

Scramblers: Lesser Joyweed (*Alternanthera denticulata*) and Slender Knotweed (*Persicaria decipiens*) are fairly abundant in the more natural wetland depressions. Angled Lobelia (*Lobelia anceps*) is rather localised.

Grasses, rushes and sedges: Some of the wetland depressions are dominated by Common Reed (*Phragmites australis*). Hollow Rush (*Juncus amabilis*), Green Rush (*J. gregiflorus*) and Common Bog-rush (*Schoenus apogon*) are fairly abundant. Tall Sedge (*Carex appressa*) is abundant in at least one wetland but probably only due to planting.

Other: Common Cudweed (*Euchiton involucratus*) is fairly abundant in a wetland near Abbey Walk. Common Duckweed (*Lemna disperma*) was dense on a small wetland at the site's eastern end during this study's inspection but that species is notable for its boom-bust populations.

Stream channel (no EVC is recognised by the Victorian Government)

Woody plants: Occasional patches of Swamp Paperbark (*Melaleuca ericifolia*) extend into the channel of Dandenong Creek from the adjacent vegetation. Otherwise, only scattered introduced trees (Desert Ash and willows) occur in the channel.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Site 69 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Blechnum cartilagineum* (Gristle Fern) – recorded in 1996 upstream of the dead end of Chandlers Lane, Kilsyth South, but not detected in subsequent flora surveys;
- *Calystegia marginata* (Forest Bindweed) – fairly abundant upstream from a point 325 m west of Colchester Road – the only known occurrence in Maroondah;
- *Carex gaudichaudiana* (Fen Sedge) – a substantial patch just upstream of the bend where Dandenong Creek meets Chandlers Lane. The only other records from Maroondah this century are at Eastfield Park (Site 61), the Healesville Freeway Reservation (Site 64), the Little Bungalook Creek floodplain (Site 72a) and Scott Street Reserve in Heathmont (Site 80);
- *Gynatrix pulchella* (Hemp Bush) – at least twenty wild individuals grow upstream from a point 325 m west of Colchester Road. With the possible exception of eight plants on Brushy Creek in Site 56 (which may have been planted), the Dandenong Creek corridor has the only remaining wild population of the species in Maroondah;
- *Muellerina eucalyptoides* (Creeping Mistletoe) – recorded in 1995 at an uncertain location within Site 69 but not detected in this study;
- *Polystichum proliferum* (Mother Shield-fern) – recorded in 1996 upstream of the dead end of Chandler Lane, Kilsyth South, but not detected in subsequent flora surveys;
- *Potamogeton crispus* (Curly Pondweed) – scattered sparsely in sections of the creek which carry a perennial flow of water above ground. The only other records on the species in Maroondah this century

are at the former Croydon District Golf Club (in a wetland since filled in), the Andersons Creek East Branch reserve (Site 9) and the Croydon Library pond (Site 135); and

- *Senecio minimus* (Shrubby Fireweed) – scattered thinly in the eastern quarter of the site. Roughly a dozen were seen in this study but the species is known for its large population fluctuations.

Significant fauna

The following fauna species seen in Site 69 are rare in Maroondah:

- Buff-banded Rail – one individual was inadvertently flushed from a weedy, shallow depression immediately downstream of Eastlink during this study;
- Sacred Kingfisher – one bird was reported near Abbey Walk by David Fleming via eBird on two days in December 2017;
- Striated Pardalote – one bird was reported near Abbey Walk by David Fleming via eBird on 8/8/14;
- Golden-headed Cisticola – one bird near Barrow Drive reported via eBird on 4/11/18. The bird's principle habitat would be on the southern side of the creek, in open country with blackberry patches;
- Flame Robin – one bird was reported near Abbey Walk by David Fleming via eBird on 2/8/14;
- Striped Marsh Frog – reported near Abbey Walk several times by Anthony Bigelow via the Melbourne Water Frog Census in 2017.

Fauna habitat

- The creek channels provide habitat for hardy fish, aquatic invertebrates and waterbirds;
- The wetlands and depressions provide habitat for waterbirds, frogs and aquatic invertebrates, including yabbies. The frogs and invertebrates are a source of prey for other fauna. The abovementioned Buff-banded Rail highlights the value that even small, weedy wetlands can have for uncommon species;
- The structure and composition of the more natural areas of vegetation represent basic habitat for forest birds, bats, possums, lizards, frogs and invertebrates;
- Some of the site's trees have trunk diameters greater than the state government's benchmark for 'large trees'. Such trees are highly regarded as fauna habitat;
- Tree hollows provide roost sites or nest sites for some animals, including bats;
- A small number of logs provide cover for invertebrates and small terrestrial vertebrates (e.g. lizards and frogs);
- The role of the site as a habitat corridor greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the following areas fall into rating 'C' (fair):

- Approximately 2 ha of the creek channel and its banks upstream of 40 Toolimerin Avenue, Bayswater North;
- Approximately 0.2–0.3 ha of forest between Dexters' Bush (Site 76) and the Simpson Court Escarpment (Site 79); and
- Approximately 0.5 ha of forest and wetland downstream of Heatherdale Creek, near Abbey Walk.

The site's remaining 15 ha falls into rating 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State in parts; Local elsewhere

Regionally threatened Ecological Vegetation Class

The Swampy Riparian Woodland immediately west of Colchester Road meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Swampy Riparian Woodland is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that that part of the site meets standard criterion 3.2.3 for a site of **State** significance.

It is possible that the Swampy Riparian Woodland in the 200-metre stretch extending upstream from near Memory Court, Kilsyth South, meets the same criterion for State significance. A more detailed assessment would be required to confirm or correct that impression.

In the site's far west (in Vermont), there is a fenced enclosure and abutting native vegetation to its south, all with at least 10% native understorey cover. The vegetation is Swampy Woodland, which is another 'endangered' EVC. A careful measurement would need to be taken to determine whether the area is slightly less than the threshold of 0.25 ha or slightly more. If the area is at least 0.25 ha (as seems likely), it meets the same criterion as above for a site of State significance.

Rare or threatened plant species

Referring to the section above headed 'Significant plants', Site 69's populations of *Calystegia marginata* (Forest Bindweed), *Carex gaudichaudiana* (Fen Sedge), *Gynatrix pulchella* (Hemp Bush), *Potamogeton crispus* (Curly Pondweed) and *Senecio minimus* (Shrubby Fireweed) each fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

As discussed above, Site 69 acts as a habitat corridor, linking numerous other sites. The *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives it a 'very high corridor conservation priority'. Consequently, Site 69 fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords **Local** significance to such a site.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Swampy Riparian Woodland and Swampy Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit immediate neighbours as well as users of the Dandenong Creek Trail and the reserve at 191 Heatherdale Road, Vermont. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creek and wetlands helps to stabilise the creek bed and bank and remove water pollution.

As explained in Section 1.3 of Volume 1, there is good evidence that people's health, wellbeing, quality of life and childhood development benefit from exposure to nature. Therefore, Site 69's natural ambience is expected to bring such benefits to people making use of the site. That may be particularly important for the scouts whose hall abuts the site at 14a Barrow Drive, Heathmont, as nature helps the development of children's minds. The natural ambience also encourages people to get exercise by walking or running through the site.

Some of the benefits of nature are spread into surrounding areas by birds, butterflies and other animals moving out of the site into neighbouring streets and gardens.

The site's location along a major stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

While the members of the First Friends of Dandenong Creek provide ecological benefits to the site's habitat, the site reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The site's vegetation contributes to Maroondah's 'green and leafy' character. It also preserves something of Dandenong Creek's natural landscape and wildlife, thereby helping to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Based on aerial photographs from 2001 and 2017, there was an increase of roughly 1 ha in the extent of native vegetation over that period due to the spreading of eucalypt crowns over abandoned pasture. A much smaller increment has arisen through revegetation. No significant losses of native vegetation are discernible.

Change in the ecological condition of habitat

Since 1996, there has been a substantial deterioration of the north-south-oriented segment of the site in Kilsyth South between the Liverpool Road Retarding Basin and Chandlers Lane. In 1996, the present author's field notes recorded that this stretch 'for c. 50–100 m downstream of the Liverpool Road Retarding Basin has good stands of *Gynatrix pulchella* and *Calystegia marginata* [both rare species in Maroondah] under good cover of *Eucalyptus ovata*'. The *Gynatrix*, *Calystegia* and several other indigenous plant species have now gone, replaced by environmental weeds and a dirt-bike track that is mostly located on an adjacent property. The formerly good cover of *Eucalyptus ovata* is now quite thin. Some of the losses appear to have been caused by herbicide spraying.

The section of the site beside Chandlers Lane has also lost a number of indigenous plant species.

Aerial photographs from 2001, 2011 and 2017 show that a substantial number of eucalypts died between 2001 and 2017. The same can be said for most of the sites in this volume but an unusual feature in this case is that most of the deaths occurred since 2011, not during the Millennium Drought.

There is too little information to draw further inferences about changes to the site.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;

- Loss of indigenous plant species and their dependent fauna due to drying of the floodplain and wetlands during prolonged, severe droughts. Droughts are predicted to become more severe and frequent as a result of climate change;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna;
- Displacement of indigenous flora and fauna by environmental weeds such as Blackberry, Monterey Pine and Wandering Trad; and
- Worsening of the extremes of low and high creek flows, which is expected to be a consequence of climate change and possibly further urbanisation of the catchment;
- Water pollution, affecting vegetation, aquatic invertebrates, fish, frogs and waterbirds;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Removal of native vegetation throughout Site 69 is controlled under the Vegetation Protection Overlay (VPO) and the state-wide baseline planning controls of clause 52.17 of the Victoria Planning Provisions. The VPO also covers parts of the creek corridor that are not assessed here as being of biological significance.

In addition, the Significant Landscape Overlay requires a permit for the removal of native or introduced canopy trees (subject to exemptions) in these stretches: (a) between Sites 76 and 80; (b) from Dorset Road to Colchester Road; and (c) in the easternmost 430 m of the site.

Consistent with the discussion of planning controls in Section 11.1.2 of Volume 1, it is recommended to remove the VPO entirely and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 69 as mapped on p. 530. The application of the Environmental Significance Overlay will provide consistency with the other side of the municipal boundary, where it already applies to the areas shown hatched in purple on the aerial photograph on p. 530.

It would be open to Maroondah City Council to expand the area covered by ESO1 to provide a simpler boundary, as was done with the existing VPO. Areas with no native vegetation would be affected very little by ESO1, if at all.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of approximately 1½ days of ecological survey for this study during the period 10/2/18 to 12/1/20, including: (a) compiling lists of indigenous plant species and their abundances; (b) documenting the details of rare plants and large eucalypts; (c) mapping the vegetation and rare plants; and (d) checking for other attributes of the site relevant to the standard criteria for assessing biological significance;
- Melbourne Water Frog Census observations, principally by Anthony Bigelow, during 2017–2019;
- eBird records from numerous contributors, mostly since 2014;
- Birds Australia records obtained *via* the Victorian Biodiversity Atlas;
- Lorimer G.S. (2010). *'Sites of Biological Significance in Knox'*, 2nd edition, by G.S. Lorimer. Although this report was written for Knox City Council, it includes information relevant to the Maroondah side of Dandenong Creek;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork by John C. Reid and the present author in December 1995 to March 1996. The fieldwork included: (a) compilation of nine plant lists (without abundance data) for different areas or types of vegetation; (b) a 20-minute bird census; and (c) incidental observations of frogs, birds and butterflies;

- *'Vegetation Survey of Linear Reserves – A Management Strategy for Riparian and Floodplain Vegetation'* by J.C. Reid, H. Moss and G.S. Lorimer, dated September 1997. Although this report was written for Knox City Council, it includes data and analysis of the Dandenong Creek corridor on both the Knox and Maroondah sides of the creek; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

Note that the state government's mapping of current-day and pre-European vegetation types in Site 69 is unreliable, as it has been based on inferences rather than actual flora data and it has evidently not been ground-truthed. Importantly, it overlooks Riparian Forest, it assumes the current-day course of Dandenong Creek is the natural course, and it takes no account of changes in vegetation that have resulted from the fallen water table caused by barrel-draining.

Site 70. Appletree Hill Reserve, Kilsyth South

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundaries, land use and tenure

Site 70 occupies the whole of Appletree Hill Reserve, Kilsyth South. The site boundaries (shown in mid-blue above) coincide with boundaries of parcels of land. Between the two yellow curves that run through the site, the land is officially a municipal drainage reserve. The rest of the site is designated as a municipal recreation reserve. However, the distinction is misleading because the floodway for Little Bungalook Creek passes more through the 'recreation reserve' than the drainage reserve. The area south and east of the fence marked on the aerial photograph is managed for nature conservation.

General description

Site 70 occupies 3.7 hectares on the floodplain of Little Bungalook Creek. Within the site, 2.7 hectares contain native vegetation.

For some decades up to the 1990s, the site was at the edge of an apple orchard. A 'turkey nest' dam that irrigated the orchard remains as a relic of that era. The dam (marked on the aerial photograph above) supports a range of indigenous flora and fauna. As well as wild waterbirds, frogs and aquatic invertebrates, the dam supports fish (Redfin and Mosquitofish) that have been released into it.

Although the vegetation surrounding the dam was somewhat modified during the orchard era, the fenced area shown on the aerial photograph retains a good range of plant species typical of more natural examples of the endangered Ecological Vegetation Class (EVC) called Swampy Woodland. Some of the indigenous plant species there are unique in Maroondah and for some distance beyond.

To the north of the fenced area, the aerial photograph above shows that Little Bungalook Creek no longer exists as a creek but rather as an underground pipe with a mown-grass floodway above. The excavations that caused that transformation occurred in 1995–1996, leaving some vestiges of native vegetation beside the floodway. Those vestiges have regenerated to form the patches of tree cover seen lining the floodways on the aerial photograph. Kangaroo Grass (*Themeda triandra*) and non-indigenous grass species were sown along and beside the floodways and are kept mown.

More recently, mulched garden beds have been revegetated with indigenous species along the reserve's frontage with Watermoor Avenue, building on the few pre-existing wild Swamp Gums (*Eucalyptus ovata*) growing there.

There has also been a substantial amount of 'enrichment planting' of indigenous plants within the fenced area, with a focus on locally threatened species that require soil that is normally sodden in the wetter months and quite dry in summer and autumn.

Across the whole reserve, this study detected eighty-one naturally-occurring, indigenous plant species.

Relationship to other land

As can be seen on the aerial photograph on the previous page, Appletree Hill Reserve abuts Site 68 (Eastwood Golf Course) and Site 133 (9 Lillypilly Lane). Sites 66, 67 and 95 are contiguous with Site 68. The important wildlife corridor of Dandenong Creek (Site 69) lies 260 m to the south – see the key map on p. 1.

The ecological values of Appletree Hill Reserve benefit from the buffering provided by the habitat on Sites 68 and 133.

There is very little tree cover in the area other than within these sites and some Swamp Gums on a few properties along Lillypilly Lane.

For tree-dependent bird and insect species, Sites 70 and 133 represent a single patch of tree cover of approximately 4½ ha. That is regarded as large enough to act as an ecological stepping-stone for tree-dependent birds and insects to move between the Dandenong Creek habitat corridor and Sites 66–68.

Birds and flying insects flying between the sites are likely to carry pollen and seeds, improving the viability of the indigenous flora.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation below include only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion), in part tending toward Swamp Scrub due to regeneration after past clearing

Canopy trees: A pure stand of Swamp Gum (*E. ovata*).

Lower trees: Moderately dense, dominated in different areas by Blackwood (*Acacia melanoxylon*), Cherry Ballart (*Exocarpos cupressiformis*) or Swamp Paperbark (*Melaleuca ericifolia*). There is also a single, large Silver Wattle (*A. dealbata*).

Medium to large shrubs: Mostly dense but with some sparse patches. Dominated by Prickly Currant-bush (*Coprosma quadrifida*) and Hop Goodenia (*Goodenia ovata*). The following species are widespread in the site or fairly abundant: Prickly Moses (*A. verticillata*), Pale-fruit Ballart (*Exocarpos strictus*), Manuka (*Leptospermum scoparium*), Tree Everlasting (*Ozothamnus ferrugineus*) and Large Kangaroo Apple (*Solanum laciniatum*). The following species are scarce or highly localised: Hop Wattle (*Acacia stricta*), Sifton Bush (*Cassinia sifton*) and Indian Weed (*Sigesbeckia orientalis*).

Small shrubs: There is a single Wiry Bush-pea (*Almaleea subumbellata*).

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) is fairly abundant inside the fence and Cotton Fireweed (*Senecio quadridentatus*) is fairly abundant outside. Numbers of both species are likely to fluctuate from year to year.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over a substantial area.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is fairly abundant. Twining Silkpod (*Parsonsia brownii*) – a recent arrival to Maroondah – is smothering many other species in part of the fenced area. Downy Dodder-laurel (*Cassytha pubescens*) and Small-leafed Clematis (*Clematis decipiens*) are very scarce.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is abundant and Angled Lobelia (*Lobelia anceps*) fairly abundant. The following species are scarce or highly localised: Centella (*Centella cordifolia*), Kidney-weed (*Dichondra repens*), Ivy-leaf Violet (*Viola hederacea*) and the wood-sorrel, *Oxalis exilis/perennans*. Lanky Goodenia (*Goodenia elongata*) was recorded in 1996 but could not be found in this study.

Grasses, rushes and sedges: Abundant and rich in species, creating a rather dense, tough, wiry ground-flora. Dominated variously by Red-fruit Saw-sedge (*Gahnia sieberiana*), Tall Sword-sedge (*Lepidosperma elatius*), Pithy Sword-sedge (*L. longitudinale*) or Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*). Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Weeping Grass (*Microlaena stipoides*) are widespread and fairly abundant. The following species are somewhat less abundant: Short-stem Sedge (*Carex breviculmis*), Hooker Fescue (*Hookerochloa hookeriana*), Common Tussock-grass (*Poa labillardierei*), Slender Tussock-grass (*Poa tenera*), Clustered Wallaby-grass (*Rytidosperma racemosum*), Common Bog-rush (*Schoenus apogon*) and Kangaroo Grass (*Themeda triandra*). The following species are scarce or highly localised: Soft Twig-rush (*Baumea* ?*rubiginosa*), Square Twig-rush (*Baumea tetragona*), Blady Grass (*Imperata cylindrica*), Hollow Rush (*Juncus amabilis*), Austral Rush (*J. australis*), Green Rush (*J. gregiflorus*), Pale Rush (*J. pallidus*), Loose-flower Rush (*J. pauciflorus*), Tall Rush (*J. procerus*), Finger Rush (*J. subsecundus*), Variable Sword-sedge (*Lepidosperma laterale*), Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*), Soft Tussock-grass (*Poa morrisii*), Slender Wallaby-grass (*Rytidosperma penicillatum*) and Tasmanian Wallaby-grass (*R. semiannulare*).

Other groundcover: Mosses are abundant and rich in species, the most abundant being Heath Star Moss (*Campylopus introflexus*). Tasman Flax-lily (*Dianella tasmanica*) and Common Raspwort (*Gonocarpus tetragynus*) are fairly abundant. No other species were found in this study (in March) but some are likely to be found at other times of the year.

Farm dam (No EVC or conservation status applicable)

Trees and shrubs: Absent.

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) was fairly abundant at water's edge during this study but numbers will fluctuate with rising and falling water.

Grasses, rushes and sedges: The true aquatic species, Tall Spike-rush (*Eleocharis sphacelata*) and the cumbungi, *Typha orientalis*, each dominate part of the dam. Amphibious species are abundant and rich in species. Parts of the shore is dominated by Tall Rush (*Juncus procerus*). The following species are fairly abundant: Tall Sedge (*Carex appressa*), Slender Joint-leaf Rush (*Juncus fockei*), Broom Rush (*Juncus sarophorus*) and Common Blown Grass (*Lachnagrostis filiformis*). Hollow Rush (*Juncus amabilis*) and Green Rush (*Juncus gregiflorus*) were scarce at the time of this study's survey but they, and other rushes, are likely to be more abundant at other times.

Other Amphibious species: Slender Knotweed (*Persicaria decipiens*) is co-dominant around part of the dam's fringe. Lesser Joyweed (*Alternanthera denticulata*) is abundant; Waterwort (*Elatine gratioloides*) and Water-pepper (*Persicaria hydropiper*) somewhat less so.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Appletree Hill Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Baumea* ?*rubiginosa* (Soft Twig-rush) – a patch 3 m long and 1 m wide grows near the top of the dam embankment near its northwest corner. No fertile material was available for definite identification during this study. If confirmed, this would be the last known occurrence in Maroondah;
- *Baumea tetragona* (Square Twig-rush) – Maroondah's last known plant of the species grows on the lower outer slope of the dam embankment near its northeast corner;
- *Empodisma minus* (Spreading Rope-rush) – recorded in 1996 (without an indication of abundance) but not found in this study, perhaps due to obscuration by dense undergrowth;
- *Goodenia elongata* (Lanky Goodenia) – as above;
- *Goodia lotifolia* (Golden Tip) – the only natural plant of the species ever recorded in Maroondah was in this site until it was destroyed by the barrel-draining of Little Bungalook Creek in 1995 or 1996. Quite a few are now present due to planting;
- *Hookerochloa hookeriana* (Hooker Fescue) – over forty individuals were counted in this study, widespread north of the dam in the fenced area (and one to the east of the dam);
- *Lepidosperma longitudinale* (Pithy Sword-sedge) – a remarkable, dense, thriving patch covering tens of square metres grows north of the dam. The closest record is 11 km away on sand at Lysterfield Park and all other records in the Melbourne area are on the sand belt in heathy wetlands;
- *Poa tenera* (Slender Tussock-grass) – fairly abundant. Of the seven other locations where this species was found in this study, six of them had only a few plants at most;
- *Senecio minimus* (Shrubby Fireweed) – abundant and widespread in the site at the time of this study, but numbers will vary greatly over time depending on the prolonged availability of plentiful soil moisture;
- *Sigesbeckia orientalis* subsp. *orientalis* (Indian Weed) – a cluster of 26 plants was found in this study.

A non-indigenous species of scientific interest in the site is *Rytidosperma richardsonii* (Straw Wallaby-grass), which is listed as 'vulnerable' in Victoria because its natural habitat in the state is a small area near the Murray River. It is now fairly abundant on the southern bank of the floodway at Appletree Hill Reserve, where it was probably in a mix of native grass seed sown straight after Little Bungalook Creek was barrel-drained in 1996. To persist for so long, the *Rytidosperma* must have gone through multiple generations. Although it is unexpected for a threatened species to become naturalised in an area so different from its natural habitat, the seed that were sown were almost certainly of one of the unnaturally robust varieties bred by the CSIRO for commercial production.

Fauna habitat

- The dam supports waterbirds, frogs and aquatic invertebrates. The frogs and invertebrates are a source of prey for other fauna;
- The dam also provides a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat;
- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, possums and invertebrates. That habitat benefits from the fertility of the alluvium soil, which favours high production of carbohydrates by plants and hence strengthens the base of the food chain;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- Immediately south of the floodways are three large, old Swamp Gums, which are of high value as habitat trees;

- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), approximately 1 ha of the woodland north of the dam is on the borderline between rating 'A' (excellent) and 'B' (good). In the rest of the site, 1.2 ha rates 'C' (fair), 0.5 ha rates 'D' (poor) and 1.0 ha has little if any native vegetation.

The health of the eucalypt canopy is fair to good, with an average health rating of approximately 75% under the state government's 'Vegetation Quality Assessment' method. The crown health of Swamp Paperbark stems (*Melaleuca ericifolia*) over 3 m tall is mostly poor but shorter stems are in good health. Some of ill-health of eucalypts and paperbarks is probably due to the density of trees being greater than can all reach maturity.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

Swampy Woodland is an endangered EVC in the Gippsland Plain bioregion. The stand at Appletree Hill Reserve easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

The section above headed 'Significant plants' provides details of populations of plant species that fall into the 'critically endangered' category of risk of dying out in Maroondah. All of those populations except perhaps the *Empodisma* and *Goodenia* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Referring to the section above headed 'Relationship to other land', the combination of Appletree Hill Reserve and the abutting Site 133 (9 Lillypilly Lane) fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Such a site is recognised by the standard criteria as having Local significance.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Swampy Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the reserve or living in neighbouring homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The reserve's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the reserve into surrounding streets and gardens.

The reserve preserves something of the area's natural landscape. It, and the associated birds, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

The reserve's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there has been an increase in the extent of habitat in Appletree Hill Reserve by slightly over 0.1 ha during that period. The increase occurred mainly from growth of the crowns of pre-existing trees to cover ground that had no native vegetation cover. Natural and planted trees both contributed.

Change in the plant species present

Allowing for the normal variability in detection of plant species between any two flora surveys due to factors such as seasonality, there is little difference between the data from 29/3/96 and 28/3/18. The most significant difference is that the vines, *Clematis decipiens* and *Parsonsia brownii*, have colonised the reserve as part of the surprising expansion of their ranges. Although both species have long occurred naturally within a few kilometres, they did not occur in Swampy Woodland in the Melbourne area until the past decade or so. The *Parsonsia*'s rapid proliferation and smothering habitat have come to threaten the survival of some indigenous plant species in Appletree Hill Reserve.

Change in the ecological condition of habitat

The section headed 'Ecological condition' above provides a very similar assessment to the 1996 assessment of ecological condition reported by Lorimer *et al.* (1997).

Aerial photographs from 2001, 2011 and 2017 show that many eucalypts died between 2001 and 2011 and between 2011 and 2017. Eucalypt deaths and debilitation have been common in Maroondah, but in areas drier than Appletree Hill Reserve, a much higher proportion of the deaths have occurred during the Millennium Drought. A likely contributor to the deaths and debilitation at Appletree Hill Reserve is the dropping of the water table caused by the barrel-draining of Little Bungalook Creek in 1995–1996. That effect is additional to the dropping water table caused by the general draining of the area for agriculture many years prior.

Threats

This study has identified the following threats to the site's biodiversity (in no particular order):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued drying of the winter-sodden soil due to climate change, catchment land use changes and the legacy effects of Little Bungalook Creek being replaced by a barrel-drain in 1995–1996;

- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Twining Silkpod (*Parsonsia brownii*) is smothering many other species in part of the fenced area and is cause for some concern, as until recent years, the species did not occur west of the Dandenong Ranges except in the Otway Ranges; and
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. Deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

Of the three parts of the site separated by yellow curves (property boundaries) on the aerial photograph on p. 540, the southern part is zoned 'Public Conservation and Resource Zone' and the other two are zoned 'Neighbourhood Residential – Schedule 4'. Throughout the site, removal of native vegetation is regulated under the state-wide controls of clause 52.17 of the Victoria Planning Provisions as well as the Vegetation Protection Overlay (VPO).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to replace the VPO with the proposed schedule ESO1.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of approximately 6¾ hours of fieldwork by the author for this study on 28/3/18, 9/4/18 and 14/9/19, including: (a) compiling a list of indigenous and introduced plant species (including mosses and liverworts) and their abundances for each of three parts of the reserve (the dam, the fenced area and the rest); (b) documenting the details of rare or scarce plants; (c) mapping the vegetation and rare plants; and (d) recording fauna observed incidentally (25 bird species, 1 frog species, 1 reptile species, 2 fish species and 4 butterfly species);
- A pressed herbarium specimen of *Rytidosperma richardsonii* collected during the fieldwork above;
- Maroondah City Council's records of planting in the reserve;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which the fieldwork in the reserve was done on 29/3/96 and comprised: (a) compiling a list of indigenous and introduced plant species (without abundances) for each of four parts of the reserve (the dam, paperbark scrub, the rest of what is now the fenced area, and along the floodway); and (b) incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird. The state government's vegetation mapping wrongly shows Valley Heathy Forest in the north of the reserve.

Site 71. Canterbury Gardens Reserve, Bayswater North

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundaries

Site 71 comprises 2.16 hectares of native vegetation at Canterbury Gardens Reserve and its nature strip along Allambanan Drive, Bayswater North. The site boundaries (shown with dashed blue lines above) have been drawn to closely circumscribe nearly all the reserve's native vegetation.

The original version of Site 71 created by Lorimer *et al*. (1997) differed in two respects:

- It omitted the western third (approximately) of the current site because the significance of the vegetation type (Swampy Woodland) was not recognised in 1997; and
- Its boundary was chosen to follow cadastral boundaries rather than the edges of native vegetation, as a practicality in the age before geographic information systems.

Land use and tenure

The site is part of a council reserve for amenity and recreation.

General description

The reserve includes an oval, kindergarten, community house, playground, plant nursery, car park, picnic facilities, tennis courts and public toilets. These facilities hardly overlap at all with the parts of the reserve that form Site 71.

A 23-metre-wide strip just inside the reserve's northern boundary is mostly used as part of the playing fields of Bayswater North Primary School. The school has planted indigenous plants at the western edge of the strip in an effort to provide habitat for the Sword-grass Brown Butterfly, which is locally threatened or extinct.

The site is situated on the floodplain of Dandenong Creek, with an extremely slight slope of typically 1:130 draining to the west. The soil is alluvial clay loam.

The site's polygon that lies south to east of the oval contains that highest diversity and rarity of the site's plant species. The next most significant area of vegetation lies north of a footpath that skirts the northern edge of the oval. The rest of the site's vegetation has rather little natural understorey but it has a fairly natural tree canopy and parts of it contain planted indigenous understorey.

Across the whole reserve, this study detected thirty-nine naturally-occurring, indigenous plant species.

Relationship to other land

The tree canopy of Site 71 is complemented by remnant eucalypts in the grounds of Bayswater North Primary School. Otherwise, the neighbourhood has generally poor tree cover and wildlife habitat. The nearest substantial area of habitat is along the Dandenong Creek habitat corridor (Site 69), which lies approximately 220 m to the south. However, that part of the corridor is heavily modified from a natural condition, with very little indigenous understorey.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Swampy Woodland (Ecological Vegetation Class no. 937, **Endangered** in the Gippsland Plain bioregion)

Canopy trees: North of the footpath that skirts the oval's northern edge, the tree canopy comprises Mealy Stringybark (*Eucalyptus cephalocarpa*) and a few Messmate Stringybarks (*E. obliqua*). Elsewhere, there is an almost pure stand of Swamp Gum (*E. ovata*), interrupted only by three Bundy (*E. goniocalyx*) west of the tennis courts – unusual components of Swampy Woodland.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*) and Swamp Paperbark (*Melaleuca ericifolia*). Cherry Ballart (*Exocarpos cupressiformis*) is scattered and there is a single Hazel Pomaderris (*Pomaderris aspera*).

Medium to large shrubs: Greatly depleted except south and east of the oval, where Hop Wattle (*Acacia stricta*), Prickly Moses (*Acacia verticillata*), Prickly Currant-bush (*Coprosma quadrifida*), Pale-fruit Ballart (*Exocarpos strictus*) and Hop Goodenia (*Goodenia ovata*) are fairly abundant. The following species are scarce: Sweet Bursaria (*Bursaria spinosa*), Sifton Bush (*Cassinia sifton*), Tree Everlasting (*Ozothamnus ferrugineus*) and Large Kangaroo Apple (*Solanum laciniatum*). Hop Bitter-pea (*Daviesia latifolia*) and Prickly Tea-tree (*Leptospermum continentale*) were also present (but scarce) in the 1990s.

Small shrubs: None seen.

Shrubby herbs: None seen, but Cotton Fireweed (*Senecio quadridentatus*) is likely to appear from time to time.

Ferns: Austral Bracken (*Pteridium esculentum*) was present in the previous flora survey (1996) but not seen in this study.

Climbers: Downy Dodder-laurel (*Cassytha pubescens*) is fairly abundant. Common Apple-berry (*Billardiera mutabilis*) was present in 1996 but not seen in this study.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) and Kidney-weed (*Dichondra repens*) are fairly abundant. Centella (*Centella cordifolia*) and the wood-sorrel, *Oxalis exilis/perennans*, were recorded in 1996 but not in this study.

Grasses, rushes and sedges: Abundant and rich in species, including rare species. The groundcover is dominated variously by Thatch Saw-sedge (*Gahnia radula*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*) or Clustered Wallaby-grass (*Rytidosperma racemosum*). The following species are also fairly abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *australis* and subsp. *rudis*), Blady Grass (*Imperata cylindrica*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Smooth Wallaby-grass (*Rytidosperma laeve*). There are small amounts of Mat Grass (*Hemarthria uncinata*), Hooker Fescue (*Hookerochloa hookeriana*), Tall Sword-sedge (*Lepidosperma elatius*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Common Tussock-grass (*Poa labillardierei*) and Slender Tussock-grass (*Poa tenera*). Thirteen additional species were recorded in 1996. Some of them may have been overlooked in this study's brief November survey but the large and ecologically important species, Red-fruit Saw-sedge (*Gahnia sieberiana*), and several species of rush (*Juncus*), can be confidently concluded to have died out due to a reduction in soil moisture availability.

Other groundcover: Pale Flax-lily (*Dianella longifolia*), Tasman Flax-lily (*Dianella tasmanica*) and Common Raspwort (*Gonocarpus tetragynus*) are fairly abundant or widespread. Hairy Solenogyne (*Solenogyne gunnii*) is very localised. Hairy Willow-herb (*Epilobium hirtigerum*) and Small Poranthera (*Poranthera microphylla*) were recorded in 1996 and may well reappear from time to time.

Significant plants

Rare (but not otherwise threatened) in Victoria

This study's flora survey of Canterbury Gardens Reserve counted fifty-five individuals of the rare subspecies of Veined Spear-grass, *Austrostipa rudis* subsp. *australis*. Others could easily have escaped detection due to similarity with the common subspecies *rudis*. Subspecies *australis* is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Canterbury Gardens Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – an unstated number of plants was recorded in the previous flora survey (1996) but none were found in this study. The vast majority of plants of this species in Maroondah died during the Millennium Drought and have not been replaced;
- *Hookerochloa hookeriana* (Hooker Fescue) – a single individual grows in the site's southeastern corner, a remnant of a larger population observed in the 1990s. Similar declines have occurred to all of Maroondah's populations of the species due to reduced soil moisture on floodplains;
- *Poa tenera* (Slender Tussock-grass) – as for *Hookerochloa hookeriana*.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including bats;

- There are two large, old Mealy Stringybarks (*Eucalyptus cephalocarpa*) in the site's north. Such large trees are of high habitat value, particularly for nesting and roosting;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), approximately 0.07 ha southeast of the oval rates 'B' (good), 1 ha of the site rates 'C' (fair) and the remaining 1.1 ha rates 'D' (poor).

The health of the eucalypt canopy is quite variable, from good to dying.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The southeastern polygon of Site 71 easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The Ecological Vegetation Class is Swampy Woodland, which is listed as endangered in the Gippsland Plain bioregion. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of **State** significance. A more detailed assessment would be required to determine whether the vegetation north and northwest of the oval meets the same criterion.

Rare or threatened plant species

Referring to the section above headed 'Significant plants', Site 71 has a substantial population of *Austrostipa rudis* subsp. *australis*. That subspecies is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. The subspecies occurs interstate as well as Victoria. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Referring further to the 'Significant plants' section above, Site 71 has a single plant of each of the grass species, *Hookerochloa hookeriana* and *Poa tenera*. Both species fall into the 'critically endangered' category of risk of dying out in Maroondah. Those plants are remnants of substantial populations that occurred in the site until the Millennium Drought. The two plants might be deemed too few to be biologically significant, but they nevertheless represent a significant fraction of the entire Maroondah populations of the species. The fact that they have survived at all offers some small hope that the site may one day support larger populations. On balance, it appears reasonable to regard the plants as fitting the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Swampy Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and its facilities as well as people living in neighbouring homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The reserve's semi-natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of people using the reserve and its facilities. The most significant of those benefits may be to children at the kindergarten or in the playground, as nature helps the development of children's minds (Section 1.3 of Volume 1). Continuation of the indigenous tree cover into Bayswater North Primary School extends those benefits into a greater part of local children's lives.

The benefits of contact with nature are spread into surrounding areas by the movement of birds, butterflies and other animals out of the reserve into surrounding streets and gardens.

The site's vegetation adds a 'green and leafy' character to the neighbourhood. It also preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

A comparison of aerial photographs from 2001 and 2017 indicates that the average size of eucalypt crowns in Canterbury Gardens Reserve has increased significantly over that interval. As a result, many crowns around the edges of the vegetation now extend over surfaces such as lawn and car parking that had no native vegetation cover in 2001. This change represents a small increase in the extent of native vegetation, difficult to quantify.

That increase has been approximately balanced by removals of trees, which probably died. Overall, there is no clear net change in the extent of the site's native vegetation.

Change in the plant species present

As part of this study, indigenous plant species recorded in this study's flora survey of Site 71 (in 2018) were compared with the previous study (in 1996 – see Lorimer *et al*. 1997). The only clear change is the striking one that almost all the species that rely on wet soil in winter appear to have died out. They include Red-fruit Saw-sedge (*Gahnia sieberiana*), Hooker's Fescue (*Hookerochloa hookeriana*), Slender Tussock-grass (*Poa tenera*), Centella (*Centella cordifolia*) and up to five species of rush (*Juncus*). This pattern is consistent with the general conclusion from this study that most of Maroondah's plant species specially adapted to winter-wet soil have declined seriously as a result of drying soil – see Section 5.1.3 of Volume 1.

Change in the ecological condition of habitat

A comparison of the ecological condition of native vegetation in the 1996 and 2018 flora surveys must be restricted to the smaller area covered by the original version of the site. One such comparison is based on the A–D scale of ecological condition of vegetation used by Lorimer *et al*. (1997). The 1996 flora survey estimated that approximately 0.5 ha of the original version of Site 71 was borderline between categories 'B' (good) and 'C' (fair). This study's assessment (by the same author) is that at most 0.25 ha could be regarded as borderline between 'B' and 'C' in 2018. The main indicator of change is a decline in the

number of indigenous plant species, as discussed above. The 1996 survey also estimated that another 0.5 ha of the site fitted category 'C'. Perhaps as much as half of that has declined to category 'D' (poor).

The main causes of decline in ecological condition appear to be a reduction in the availability of soil moisture and the construction of a BMX bike track in c. 2010.

Aerial photographs of Site 71 from 2001, 2011 and 2017 indicate that a substantial number of eucalypts died during 2001–2011 (the Millennium Drought) and the foliage density of surviving trees appears to have declined. (The increasing resolution of aerial photographs over the years complicates the comparison of foliage densities.) These observations are consistent with native vegetation in Maroondah as a whole.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued drying of the floodplain due to climate change, increasing land use intensity in the catchment and a consequent reduction of water infiltration into the soil;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Eucalypt deaths and consequent ecological disruption to understorey and fauna.

All these threats will be most likely to materialise during droughts, which are predicted to worsen with climate change.

Strategic planning

The whole of Canterbury Gardens Reserve is zoned 'Public Park and Recreation Zone'. The nature strip of Allambanan Drive is zoned 'General Residential Zone'.

Throughout Site 71, removal, lopping and destruction of native vegetation are regulated under the state-wide baseline controls of clause 52.17 of the Victoria Planning Provisions. Within the part of the reserve that formed the original version of Site 71, the Vegetation Protection Overlay (VPO) provides additional planning control over removal, destruction and lopping of native vegetation. Schedule 4 of the Significant Landscape Overlay (SLO4) regulates removal, lopping and destruction of trees above a threshold size, regardless of whether they are native to Victoria.

As discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of State biological significance such as Site 71. It is recommended to remove the VPO entirely.

The parts of Site 71 within the road reservation of Allambanan Drive (see p. 547) only contain parts of tree crowns, which need no planning protection other than the existing SLO4 and clause 52.17 of the Victoria Planning Provisions. With that exception, the whole of the southeastern polygon of Site 71 is suited to the proposed schedule ESO1 of the Environmental Significance Overlay – see Section 11.1.2 of Volume 1. The northern polygon is also suited to ESO1 except for the part within the fence of the Arrabri nursery. For the rest of the site, no new planning controls are needed.

It would be open to Maroondah City Council to expand the area covered by ESO1 to provide a simpler boundary, as was done with the existing VPO. Areas with no native vegetation, such as the oval, would be unaffected by ESO1.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately 75 minutes of fieldwork by the author for this study on 15/11/18, including: (a) compiling lists of indigenous plant species (excluding mosses and liverworts) and their abundances –

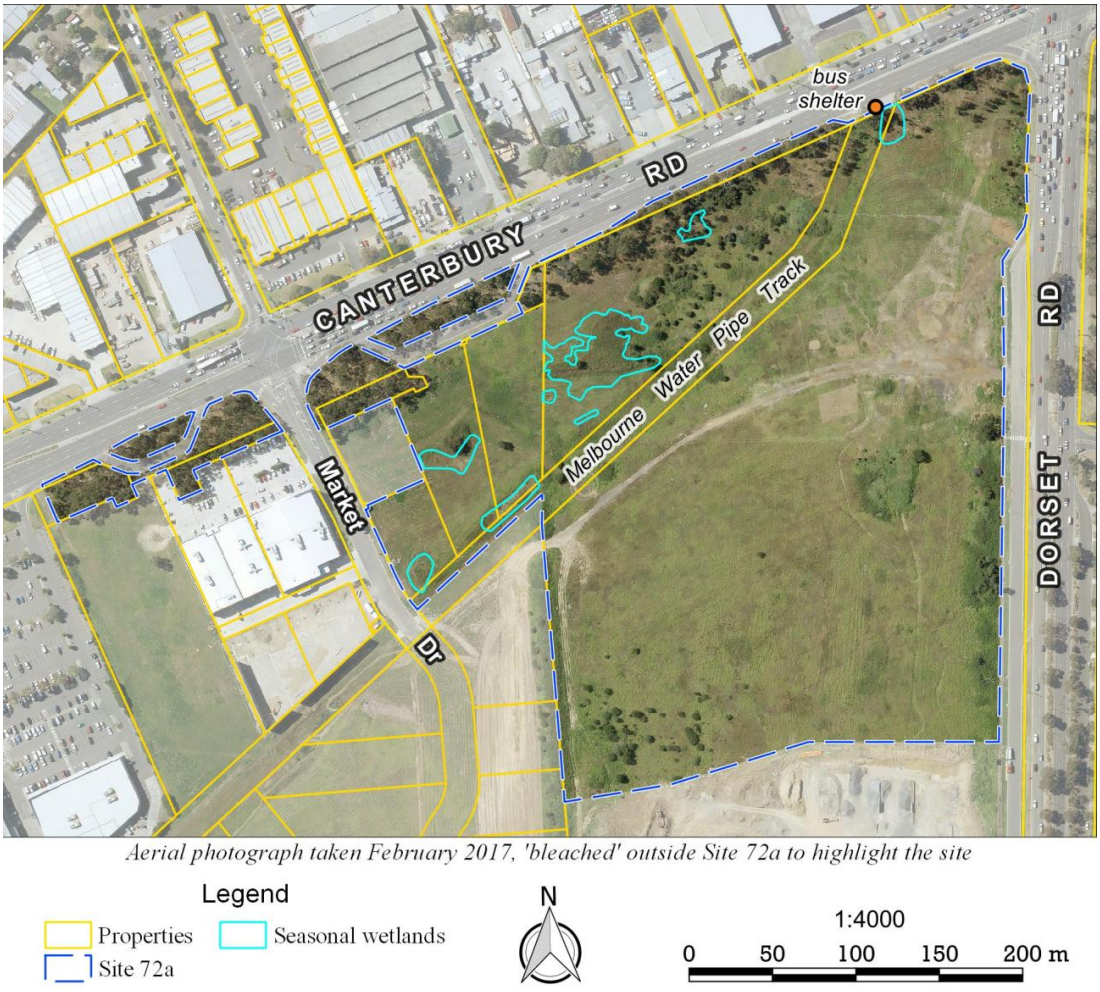
one list for the Swamp Gum community and the other for the Mealy Stringybark community; (b) documenting the details of rare or scarce plants; (c) mapping the vegetation and rare plants; and (d) assessing the site's biological significance against the standard criteria of Amos (2004);

- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which the fieldwork in the area of the original version of Site 71 was done on 3/4/96 and comprised: (a) compiling lists of indigenous and introduced plant species (without abundances) – one list for the Swamp Gum community and the other for the Mealy Stringybark community; and (b) incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird. The state government's vegetation mapping wrongly shows the reserve's native vegetation to be Valley Heathy Forest and to be more restricted than it actually is.

Site 72a. Little Bungalook Creek Floodplain, Bayswater North

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017, 'bleached' outside Site 72a to highlight the site

Boundaries

The boundaries of Site 72a are outlined with dashed blue lines above. They coincide with property boundaries where yellow can be seen in the gaps between the dashes. Along Canterbury Road, they follow the backs of the kerbs. Along Dorset Road, the boundary follows a fence. The southern boundary follows the northern edge of an area used for construction activity in 2017, which destroyed all native vegetation there. Within the labelled Melbourne Water pipe track, the boundary has been drawn as a simple shape that circumscribes the native vegetation.

Land use and tenure

The public land in the site includes the pipe track, the road reservation for Canterbury Road and some abutting small reserves. The small reserves are 'offset sites' where native vegetation is conserved to compensate for removal of vegetation on adjacent industrial land.

The rest of the land is private. At the time of writing, it is subject to industrial development proposals. Its only human use in recent years has been for circuses, stockpiling earth and a limited amount of planting and fencing to compensate for breaches of planning controls.

Although the aerial photograph shows Market Drive as being incompletely constructed and most of the abutting properties undeveloped, the situation has since changed. Market Drive is now fully constructed and factories have been built on many of the adjacent properties (but not within Site 72a). Those developments have resulted in the original Site 72 of Lorimer *et al*. (1997) being substantially reduced in size and split into Sites 72a and 72b here.

General description

Site 72a occupies a total of 12.1 hectares on the floodplain of Little Bungalook Creek. The natural slope is extremely slight – between 1:120 and 1:250.

Prior to settlement, the creek flowed westward through the middle of the site. A pioneering farmer evidently filled in the creek and replaced it with two agricultural drains. Only a 55-metre-long segment of those drains remains, leaving the land very poorly drained. Depressions fill with water readily and act as seasonal wetlands, most of which are outlined on the aerial photograph above.

The aerial photograph also depicts a patchy strip of treed vegetation beside Canterbury Road, 20–40 m wide. It is a remnant of the endangered Ecological Vegetation Class (EVC) called Swampy Woodland. Much of it contains a substantial component of introduced plants. However, rare wild plants are widespread through it, even in rather weedy sections. Additional, locally-rare plants have been planted over the past decade.

The rest of the land has a history of farming. In recent decades, it has been subject to occasional slashing, piecemeal clearing, filling-in of drains and wetlands, temporary stockpiling of earth and – in the northeast corner – use for circuses. Despite these activities and the associated passage of heavy machinery over the land, indigenous species of seasonal wetlands and swampy ground keep regenerating. A substantial part of the land is dominated by indigenous rushes (*Juncus*), seen on the aerial photograph as the mottled-khaki areas. The wetlands include locally rare plant species, some of which persist at only one or two other sites in Maroondah.

Across the whole site, this study detected seventy-seven naturally-occurring, indigenous plant species.

Development proposals for the private land within the site could lead to very large changes in the site. The information provided here may assist consideration of those proposals but it could rapidly lose currency once development commences.

Relationship to other land

Site 72a lies midway between two other patches of semi-natural swamp vegetation – the Connolly Crescent Reserve (Site 72b, almost 200 m to the southwest) and the Healesville Freeway Reservation (Site 64, 520 m to the north). Although these distances are rather small, the passage of wildlife and plant seeds between the sites is strongly inhibited by factories.

Between Sites 72a and 72b, some factories are newly constructed, some are under construction and others are proposed. It is currently unclear how further development will unfold and the degree to which hydrology and wildlife movements between Sites 72a and 72b will be adversely affected.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation below include only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion)

Canopy trees: Dominated by various mixtures of Mealy Stringybark (*Eucalyptus cephalocarpa*) and Swamp Gum (*E. ovata*). Messmate Stringybark (*E. obliqua*) and Narrow-leaved Peppermint (*E. radiata*) are also present in reasonable numbers.

Lower trees: Blackwood (*Acacia melanoxylon*) is clearly the most abundant sub-canopy tree species. Black Wattle (*A. mearnsii*), Cherry Ballart (*Exocarpos cupressiformis*) and Swamp Paperbark (*Melaleuca ericifolia*) are fairly abundant. Silver Wattle (*A. dealbata*) and Golden Wattle (*A. pycnantha*) are scarce.

Medium to large shrubs: Dominated by Hedge Wattle (*Acacia paradoxa*). Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*), Sifton Bush (*Cassinia sifton*) and Hop Goodenia (*Goodenia ovata*) are also fairly abundant. Prickly Tea-tree (*Leptospermum continentale*), Manuka (*Leptospermum scoparium*), Tree Everlasting (*Ozothamnus ferrugineus*) and Large Kangaroo Apple (*Solanum laciniatum*) are scarce.

Small shrubs: None seen.

Shrubby herbs: Cotton Fireweed (*Senecio quadridentatus*) is fairly abundant and Rough Fireweed (*Senecio hispidulus*) is scarce.

Fern: Austral Bracken (*Pteridium esculentum*) is fairly abundant but localised.

Climbers: Small-leafed Clematis (*Clematis decipiens*) is the only climber that might be regarded as indigenous (though its range has only recently expanded into Bayswater North).

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is fairly abundant. Centella (*Centella cordifolia*) and the wood-sorrel, *Oxalis exilis/perennans*, are scarce. Creeping Raspwort (*Gonocarpus micranthus*) was present until at least 2012 near the Canterbury Road bus shelter but it was not seen in this study.

Grasses, rushes and sedges: Abundant and rich in species, including rare species. The groundcover is dominated variously by the rare form of Veined Spear-grass (*Austrostipa rudis* subsp. *australis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or Weeping Grass (*Microlaena stipoides*). Thatch Saw-sedge (*Gahnia radula*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are also abundant. The common form of Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) is also fairly abundant, as are Common Love-grass (*Eragrostis brownii*), Pale Rush (*Juncus pallidus*), Broom Rush (*Juncus sarophorus*), Common Blown Grass (*Lachnagrostis filiformis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Soft Tussock-grass (*Poa morrisii*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Common Bog-rush (*Schoenus apogon*) and Small Grass-tree (*Xanthorrhoea minor*). The following species are scarce: Knob Sedge (*Carex inversa*), Mat Grass (*Hemarthria uncinata*), Hollow Rush (*Juncus amabilis*) Austral Rush (*Juncus australis*), Green Rush (*Juncus gregiflorus*), Tall Rush (*Juncus procerus*), Finger Rush (*Juncus subsecundus*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*) and Kangaroo Grass (*Themeda triandra*).

Other groundcover: Black-anther Flax-lily (*Dianella revoluta*) and Hairy Willow-herb (*Epilobium hirtigerum*) are abundant. Pale Flax-lily (*Dianella longifolia*) and Tasman Flax-lily (*Dianella tasmanica*) are also fairly abundant. Small St John's Wort (*Hypericum gramineum*), Lesser Loosestrife (*Lythrum hyssopifolia*) and Yellow Rush-lily (*Tricoryne elatior*) are scarce.

Seasonal wetland (part of EVC 74, **Endangered** in the Gippsland Plain bioregion)

Trees: There is a trace of Swamp Paperbark (*Melaleuca ericifolia*) extending into at least one wetland.

Shrubs and shrubby herbs: Absent.

Creepers: Centella (*Centella cordifolia*) is fairly abundant. A single plant of Robust Willow-herb (*Epilobium billardiereanum* subsp. *billardierianum*) was recorded in 2012 and may well persist.

Grasses, rushes and sedges: Different parts of the wetlands are dominated by Fen Sedge (*Carex gaudichaudiana*), Common Spike-rush (*Eleocharis acuta*), Australian Sweet-grass (*Glyceria australis*), Slender Joint-leaf Rush (*Juncus fockei*), Broom Rush (*Juncus sarophorus*), Common Reed (*Phragmites australis*) or cumbungi (*Typha* species). Swamp Club-rush (*Isolepis inundata*) and Hollow Rush (*Juncus amabilis*) are also abundant. The following species are fairly abundant: Common Love-grass (*Eragrostis brownii*), Mat Grass (*Hemarthria uncinata*), Floating Club-rush (*Isolepis fluitans*), Austral Rush (*Juncus australis*), Pale Rush (*Juncus pallidus*), Broad-leaf Rush (*Juncus planifolius*), Tall Rush (*Juncus procerus*), Finger Rush (*Juncus subsecundus*), Common

Blown Grass (*Lachnagrostis filiformis*) and Common Bog-rush (*Schoenus apogon*). The following species are scarce: Veined Swamp Wallaby-grass (*Amphibromus nervosus*), Soft Twig-rush (*Baumea rubiginosa*), Tall Sedge (*Carex appressa*), Knob Sedge (*Carex inversa*), Toad Rush (*Juncus bufonius*), Thread Rush (*Juncus filicaulis*), Green Rush (*Juncus gregiflorus*), Joint-leaf Rush (*Juncus holoschoenus*) and Loose-flower Rush (*Juncus pauciflorus*).

Other species: Water Plantain (*Alisma plantago-aquatica*), Glandular Brooklime (*Gratiola pubescens*) and Upright Water-milfoil (*Myriophyllum crispatum*) are abundant. Hairy Willow-herb (*Epilobium hirtigerum*), Common Cudweed (*Euchiton involucratus*), Lesser Loosestrife (*Lythrum hyssopifolia*) and Slender Knotweed (*Persicaria decipiens*) are fairly abundant. Amphibious Water-milfoil (*Myriophyllum simulans*) is scarce. Austral Ladies' Tresses (*Spiranthes australis*) was present in 1996 but its persistence could not be checked during this study.

Significant plants

Rare (but not otherwise threatened) in Victoria

The rare subspecies of Veined Spear-grass, *Austrostipa rudis* subsp. *australis*, is the dominant groundcover around the middle of the strip of treed vegetation beside Canterbury Road, and scattered through much of the rest of the strip. There are hundreds of individuals, if not more. The subspecies is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Presumed extinct in Maroondah

Two plants of *Spiranthes australis* (Austral Ladies' Tresses) were recorded in February 1996 – the only record ever in Maroondah. While the species may well have died out, it may have simply escaped detection due to the absence of subsequent flora data during the species' flowering season (midsummer).

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Site 72a can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amphibromus nervosus* (Veined Swamp Wallaby-grass) – at least three plants grow near the Canterbury Road bus shelter;
- *Baumea rubiginosa* (Soft Twig-rush) – a single patch was recorded in flora surveys in 1996 and 2012, too far from public land to be checked during this study;
- *Carex gaudichaudiana* (Fen Sedge) – a dense patch of approximately 25 m² grows in a seasonal wetland immediately east of the child care facility on Market Drive. The only other records from Maroondah this century are at Eastfield Park (Site 61), the Healesville Freeway Reservation (Site 64), on Dandenong Creek (in Site 69) and at Scott Street Reserve in Heathmont (Site 80);
- *Centipeda elatinoides* (Elatine Sneezeweed) – recorded in 1996 without an indication of abundance. Not recorded in subsequent surveys but it may yet reappear under the right sequence of weather;
- *Gonocarpus micranthus* (Creeping Raspwort) – a few were recorded in a 2012 flora survey near the Canterbury Road bush shelter, unable to be seen in this study;
- *Gratiola pubescens* (Glandular Brooklime) – a dominant groundcover species in part of the site's largest wetland. The only other occurrences recorded in Maroondah this century are at Bungalook Conservation Reserves (where it has since died out) and in a dam in Warranwood (Site 16);
- *Hypericum japonicum* (Matted St John's Wort) – recorded as scarce in the most recent full flora surveys (2012);
- *Isolepis fluitans* (Floating Club-rush) – fairly abundant in the largest of the site's seasonal wetlands;
- *Juncus filicaulis* (Thread Rush) – a single plant grows near the Canterbury Road bus shelter – the only member of the species ever recorded in or near Maroondah;
- *Juncus holoschoenus* sensu stricto (Joint-leaf Rush) – recorded as scarce near Dorset Road in February 1996 and near Market Drive in 2020. In this site and Maroondah in general, the similar taxon, *J. holoschoenus* is much more abundant;

- *Myriophyllum crispatum* (Upright Water-milfoil) – abundant in some of the wetlands and dominant in the elongated one on the edge of the pipe track;
- *Myriophyllum simulans* (Amphibious Water-milfoil) – scarce;
- *Schoenus tesquorum* (Soft Bog-rush) – not recorded since 1996, perhaps due to absence of a flora survey during a time of year when the species is distinguishable from the abundant *Schoenus apogon*;
- *Senecio minimus* (Shrubby Fireweed) – recorded in 1996 and likely to reappear sporadically in years of high rainfall; and
- *Viminaria juncea* (Golden Spray) – a single plant was seen growing on an earth mound by the author in March 2012 and by Steve Mueck in January 2013 but the mound was then cleared and removed. That was the last known plant of the species in Maroondah. Soil disturbance may prompt regeneration from seed, as the author has observed in a number of sites in Maroondah and Knox in past decades.

Significant fauna

Vulnerable in Victoria

A small number of Glossy Grass Skinks were observed in an area around the pipe track in 2009 and 2013. The author is unaware of any subsequent surveys to determine whether the species has persisted. The closest record of the species was in Wantirna South in 1988. The next-closest was near Lilydale in 2015, then Churchill National Park in 1994.

Rare in Maroondah

The following fauna species observed in Site 72a are rare in Maroondah:

- an unidentified quail (probably a Stubble Quail) – observed incidentally by the author during his most recent ecological survey of the site, in 2012;
- Black-shouldered Kite – a regular hunter in the site;
- Nankeen Kestrel – reported on 'Birdline' in 2008; and
- Golden-headed Cisticola – apparently resident, seen most recently by the author in late 2019.

Fauna habitat

- The wetlands support waterbirds, frogs and aquatic invertebrates. The frogs and invertebrates are a source of prey for other fauna, including Glossy Grass Skinks and Lowland Copperhead snakes;
- The open area with sparsely scattered trees is used by reptiles (e.g. Glossy Grass Skink), frogs and birds of open country such as Golden-headed Cisticolas and Black-shouldered Kites. The raptors are presumably hunting rodents, reptiles and perhaps frogs;
- The structure and composition of the treed vegetation near Canterbury Road represent suitable habitat for common forest birds (including Superb Fairy-wrens), bats, possums, frogs and invertebrates;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1). Rushes also appear to be important for Glossy Grass Skinks.

Ecological condition

In the absence of permission to conduct a thorough inspection of the site, a reliable, up-to-date assessment of ecological condition has not been possible during this study.

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the treed vegetation close to Canterbury Road varies between rating 'B' (good) in small areas to 'D' (poor) near Dorset Road. The wetlands near Canterbury Road and Market Drive fit rating 'C' (fair). The condition of the largest wetland appears, from the pipe track, to vary from

rating 'A' (excellent) to 'C', as when surveyed in 2012. The rest of the open expanses appear to vary between ratings 'C' and 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

From a position northwest of the largest wetland to near the bus shelter, the strip of treed vegetation beside Canterbury Road meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The Ecological Vegetation Class is Swampy Woodland, which is listed as endangered in the Gippsland Plain bioregion. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of **State** significance.

It could be argued that the full length of the strip of treed vegetation from its western limit to near the bush shelter should be regarded as a single patch for this purpose, regardless of the service roads that interrupt it.

Rare or threatened plant species

Referring to the section above headed 'Significant plants', Site 72a has a large population of *Austrostipa rudis* subsp. *australis*. That subspecies is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. The subspecies occurs interstate as well as Victoria. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Most or all of the other species in the 'Significant plants' section above have populations in Site 72a that fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Swampy Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting or working at the existing and proposed buildings near the vegetation, as well as children at the Market Drive child care facility and users of the Canterbury Road bus stop. The vegetation is also expected to reduce the noise level experienced by the same people (see Section 1.3 of Volume 1).

As part of the 'urban forest', the trees help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The strip of treed vegetation beside Canterbury Road provides green and leafy relief in an otherwise stark, industrial landscape.

The reserve's location on Little Bungalook Creek is relevant to Aboriginal cultural heritage. Traditional Aboriginal life was focused around streams and their floodplains because of the availability of water and

the high productivity of aquatic and floodplain habitats. The replacement of Little Bungalook Creek by drains and pipes has not erased all the cultural significance of the place.

Changes

Change in the extent of habitat

As discussed in the section above headed 'Relationship to other land', the current Sites 72a and 72b are remnants of the much larger Site 72 of Lorimer *et al*. (1997). That reduction is the result of land development and (to a small degree) the widening of Canterbury Road in c. 2005. The original site measured 42 hectares whereas the total of the new Sites 72a and 72b is 16.1 hectares – a reduction of 62%. However, a substantial fraction of the reduction involves land with little if any habitat value. The area of permanently lost habitat is hard to quantify, particularly because various parts of the land have been cleared and allowed to regenerate. A rough estimate of the amount of permanently lost habitat is 6–10 hectares.

Substantial reductions in the extent of habitat are likely to continue.

Change in the plant species present

As Site 72a had to be inspected from public land for this study, it is inevitable that some plant species went undetected. Allowing for that limitation, the only plant species that can be concluded to have died out since 1997 is Golden Spray (*Viminaria juncea*), which might regenerate naturally in a wet year.

Change in the ecological condition of habitat

It has not been possible to assess changes in ecological condition across the site from public land alone.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Proposed land development;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Possible continuation of filling in of wetlands;
- Possible continuation of stockpiling mounds of earth, along with associated traverses of the land by heavy vehicles;
- Continued drying of the floodplain and wetlands due to climate change and development of nearby land;
- Fragmentation of habitat between Sites 72a and 72b by ongoing industrial development; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The road reservation for Canterbury Road is zoned 'Road Zone – Category 1' (for an arterial road). The Melbourne Water pipe track is zoned 'Public Use Zone – Service and Utility'. The rest of Site 72a is zoned 'Industrial 1 Zone'. The entire site except the road reservation is covered by Schedule 5 of the Design and Development Overlay and Schedule 1 of the Development Plan Overlay.

Throughout Site 72a, removal, lopping and destruction of native vegetation are regulated under the state-wide baseline controls of clause 52.17 of the Victoria Planning Provisions. The Vegetation Protection Overlay (VPO) provides further vegetation controls except on the road reservation. The VPO extends beyond Site 72a onto land that is now developed or in the process of being developed.

As discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of State biological significance such as Site 72a. Nor is it suitable for the adjacent developed properties or for land where groundwater and drainage are important to biological significance. It is recommended to remove the VPO entirely and follow the principles of Section 11.1.2 of Volume 1 by covering Site 72a with the proposed schedule ESO1 of the Environmental Significance Overlay.

Information sources

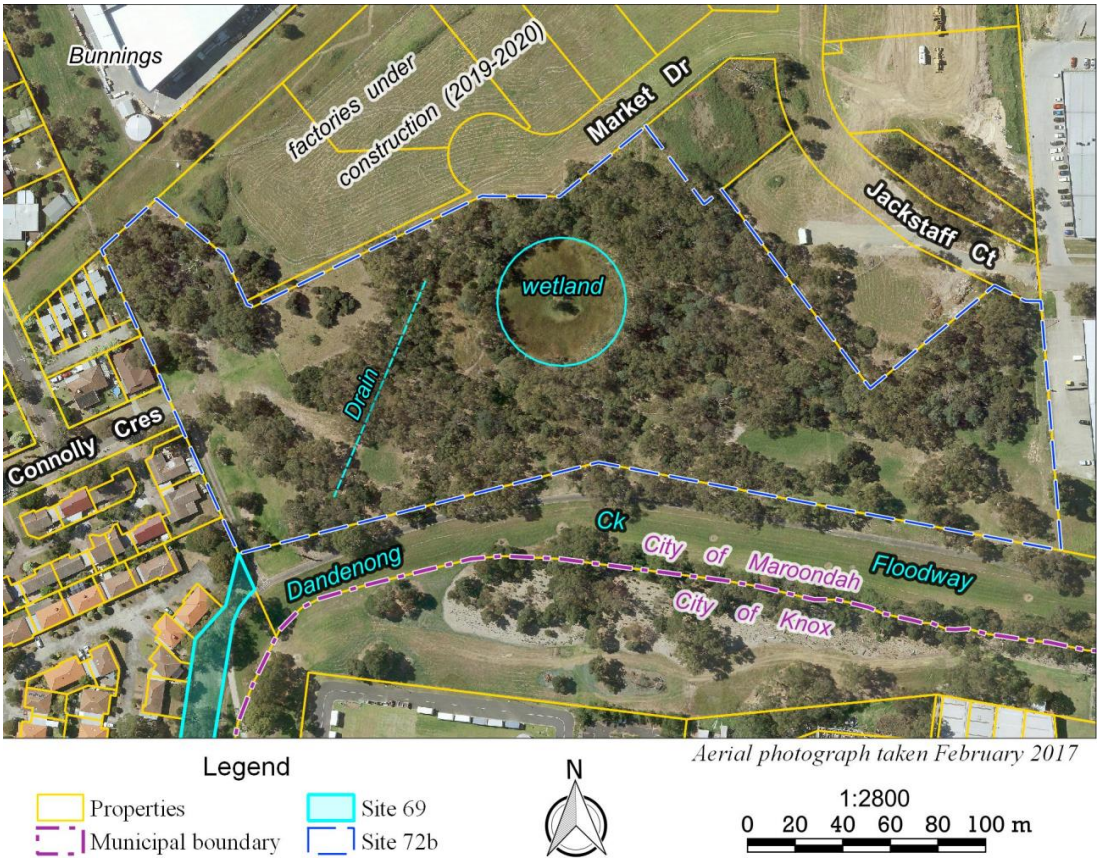
The analysis above draws on the following sources of information about the site:

- A total of approximately five hours of fieldwork by the author on 12/2/18, 8/12/18, 22/11/19 and 10/12/19, including: (a) compiling four lists of indigenous and introduced plant species and their abundances (but incomplete for mosses and liverworts)– one for the wetlands, one for the treed strip beside Canterbury Road and one for the balance of the land; (b) documenting and mapping rare or scarce plants; and (c) assessing the site's biological significance against the standard criteria of Amos (2004);
- Observations of Glossy Grass Skinks by David De Angelis in August 2009 and Bradley Jenner from around then until July 2013;
- A flora list by Steve Mueck on 25/1/13, available through the Victorian Biodiversity Atlas (VBA);
- Expert ecological evidence presented to the Victorian Civil and Administrative Tribunal by the present author and others in a 2012 hearing regarding enforcement proceedings and proposed development of 640 Dorset Road (VCAT reference numbers P129/2012 and P569/2012). The evidence was based on extensive fieldwork regarding flora and fauna but not at times of the year that would detect all the site's significant species;
- Casual observations of flora and fauna by the present author while he was a resident of Bayswater North during 2002–2016;
- A report of Nankeen Kestrel on 9/9/08 through 'Birdline';
- A flora survey of the road verge of Canterbury Road by the present author on 24/11/04 prior to the road being widened;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The report's fieldwork at Site 72a included compiling a list of plants (without abundances) on 3/2/96, by Helen Moss and the present author; and
- Aerial photographs from 1945, 2001, 2011, 2017 and 2018.

No additional useful information could be found in the VBA, the Atlas of Living Australia or eBird.

Site 72b. Connolly Crescent Reserve, Bayswater North

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundary, land use and tenure

Site 72b is a council reserve. Its boundary is outlined with dashed blue lines above, coinciding with cadastral boundaries.

General description

Site 72b occupies 4.0 hectares on the floodplain of Dandenong Creek. The natural slope is extremely slight – approximately 1:230. However, the natural lay of the land has been altered by drains and the construction of a circular pond, which is marked as 'wetland' on the aerial photograph above. The pond was apparently much deeper some decades ago and used for exercising horses in water. Over time, the pond has become shallower due to accumulation of sediment. Until this century, the pond probably dried out rarely and only for short periods. As a result of the drying climate, it is now dry for much of the time, making it a seasonal wetland rather than the pond it once was.

At the time the present author first saw the site in February 1996, the only apparent attention it had received from humans for many years was periodic slashing of the weedy grasses that surrounded the pond. The pond itself had become colonised by many aquatic plant species, brought in by waterbirds. Among those species were several that are rare in the Melbourne region or at least the eastern part of that region. Most of them died out as a result of the pond drying out for extended periods during the Millennium Drought.

Until around the year 2000, Maroondah City Council owned about half of Site 72b, including nearly all the pond. Then, subdivision of the industrial land to the north resulted in Council acquiring the rest of the site. The vegetation of the pond and its surroundings came under active management for nature conservation except that no attempt was made to stop the pond drying out. As the rare aquatic plants in the pond were dying out, other locally rare plant species were planted. Elsewhere in the site, there was extensive revegetation with indigenous floodplain species, which now provide dense cover. The cover of introduced plant species is now low in most of the site.

This study detected thirty naturally-occurring, indigenous plant species within the reserve.

Relationship to other land

Site 72b obviously has a close ecological and hydrological relationship to the abutting Dandenong Creek corridor (Site 69). Dandenong Creek has been converted to a low-flow pipe and floodway, and its riparian vegetation is fragmented and of mediocre habitat quality. Nevertheless, many fauna species (particularly birds) move along such corridors and pause at habitat nodes like Site 72b.

The amount of impervious surface on the floodplain to the north, northeast and east of Site 72b affects the amount of water that percolates into the pond and the surrounding soil. The recent and ongoing construction of factories in those directions must be expected to adversely affect Site 72b's ecological viability unless specific countermeasures are taken, e.g. diverting factory roof runoff into Site 72b.

Lorimer *et al*. (1997) regarded Sites 72a and 72b as parts of a single site because of the continuity of habitat and groundwater influences at that time. The sites have since been separated by industrial development. It is currently unclear how further development will unfold and the degree to which hydrology and wildlife movements between Sites 72a and 72b will be adversely affected.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species.

Artificial wetland (not formally part of any Ecological Vegetation Class), 0.22 ha in area

Trees: Formerly absent but in recent years, young Blackwood (*Acacia melanoxylon*) trees have established as the wetland has become drier.

Shrubs and shrubby herbs: Absent prior to the Millennium Drought but now represented by one Large Kangaroo Apple (*Solanum laciniatum*) and scattered plants of Annual Fireweed (*Senecio glomeratus*), Rough Fireweed (*Senecio hispidulus*) and Shrubby Fireweed (*Senecio minimus*).

Creepers: None present in 1996 but now represented by fairly abundant Centella (*Centella cordifolia*) and Bidgee-Widgee (*Acaena novae-zelandiae*). Those species may have been planted.

Other dry-land species: None present in 1996 but now represented by substantial numbers of Hairy Willow-herb (*Epilobium hirtigerum*), Small St John's Wort (*Hypericum gramineum*) and Lesser Loosestrife (*Lythrum hyssopifolia*) as well as a few Slender Wallaby-grass (*Rytidosperma penicillatum*) and Common Cudweed (*Euchiton involucratus*).

Amphibious species: Swamp Club-rush (*Isolepis inundata*), Common Blown Grass (*Lachnagrostis filiformis*) and Upright Water-milfoil (*Myriophyllum crispatum*) are abundant. The following species are also fairly abundant: Veined Swamp Wallaby-grass (*Amphibromus nervosus*), Australian Sweet-grass (*Glyceria australis*), Broom Rush (*Juncus sarophorus*), Common Spike-rush (*Eleocharis acuta*), Amphibious Water-milfoil (*Myriophyllum simulans*) and Slender Knotweed (*Persicaria decipiens*). The following species are scarce: Lesser Joyweed (*Alternanthera denticulata*), Waterwort (*Elatine gratioloides*), Slender Joint-leaf Rush (*Juncus fockei*) and Green Rush (*Juncus gregiflorus*). Fen Sedge (*Carex ?gaudichaudiana*) and Austral Rush (*Juncus australis*) appear to have died out since 1996.

Aquatics: The wetland's vegetation is dominated by Tall Spike-rush (*Eleocharis sphacelata*). Water Plantain (*Alisma plantago-aquatica*) and Small-fruit Pondweed (*Potamogeton cheesemanii*) are

fairly abundant. Common Duckweed (*Lemna disperma*) was fairly abundant in 1996 and may be expected to reappear in some wet years. The following aquatic species have died out due to the pond becoming progressively drier: Swamp Lily (*Ottelia ovalifolia*), Blunt Pondweed (*Potamogeton ochreatus*) and Yellow Bladderwort (*Utricularia australis*).

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion)

No survey of the site's (largely planted) vegetation outside the wetland has been undertaken. Remnant Swamp Gums (*Eucalyptus ovata*) are scattered thinly through the site.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Site 72b can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amphibromus nervosus* (Veined Swamp Wallaby-grass) – at least 35 plants were seen at the edge of the wetland, east and northeast of the centre;
- *Carex* ?*gaudichaudiana* (Fen Sedge) – recorded in 1996, apparently died out since;
- *Centipeda elatinoides* (Elatine Sneezeweed) – approximately forty plants were counted at the northern edge of the wetland in 2018. The only record elsewhere in Maroondah's history is from Bungalook Conservation Reserves (Site 66) in 1989, where it has since died out;
- *Myriophyllum crispatum* (Upright Water-milfoil) – abundant in the wetland, far more so than the other two sites in Maroondah where the species has been recorded this century;
- *Myriophyllum simulans* (Amphibious Water-milfoil) – moderately abundant in lowest parts of the wetland. The only other occurrence recorded in Maroondah's history is nearby in Site 72a, where it is at extreme risk of destruction by industrial development;
- *Ottelia ovalifolia* (Swamp Lily) – died out since 1996;
- *Potamogeton cheesemanii* (Small-fruit Pondweed) – rather abundant in the wetland but in poor condition due to the wetland becoming drier over the years;
- *Senecio minimus* (Shrubby Fireweed) – small numbers grow in the wetland; and
- *Utricularia australis* (Yellow Bladderwort) – abundant, floating in the water of the (then) pond in 1996; since died out due to prolonged dry periods.

Fauna habitat

- When the wetland and drain hold water, they support waterbirds, frogs and aquatic invertebrates. The frogs and invertebrates are a source of prey for other fauna, including Lowland Copperhead snakes;
- A particularly large Swamp Gum beside the wetland represents good habitat for invertebrates and hollow-dependent vertebrates;
- The structure and composition of the rest of the site's native vegetation represent suitable habitat for common forest birds, bats, possums, frogs and invertebrates;
- The terrestrial native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the wetland rates 'B' (good). No similar assessment was made of the rest of the site's ecological condition.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The forested vegetation that surrounds the wetland easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The Ecological Vegetation Class is Swampy Woodland, which is listed as endangered in the Gippsland Plain bioregion. Having a 'patch' of such vegetation meets standard criterion 3.2.3 for a site of **State** significance.

The area of forest or woodland immediately north of the dead end of Connolly Crescent currently fails to meet the same criterion because it is slightly too small. A small amount of revegetation could easily link it to the rest of the treed vegetation and raising its significance to the State level.

Rare or threatened plant species

Referring to the section above headed 'Significant plants', Site 72b's populations of *Amphibromus nervosus* (Veined Swamp Wallaby-grass), *Centipeda elatinoides* (Elatine Sneezeweed), *Myriophyllum crispatum* (Upright Water-milfoil), *Myriophyllum simulans* (Amphibious Water-milfoil) and *Potamogeton cheesemanii* (Small-fruit Pondweed) all fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Swampy Woodland.

Note that not all of the site is biologically significant in its current condition. It is nevertheless appropriate to treat the whole site as a unit. As Maroondah City Council is managing and revegetating the site for nature conservation, it is important to recognise the potential for all parts to become significant.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit visitors to the reserve and people who use the adjacent Dandenong Creek Trail. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The reserve's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of people who regularly use the reserve or walk along the Dandenong Creek Trail. That may be particularly important for visitors who are employees in the adjacent industrial zone, where the landscape is in stark contrast to the natural world.

The site's location beside a major stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

A comparison of aerial photographs from 2001 and 2017 indicates that revegetation has greatly increased the extent of the site's native vegetation.

Change in the plant species present

As will be apparent from the description of the wetland vegetation in the section above headed 'Habitat types', a significant number of dry-land plant species have colonised the wetland while many of the aquatic species recorded in 1996 have died out. These changes are consistent with the substantially drier conditions that now prevail.

Change in the ecological condition of habitat

The loss of so many wetland plant species represents a significant deterioration of the ecological condition of the wetland habitat – from rating 'A' of Lorimer *et al*. (1997) to rating 'B'. Conversely, revegetation has greatly improved the ecological condition of vegetation in the rest of the site.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued drying of the floodplain and wetland due to climate change and nearby industrial development;
- Fragmentation of habitat between Sites 72a and 72b by ongoing industrial development; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

All these threats will be most likely to materialise during droughts, which are predicted to worsen with climate change.

Strategic planning

Approximately 40% of the site, in the west, is zoned 'Industrial 3 Zone' and the remainder is zoned 'Industrial 1 Zone'. Schedule 5 of the Design and Development Overlay also applies. These planning controls are not consistent with council's management of the site, which is for nature conservation. A rezoning would be appropriate.

Throughout Site 72b, removal, lopping and destruction of native vegetation are regulated under the Vegetation Protection Overlay (VPO) and the state-wide baseline controls of clause 52.17 of the Victoria Planning Provisions. The VPO extends onto the adjoining industrial land.

As discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of State biological significance such as Site 72a. Nor is it suitable for properties covered with factories and pavement. It is recommended to remove the VPO entirely and follow the principles of Section 11.1.2 of Volume 1 by covering Site 72b with the proposed schedule ESO1 of the Environmental Significance Overlay.

Management recommendation

As discussed above, the wetland in Site 72b has a suffered significant loss of rare plants due to drying conditions. The original drains that fed water into the wetland no longer function and the drain marked on the aerial photograph on p. 562 may be draining water out of the wetland or floodplain. Runoff from land

to the north, northeast and east will no longer percolate into the floodplain and wetland as the land is being rapidly covered with factories and pavement.

It is recommended to investigate whether:

- Blocking the drain would retain more moisture in the site; and
- Arrangements can be made with any of the factories currently under construction so that some of the stormwater falling on their roofs can be directed into the wetland.

Information sources

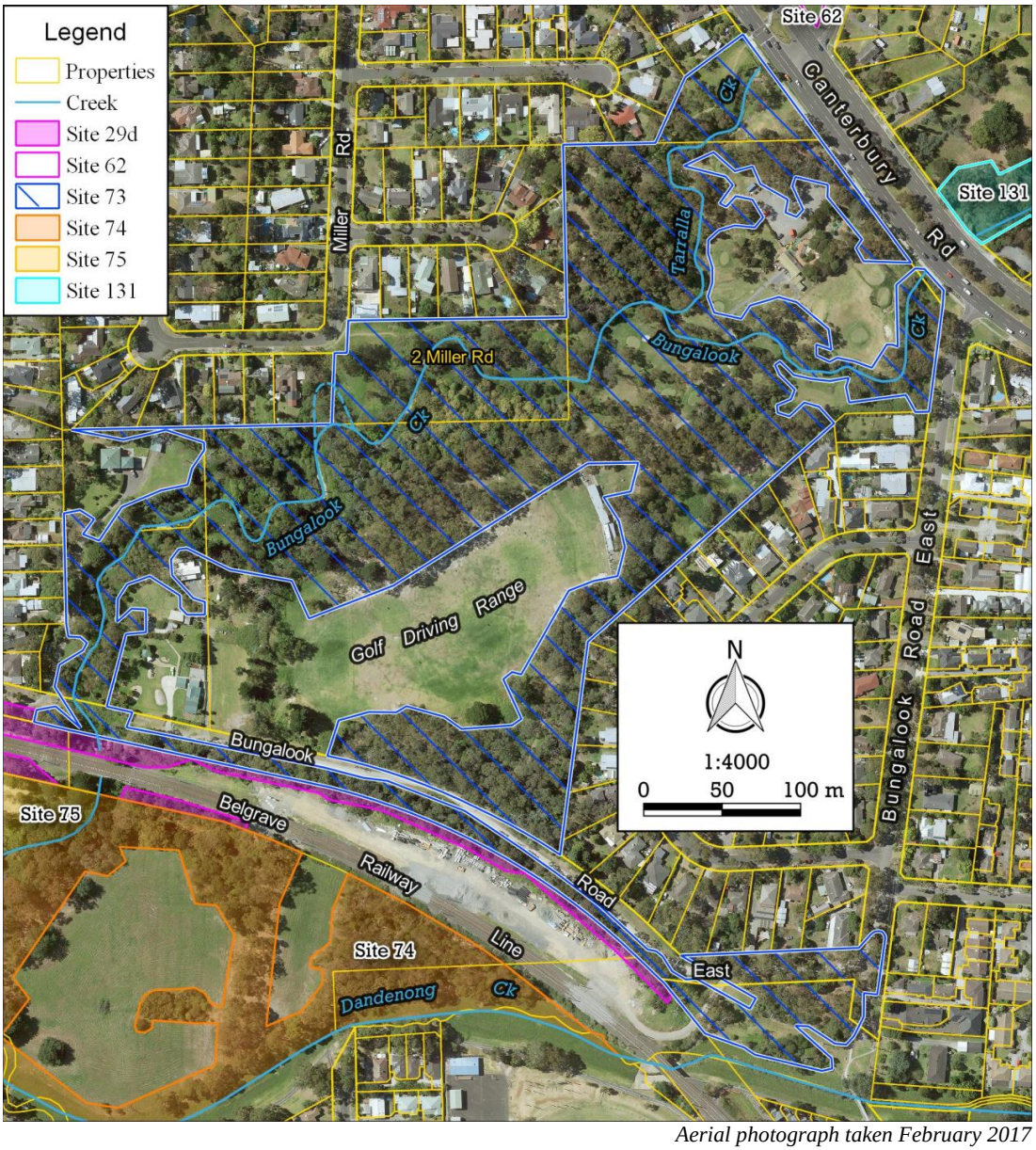
The analysis above draws on the following sources of information about the site:

- A total of 1 hour 50 minutes of fieldwork by the author (assisted in part by Daniel Flaim of Maroondah City Council) on 12/2/18, 15/11/18 and 22/11/19, including: (a) compiling a list of indigenous plant species (excluding mosses and liverworts) and their abundances for the wetland; (b) documenting the details of rare or scarce plants; (c) mapping the vegetation, drains and rare plants; and (d) assessing the site's biological significance against the standard criteria of Amos (2004);
- Bradley Jenner (of Abzeco Pty Ltd) and Laura Metcalfe (of Maroondah City Council), each of whom has been responsible for on-ground work in the site and was able to provide information about the site's wild and planted plants;
- Observations of Weasel Skink, Lowland Copperhead snake and common frogs by David De Angelis on 23/5/14, available from the Victorian Biodiversity Atlas (VBA);
- The present author's record of a Lowland Copperhead snake on 27/12/11;
- A list of 35 fauna species observed by Daniel Gilmore on 15/3/04, available from the VBA;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The report's fieldwork at Site 72b included: (a) a list of plants in the pond (without abundances) on 3/2/96, compiled by Helen Moss and the present author; (b) spotlighting for nocturnal fauna on 19/2/96 and 13/3/96 by the present author; and (c) diurnal fauna observations on 2/3/96 and 27/3/96 by the present author; and
- Aerial photographs from 1945, 2001, 2011, 2017 and 2018.

No additional useful information could be found in the VBA, the Atlas of Living Australia or eBird.

Site 73. Heathmont Golf Park and Adjacent Bushland

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundary, land use and tenure

Most of the site boundaries follow property boundaries or the edges of native vegetation. The beds and banks of Bungalook Creek and Tarralla Creek are included even in the few small cases where there is no native vegetation. The strip along the southern side of Bungalook Road East extends to the boundary with railway land, where Site 29d is located.

As with all sites in this volume, the precise boundary is available as a shapefile for geographic information systems.

Land use and tenure

The property which makes up most of this site is part of the proposed Healesville Freeway corridor. Most of it is currently occupied by Heathmont Golf Park, with a driving range, minigolf and a pitch-and-putt course. The part of that property that lies west of Tarralla Creek is vacant land.

To the west of the driving range (marked on the aerial photograph above) are two residential properties – one on each side of Bungalook Creek. 2 Miller Road (also marked on the aerial photograph) is vacant residential land zoned 'Neighbourhood Residential – Schedule 4'.

The almost-triangular property at the site's northern tip (341–345 Canterbury Road) is a reserve.

A well-worn, unsurfaced footpath extends between the northern tip of the site and the southern end of Miller Road.

In the south, the site includes part of the road reserve of Bungalook Road East, which is a gravel council road. The property at the southern tip of the site (32A Bungalook Road East) is vacant Crown land.

General description

Site 73 occupies 10.2 hectares of a floodplain. Tarralla Creek flows southward into Bungalook Creek, which exits the site's southwest corner to pass beneath the Belgrave Railway Line. The southeast of the site abuts the artificial channel of Dandenong Creek.

Streams and their floodplains are very important ecologically. That is largely because the fertility and high productivity of floodplains lead to a plentiful base for the food chain and hence a concentration of wildlife. That applies even in rather unnatural landscapes. The concentration of life along streams and floodplains is often amplified by the presence of corridors of habitat – aquatic and vegetation.

These features can be seen in the lush vegetation of Site 73 and the corridors of trees seen in aerial photographs.

Throughout the site, the natural shrubs and groundcover have been decimated by clearing and largely or wholly replaced by introduced plants. Nevertheless, remnant trees abound and there are enough surviving indigenous shrubs to provide habitat for wildlife beyond what is normal for an urban environment. Among the remnant eucalypts are some very large trees. The public land beside Bungalook Road East and in the site's southern tip also support patchy indigenous groundcover, including the locally rare Red-fruit Saw-sedge (*Gahnia sieberiana*). There are also patches of indigenous groundcover scattered elsewhere in the site.

Across the site, this study detected forty-eight naturally-occurring, indigenous plant species.

This study did not access the site's two properties with houses on them. Instead, an inspection was done from their front fences and information was obtained from aerial photographs and the results of a 1996 flora survey for *Sites of Biological Significance in Maroondah*. The inclusion of those properties within the site is principally because of the importance of maintaining the habitat corridor along Bungalook Creek, which flows along the boundary between the two properties.

Relationship to other land

Few of the animals within Site 73 could meet all their habitat needs without at least occasionally travelling to other sites. As can be seen from the aerial photograph on p. 540, Site 73 abuts Site 29d along the Belgrave Railway Line and there are only minor gaps to Sites 62, 74, 75 and 131. Some fauna, such as Shortfin Eels or the Striated Thornbills that were seen in this study, need to travel even further afield to meet their habitat needs. The travel may involve swimming along the creeks or flying along the treed creek valleys to and from destinations such as the Dorset Golf Course in Croydon (part of Site 62).

Pollination that occurs from these movements of birds and insects improves the reproductive success and genetic diversity of plants in each site visited. Exchange of seeds between the sites by fauna movements and wind also improves the viability of the plant populations.

In these ways, all of the abovementioned sites are ecologically interdependent. The presence or creation of gaps in the tree canopy tends to restrict fauna movements and hence restrict which species can live along the corridors. Fragmentation of the creeks (e.g. by pipes) has an equivalent effect on the aquatic environment.

Bioregion: Gippsland Plain

Habitat type

The site's native vegetation grades between two Ecological Vegetation Classes (EVCs). Within a typical distance of 30 m from the creeks, occasional flooding occurs and the soil is kept moist by percolation of water from the creeks. That has given rise to the EVC called Swampy Riparian Woodland (EVC 83, **Endangered** in the bioregion), although it has become heavily modified from a natural state. As distance from the creeks increases, the vegetation grades into the EVC, Swampy Woodland (EVC 937, **Endangered** in the bioregion).

There is no clear boundary between the two EVCs. Therefore, the following description of the vegetation's composition spans both EVCs.

Canopy trees: Dominated in different areas by either Swamp Gum (*Eucalyptus ovata*) or Mealy Stringybark (*E. cephalocarpa*). Messmate Stringybark (*E. obliqua*) is scattered through much of the site and there are a few Yellow Box (*E. melliodora*) close to Bungalook Creek.

Lower trees: The introduced Sweet Pittosporum (*Pittosporum undulatum*) and Large-leafed Privet (*Ligustrum lucidum*) are probably the most abundant sub-canopy trees, creating dense shade over substantial areas. The most abundant indigenous species are Silver Wattle (*Acacia dealbata*), Blackwood (*Acacia melanoxylon*), Cherry Ballart (*Exocarpos cupressiformis*) and Swamp Paperbark (*Melaleuca ericifolia*), followed by Black Wattle (*Acacia mearnsii*). Hazel Pomaderris (*Pomaderris aspera*) is scarce but a good environmental indicator.

Medium to large shrubs: Indigenous shrubs are fairly dense in the most natural areas. The most abundant species are Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*) and Yarra Burgan (*Kunzea leptospermoides*).

Small shrubs: Not detected in this study, perhaps as a result of limited access to the land. Common Flat-pea (*Platylobium obtusangulum*) was recorded as present in 1996.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches. Common Ground-fern (*Calochlaena dubia*) was recorded on 2 Miller Road in 2015 and is probably still present.

Climbers: Japanese Honeysuckle (*Lonicera japonica*) and the non-indigenous hybrid bindweed, *Calystegia sepium* × *silvatica*, are both abundant along the creek banks as both climbers and creepers. The scrambler, Blackberry (*Rubus anglocandicans*) is widespread and dense in many areas. The following indigenous climbers are all scarce: Coarse Dodder-laurel (*Cassytha melantha*), Downy Dodder-laurel (*C. pubescens*), Common Apple-berry (*Billardiera mutabilis*), Mountain Clematis (*Clematis aristata*) and Small-leafed Clematis (*C. decipiens*).

Creepers: Indigenous creepers are scarce, represented by Rainforest Crane's-bill (*Geranium homeanum*) and smaller numbers of Bidgee-widgee (*Acaena novae-zelandiae*) and Kidney-weed (*Dichondra repens*). Two other indigenous creeper species – Centella (*Centella cordifolia*) and Creeping Raspwort (*Gonocarpus micranthus*) – were recorded in 1996 but may have died out since. While indigenous creepers are scarce, introduced creepers are very abundant on the creek banks, particularly Japanese Honeysuckle (*Lonicera japonica*), Wandering Trad (*Tradescantia fluminensis*) and the non-indigenous hybrid bindweed, *Calystegia sepium* × *silvatica*.

Grasses, rushes and sedges: Weeping Grass (*Microlaena stipoides*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are dense in the drier, periodically mown areas. The following species are fairly abundant, at least within certain areas: Veined Spear-grass (*Austrostipa rudis*), Red-fruit Saw-sedge (*Gahnia sieberiana*), Variable Sword-sedge (*Lepidosperma laterale*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Spiny-headed Mat-rush (*L. longifolia* subsp. *longifolia*), Common Reed (*Phragmites australis*), Slender Wallaby-grass (*Rytidosperma penicillatum*) and Small Grass-tree (*Xanthorrhoea minor*), as well as Green Rush (*Juncus*

gregiflorus) and Broom Rush (*Juncus sarophorus*) in the creek channels. Other indigenous grassy species are scarce.

Other species: Other indigenous groundcover species are severely depleted. In the creek channels, Slender Knotweed (*Persicaria decipiens*) and Water-pepper (*P. hydropiper*) are fairly abundant. Elsewhere, Pale Flax-lily (*Dianella longifolia*) is scattered liberally and Black-anther Flax-lily (*D. revoluta*) is less abundant.

Significant plants

Much of the site was not accessible for this study, so significant plants could easily have gone undetected.

Rare (but not otherwise threatened) in Victoria

A tree identified with low confidence as Yarra Gum (*Eucalyptus yarraensis*) grows on the southern side of Bungalook Road East near the southeastern end of Site 29d (seen on the aerial photograph on p. 540). Other Yarra Gums grow on the opposite side of the railway line, the closest being 90 m to the southwest. The uncertainty about the identity of the tree in Site 73 is because Yarra Gums can be confused with hybrids and back-crosses between Swamp Gum (*E. ovata*) and Mealy Stringybark (*E. cephalocarpa*). Greater confidence could be achieved if fresh leaves or fresh fertile material become available, but only fallen, dry material could be collected during this study.

A subspecies of Veined Spear-grass (namely *Austrostipa rudis* subsp. *australis*) is represented by at least one localised cluster of plants visible from the golf driving range bays. The subspecies is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Bedford Park can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Calochlaena dubia* (Common Ground-fern) – recorded by staff of Ecology Australia Pty Ltd on 2 Miller Road in 2015. It is probably still present;
- *Eucalyptus macrorhyncha* (Red Stringybark) – only a single, dead individual was seen within the area accessible to this study. Others may have escaped detection;
- *Gonocarpus micranthus* (Creeping Raspwort) – recorded in 1996 in a wet depression in the golf course, which appears to have since been cleared and replaced by turf;
- *Goodenia humilis* (Swamp Goodenia) – as above;
- *Thelionema caespitosum* (Tufted Blue-lily) – as above;
- *Ozothamnus obcordatus* (Grey Everlasting) – recorded by staff of Ecology Australia Pty Ltd on 2 Miller Road in 2015 but the habitat seems inappropriate for that species (as well as for at least two others species on the same list);
- *Muellerina eucalyptoides* (Creeping Mistletoe) – recorded in 1996 but not in 2019;
- *Senecio minimus* (Shrubby Fireweed) – recorded in 1996 and although not found in the limited survey of 2019, the species is likely to be present, at least periodically.

Significant fauna

The Australian Platypus Conservancy recorded a Water Rat on Bungalook Creek near the railway bridge on 6/5/19. The only other modern records in Maroondah are on Mullum Mullum Creek in Ringwood (Site 24).

Fauna habitat

- The water and stream channels provide habitat for fish, aquatic invertebrates, waterbirds and frogs;
- The canopy of remnant trees and the patchy occurrence of remnant shrubs provide suitable habitat for a range of forest birds, bats, possums and invertebrates. That habitat benefits from the fertility of the

floodplain, which favours high production of carbohydrates by plants and hence strengthens the base of the food chain;

- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The treed habitat continues along Tarralla Creek (Site 62), Bungalook Creek (Sites 74, 75 and 131) and Dandenong Creek (Sites 76–82), amplifying the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Within the parts of the site accessible to this study, the ecological condition of the native vegetation varies between 'C' and 'D' on the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). Rating 'C' can be regarded as 'fair' and rating 'D' can be regarded as poor. The main factor depressing the ecological condition is displacement of indigenous flora by aggressive introduced species, particularly Large-leafed Privet (*Ligustrum lucidum*), Sweet Pittosporum (*Pittosporum undulatum*) and Blackberry (*Rubus anglocandicans*).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The strip of vegetation along the southern side of Bungalook Road East meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. It contains Swampy Woodland, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the strip meets standard criterion 3.2.3 for a site of **State** significance.

In addition, it is likely that vegetation on the northwestern side of the golf driving range also represents a 'patch' of Swampy Woodland but this study could only inspect it from a distance.

Threatened plant species

The possible Yarra Gum beside Bungalook Road East, if confirmed, is part of a larger population that is otherwise located on the opposite side of the railway line, in Site 74 and beside Dandenong Creek. The species does not occur naturally outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of State significance, but that only applies if the tree truly is a Yarra Gum.

The golf park has a population of Veined Spear-grass *Austrostipa rudis* subsp. *australis*, which is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. The subspecies occurs interstate as well as Victoria. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Referring to the list above headed 'Critically endangered in Maroondah', Ecology Australia Pty Ltd recorded *Calochlaena dubia* and *Ozothamnus obcordatus* on 2 Miller Road in 2015. The size and security of the populations of those species could not be determined in this study. If the populations are viable, they fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a

viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Threatened fauna species

Referring to the list above headed 'Significant fauna', the observation of a Water Rat in Bungalook Creek in 2019 makes Site 73 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. As for the flora just discussed, these conditions lead to a Local significance rating.

Ecological corridor

The position of Site 73 on the Bungalook Creek, Tarralla Creek and Dandenong Creek corridors fits the following description in standard criterion 1.2.6: "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Standard criterion 1.2.6 accords Local significance to such a site.

To the extent that Site 73 leaves gaps in that habitat link, the following description from standard criterion 1.3.3 applies: "Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor… Site (or one of a group of such sites) to form a strategic corridor of local importance and scale". That description applies to a site of Local significance.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the 2019 discovery of the Yarra Gum and the state government's recognition since 1997 of the 'endangered' status of Swampy Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people within the site (e.g. golfers and residents) and those who live next-door. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of those who live there or use the site to play golf or walk through it.

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into neighbouring streets and gardens.

The site's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

The 1997 report, *Sites of Biological Significance in Maroondah*, shows approximately 0.5 ha on the northeastern side of Bungalook Creek downstream of 2 Miller Road as supporting 'Messmate Sub-riparian

Forest'. Most of that land is now occupied by a house, driveway and lawns. Less than 0.1 ha of the forest remains and appears to have lost all its understorey.

The flora survey for *'Sites of Biological Significance in Maroondah'* mapped a small area of 'swampy herbfield' just northeast of the golf driving range bays. That area appears to have been replaced with turf. None of the indigenous plants appears to have survived.

The only other material change that this study detected in the extent of habitat is a small (but unquantifiable) increase due to the expansion of eucalypt crowns over land that previously had no native vegetation.

Changes in the species present

The flora survey for the 1997 report detected several plant species only in the abovementioned area of 'swampy herbfield'. Most of those species are locally threatened. None of the indigenous plants there appear to have survived.

Because this study only accessed part of the land, it is not possible to draw further conclusions about changes in the plant species present in the site.

Change in the ecological condition of habitat

Taking into account that less of the site was accessed in 2019 than 1996, no change can be discerned in the ecological condition of the remaining habitat.

Threats

This study has identified the following threats to the site's biodiversity (in approximately decreasing order except for the first two, whose likelihood is unknown):

- Construction of the Healesville Freeway through the site;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by introduced plants, particularly Large-leafed Privet (*Ligustrum lucidum*), Sweet Pittosporum (*Pittosporum undulatum*) and Blackberry (*Rubus anglocandicans*);
- Possible residential development of 2 Miller Road;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Damage to the Yarra Gum, whose trunk is barely to the side of Bungalook Road East, making it vulnerable to grading or other roadwork; and
- Destruction of vegetation (particularly Red-fruit Saw-sedge (*Gahnia sieberiana*) and Small Grass-tree (*Xanthorrhoea minor*)) to the south of Heathmont Golf Park by roadside slashing or herbicide spraying.

Strategic planning

The site's zoning is:

- 'Urban Floodway Zone' within 30 m of Dandenong Creek and within 20 m of some parts of Bungalook Creek and Tarralla Creek; and
- 'Neighbourhood Residential Zone – Schedule 4' everywhere else.

The whole site is affected by the Vegetation Protection Overlay (VPO), Schedule 4 of the Significant Landscape Overlay (SLO3) and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO completely and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 73

as outlined and hatched in blue on the aerial photograph on p. 540. It would also be open to Council to apply ESO1 to the whole of the affected properties (not just the hatched parts), either for simplicity or to increase the extent of control over development or works that could adversely affect the creeks. An important feature of the Environmental Significance Overlay is that it can control subdivision and works, which could affect the aquatic and floodplain environment even if no native vegetation is removed.

The choice about whether to extend ESO1 more widely than the hatched area on p. 540 should take into account the site's strategic role as part of the Tarralla Creek and Bungalook Creek corridors. Vegetation removal, development and land uses within the site could potentially affect the rest of the catchment, ecologically and in other respects such as flooding, erosion or pollution.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately three hours of ecological survey for this study on 14/5/19 and 18/5/19, including: (a) compiling separate lists of indigenous plant species (excluding mosses and liverworts) for three separate parts of the site; (b) documenting the details of rare plants; and (c) mapping the vegetation and rare plants;
- A record of a Water Rat on Bungalook Creek by the Australian Platypus Conservancy on 6/5/19, available through the Atlas of Living Australia;
- A plant list in the Victorian Biodiversity Atlas (VBA) for 2 Miller Road by staff of Ecology Australia on 25/3/15;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork by John C. Reid in February 1996 that included a flora survey, bird census and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the VBA, Atlas of Living Australia or eBird.

Site 74. Confluence of Dandenong & Bungalook Creeks

Biological Significance Level: *State* due to the presence of the rare Yarra Gum and an endangered vegetation type



Aerial photograph taken February 2017

Legend

Site 29d
Site 73
Site 74
Site 75
Properties
Crown land
Wetlands
EVC boundary
Railway line

N

1:4000
0 50 100 150 200 m

Boundary

Site 74 is shown with a dashed-blue outline and blue hatching above. The external boundary follows the middle of Bungalook Creek, the municipal boundary and the southern edge of the rail reserve for the Belgrave railway line. Within that external boundary, two excisions have been made from the site where the only vegetation is pasture weeds and a few historically planted exotic trees.

The external site boundary used here is unchanged from that of Lorimer *et al*. (1997). If this report were to have started from scratch, the boundary with Site 75 would have been realigned westward to the property boundary between the council land and the freeway land.

Land use and tenure

The orange-hatched parts of the site are Crown land. The rest is an unused reservation for the proposed Healesville Freeway.

General description

Site 74 occupies 3.5 hectares of floodplain, wetland and creek channel in the angle between Dandenong Creek and Bungalook Creek. Except for the creek channels, there is less than 3 m variation in elevation throughout the site. The soil is alluvium.

Bungalook Creek follows a natural route along the site boundary but its condition is far from natural. Its banks are scoured by the pulsed flows that result from the urbanised catchment and its impervious surfaces. The combination of the scouring, historical vegetation clearing and abundant environmental weeds has left the creek's banks and the channel with little native vegetation other than some patches of Swamp Paperbark (*Melaleuca ericifolia*), some large Manna Gums (*Eucalyptus viminalis*) and a large Swamp Gum (*E. ovata*). One particularly large Manna Gum is listed as tree HO9 under Maroondah's Heritage Overlay.

Despite Bungalook Creek's lack of naturalness, it is still biologically important for movement of mobile fauna such as Water Rats, birds and flying insects, partly because streams in general act as wildlife corridors and also because this site is at the junction of two such corridors.

The second corridor is Dandenong Creek, which flows along the site's southern edge in a channel that was dug in 2018. The new channel has been designed to simulate a natural stream's meanders. The channel has been planted with indigenous species, which are (at the time of writing) immature and sparse.

The floodplain that forms the remainder of Site 74 appears to have been almost completely cleared, historically. A 1945 aerial photograph shows pasture, a recently cultivated area and sparse, young trees elsewhere. The two main areas where those young trees from 1945 can be seen today are near the centre of the site boundary with the railway land and in the triangular, easternmost quarter of the site. Those areas, and particularly the latter, are the most natural areas today.

There are some shallow depressions within the site, acting as ephemeral or seasonal wetlands. Surprisingly, an ephemeral wetland only about 15 m long and 3 m wide contains roughly one hundred plants of Glandular Brooklime, a species that has almost died out in the Melbourne metro area.

Across the whole site, this study detected fifty-two naturally-occurring, indigenous plant species.

Relationship to other land

Site 74 is just one of several contiguous sites of biological significance, the others being Sites 73, 75, 76, 79, 80 and the railway corridor of Sites 29c & 29d. They are recognised separately in this report because of their different land uses. The key map of sites on p. 1 provides a broader context than the aerial photograph on p. 576.

That conglomerate of sites is connected by corridors along Bungalook Creek, Tarralla Creek and Dandenong Creek to other sites of biological significance such as Eastfield Park (Site 61), the Healesville Freeway reservation near Dorset Road (Site 64), Connolly Crescent Reserve (Site 72b), the Simpsons Court escarpment (Site 79), Scott Street Reserve (Site 80) and Bayswater Park in the City of Knox. The railway line provides a link to high-quality habitat on the 'Uambi' property (Site 32).

The habitat of each of the creek corridors is fragmented and the hydrology and channels of their streams have mostly been heavily modified from their natural states. Nevertheless, one can still readily observe the corridors being used by fauna such as eels, waterbirds and parrots. For more information about the biological significance of the corridors, see Site 62 (Tarralla Creek) on p. 465, Site 69 (Dandenong Creek) on p. 530 and Site 131 (Bungalook Creek) on p. 797.

The passage of birds and flying insects between all the abovementioned habitat areas improves the viability of the plant populations through dispersal of pollen and propagules.

The *'Maroondah Habitat Corridor Strategy'* (Context 2005) gives both the Bungalook Creek corridor and the Dandenong Creek corridor 'Very high relative corridor conservation priority'.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation composition below include only naturally-occurring, indigenous plant species except where stated otherwise. 'EVC' means 'Ecological Vegetation Class'.

Riparian Forest (EVC 18, 'Vulnerable' in the Gippsland Plain bioregion)

Canopy trees: Dominated by Manna Gum (*Eucalyptus viminalis*). There are also a few Swamp Gums (*E. ovata*) and Narrow-leaved Peppermint (*E. radiata*), as well as a single Red Stringybark (*E. macrorhyncha*), surprisingly. Messmate Stringybark (*E. obliqua*) was also present in the previous (1996) flora survey but that species appears to have died out.

Lower trees: Indigenous sub-canopy trees have been strongly out-competed by the introduced Sweet Pittosporum (*Pittosporum undulatum*). There are patches of Silver Wattle (*Acacia dealbata*) and Swamp Paperbark (*Melaleuca ericifolia*) and a few Black Wattle (*A. mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*).

Medium to large shrubs: Indigenous shrubs have been largely shaded out by Sweet Pittosporums and replaced by blackberries. Tree Everlasting (*Ozothamnus ferrugineus*) is the only indigenous species that is not scarce. A number of indigenous shrub species appear to have died out since the 1996 flora survey, e.g. Hemp Bush (*Gynatrix pulchella*) and Australian Dusty Miller (*Spyridium parvifolium*).

Small shrubs: None.

Ferns: Austral Bracken (*Pteridium esculentum*).

Climbers: None.

Creepers: Rainforest Crane's-bill (*Geranium homeanum*) is very localised.

Grasses, rushes and sedges: The indigenous ground flora has been almost completely replaced by Wandering Trad (*Tradescantia fluminensis*) and Blackberry (*Rubus anglocandicans*). Common Reed (*Phragmites australis*) is present next to the creeks and wetland depressions. The only other indigenous grasses that have been recorded are Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*).

Other groundcover: The only other surviving species of the ground flora detected in this study was Common Raspwort (*Gonocarpus tetragynus*), represented by a tiny patch. Even that was not recorded in the 1996 flora survey.

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion)

Canopy trees: Dominated by Swamp Gum (*Eucalyptus ovata*). Mealy Stringybark (*E. cephalocarpa*) is also fairly abundant. There are a few Narrow-leaved Peppermint (*E. radiata*) and at least three of the rare Yarra Gum (*E. yarraensis*). Messmate Stringybark (*E. obliqua*) was also present in the previous (1996) flora survey but that species appears to have died out.

Swamp Paperbark (*Melaleuca ericifolia*) dominates a patch of scrub in the middle of the site as a result of regrowth following clearing, where eucalypts have failed to regenerate.

Lower trees: Moderately dense, dominated variously by Silver Wattle (*Acacia dealbata*), Black Wattle (*A. mearnsii*), Blackwood (*A. melanoxylon*), Cherry Ballart (*Exocarpos cupressiformis*) or Swamp Paperbark (*Melaleuca ericifolia*). There is also a single Hazel Pomaderris (*Pomaderris aspera*), attributable to the proximity to Riparian Forest.

Medium to large shrubs: Tree Everlasting (*Ozothamnus ferrugineus*) is abundant. Sweet Bursaria (*Bursaria spinosa*), Yarra Burgan (*Kunzea leptospermoides*) and Victorian Christmas-bush (*Prostanthera lasianthos*) are fairly abundant but localised. Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*), Manuka (*Leptospermum scoparium*) and Large Kangaroo Apple (*Solanum laciniatum*) are scarce. The previous flora survey (1996) also recorded Myrtle Wattle (*Acacia myrtifolia*), Hedge Wattle (*A. paradoxa*), Prickly Moses (*A. verticillata*), Common Cassinia (*Cassinia aculeata*), Golden Bush-pea (*Pultenaea gunnii*) and Australian Dusty Miller (*Spyridium parvifolium*). Some or all of those species appear to have died out.

Small shrubs: None seen.

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) was abundant in recently-disturbed areas at the time of this study's inspection but numbers are expected to vary greatly from year to year.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over a substantial area.

Climber: Coarse Dodder-laurel (*Cassytha melantha*) and Mountain Clematis (*Clematis aristata*) are scarce. Common Apple-berry (*Billardiera mutabilis*) was also recorded in the 1996 flora survey.

Creepers: Kidney-weed (*Dichondra repens*) is fairly abundant. Bidgee-widgee (*Acaena novae-zelandiae*) and the wood-sorrel, *Oxalis exilis/perennans*, are scarce and very localised.

Grasses, rushes and sedges: Abundant and rich in species. Variously dominated by Weeping Grass (*Microlaena stipoides*), Common Bog-rush (*Schoenus apogon*) or a sword-sedge intermediate between *Lepidosperma elatius* and *L. laterale*. The club-rushes, *Isolepis cernua* and *I. platycarpa* were also abundant during this study's inspection but may be scarce in other years. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Common Love-grass (*Eragrostis brownii*) and Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) are fairly abundant and widespread within the site. The following species are scarce: Pale Rush (*Juncus pallidus*), Common Blown Grass (*Lachnagrostis filiformis*), Slender Sword-sedge (*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Soft Tussock-grass (*Poa morrisii*), Slender Wallaby-grass (*Rytidosperma penicillatum*) and Clustered Wallaby-grass (*Rytidosperma racemosum*). Red-fruit Saw-sedge (*Gahnia sieberiana*) was recorded in 1996 but it appears to have died out, as it has through most of its range in and near Maroondah.

Other groundcover: Severely depleted. During this study, the only other wild, indigenous species to be found were very small numbers of Pale Flax-lily (*Dianella longifolia*), Common Raspwort (*Gonocarpus tetragynus*) and Lesser Loosestrife (*Lythrum hyssopifolia*). The 1996 flora survey also recorded Chocolate Lily (*Arthropodium strictum*) and Yellow Rush-lily (*Tricoryne elatior*).

Wetland (EVC 74, **Endangered** in the Gippsland Plain bioregion)

The mapping of wetlands on the aerial photograph on p. 576 is only approximate.

Woody plants: Swamp Paperbark (*Melaleuca ericifolia*) grows around the edges of some of the wetlands.

Climbers: None.

Ferns: None.

Creepers: Glandular Brooklime (*Gratiola pubescens*) is represented by up to 100 individuals in one small, ephemeral wetland – the easternmost wetland marked on the aerial photograph on p. 576.

Grasses, rushes and sedges: Some of the wetland depressions are dominated by Common Reed (*Phragmites australis*). Hollow Rush (*Juncus amabilis*), Common Bog-rush (*Schoenus apogon*) and the club-rushes, *Isolepis cernua* and *I. platycarpa*, are fairly abundant but localised. The following species are scarce: Slender Joint-leaf Rush (*Juncus fockei*), Broad-leaf Rush (*Juncus planifolius*), Broom Rush (*Juncus sarophorus*) and Common Blown Grass (*Lachnagrostis filiformis*).

Other groundcover: None seen in this study, which was during a time of drought.

Perennial stream and stream channel (no EVC or conservation status have been assigned by the Victorian Government)

Trees: Swamp Paperbark (*Melaleuca ericifolia*) grows on the slopes of Bungalook Creek.

Other woody plants: None.

Shrubby herbs: None.

Climbers: None.

Creepers: None.

Ferns: None.

Grasses, rushes and sedges: Common Reed (*Phragmites australis*) is fairly abundant but localised.

Other: Common Loosestrife (*Lythrum hyssopifolia*) was fairly abundant at the time of this study's inspection but numbers will vary from year to year.

Significant plants

Rare (but not otherwise threatened) in Victoria

Yarra Gum (*Eucalyptus yarraensis*) is a Victorian endemic species listed by the state government as 'rare but not otherwise threatened in Victoria'. There are at least three Yarra Gums overhanging the new creek channel of Dandenong Creek in the site's east. Others were recorded by Dr Drew King (arborist of Jacobs Australia Pty Ltd) in a 2017 tree survey in preparation for the construction of the new creek channel. King classified those trees as being subject to removal for the project and they were not found in this study.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Site 74 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – a single tree on the bank of Dandenong Creek, 105 m upstream of Bungalook Creek;
- *Gratiola pubescens* (Glandular Brooklime) – roughly 100 plants were seen in this study in a very shallow depression – the easternmost wetland marked on the aerial photograph on p. 576. The plants were in various states of health, some of them dead or dying due to drought conditions at the time;
- *Gynatrix pulchella* (Hemp Bush) – recorded in the Riparian Forest in the 1996 flora survey but not in this study; and
- *Senecio minimus* (Shrubby Fireweed) – abundant in three areas recovering from recent campsites or herbicide use, as well as scattered individuals elsewhere. The total population is totalling roughly 200 plants, from seedlings to adults.

Significant tree

As mentioned above, a particularly large, old Manna Gum is listed as tree HO9 under the Maroondah Heritage Overlay. This study's rating of the tree's health in January 2020, using the state government's 'Vegetation Quality Assessment' method, was 90% of the health of a tree in perfect health.

Significant fauna

The Australian Platypus Conservancy recorded a Water Rat on Bungalook Creek near the railway bridge on 6/5/19. The only other modern records in Maroondah are on Mullum Mullum Creek in Ringwood (Site 24).

Fauna habitat

- The creek channels provide habitat for Water Rats and hardy fish, aquatic invertebrates and waterbirds;
- The wetlands and depressions provide habitat for waterbirds, frogs and aquatic invertebrates, including yabbies. The frogs and invertebrates are a source of prey for other fauna;
- The structure and composition of the more natural areas of vegetation represent basic habitat for forest birds, bats, possums, lizards, frogs and invertebrates;
- There are at least ten trees with trunk diameters greater than the state government's benchmark for 'large trees'. Such trees are highly regarded as fauna habitat;
- Tree hollows provide roost sites or nest sites for some animals, including bats;
- Logs provide cover for invertebrates and small terrestrial vertebrates (e.g. lizards and frogs);
- The location on the Dandenong Creek and Bungalook Creek habitat corridor greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997):

- The creeks and their banks are in rating 'D' (poor);
- The Riparian Forest has approximately 0.1 ha in rating 'C' (fair) and 0.6 ha in rating 'D';
- The Swampy Woodland has approximately 1.0 ha in rating 'C' and 1.1 ha in rating 'D'; and
- The wetlands varied between ratings 'C' and 'D' at the time of this study's inspection (during drought) but may change significantly according to each season's rainfall.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The triangle in the east of Site 74 and the Swampy Woodland to its northwest each easily meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Swampy Woodland is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of State significance.

Rare or threatened plant species

Site 74's three or more Yarra Gums are part of a larger population scattered along Dandenong Creek, including in Sites 75 and 128. The species does not occur naturally outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

Referring to the section above headed 'Significant plants', Site 74's populations of *Gratiola pubescens* (Glandular Brooklime) and *Senecio minimus* (Shrubby Fireweed) each fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Locally threatened fauna species

Referring to the list above headed 'Significant fauna', the observation of a Water Rat in Bungalook Creek in 2019 makes Site 74 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. As for the flora just discussed, these conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and the state government's recognition in the interim of the conservation status of Swampy Woodland and Yarra Gum.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. However, these effects of microclimate moderation only benefit the very small number of people who visit the site.

As part of the 'urban forest', the trees help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The very large, old Manna Gum listed as tree HO9 under Maroondah's Heritage Overlay is important for natural heritage.

The site's riparian location has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

The site adds to the area's 'green and leafy' character, particularly for people using the Dandenong Creek Trail.

Changes

Change in the extent of habitat

Based on aerial photographs from 2001 and 2017, there was an increase of roughly 0.1–0.2 ha in the extent of native vegetation over that period due to the spreading of eucalypt crowns over abandoned pasture.

Change in the ecological condition of habitat

Lorimer *et al*. (1997) described Site 74's Riparian Forest as the second-best example of that EVC in Maroondah. That certainly could not be said today because the Riparian Forest has become overrun by the vigorous environmental weeds, Blackberry and Wandering Trad. As indicated above in the description of the composition of the Riparian Forest, most of the indigenous plant species present in 1996 appear to have died out, including the locally rare Hemp Bush (*Gynatrix pulchella*).

It seems likely that a similar deterioration has occurred in the adjoining area of Swampy Woodland but there is no prior information about the condition of that area specifically.

Comparing this study's data with that from the 1996 flora survey, the only discernible change in the indigenous plant species present in the Swampy Woodland around the middle of the site is the loss of Messmate Stringybark (*Eucalyptus obliqua*). Any change in ecological condition is probably minor.

In the site's eastern triangle, approximately ten indigenous plant species recorded in 1996 were not seen in this study. A few of the apparent losses may be due to the brevity of this study's inspection. Others are likely to have died out during the Millennium Drought or (in the case of Messmate Stringybark) straight after. On the other hand, this study's list of indigenous plant species in the eastern triangle includes fifteen species that were not recorded in 1996. In nearly all cases, those fifteen species were very likely overlooked in 1996, in part due to dry conditions and the time of year. Overall, it appears likely that the eastern triangle has lost a small fraction of its indigenous flora and the ecological condition of the vegetation has deteriorated slightly.

There is too little information from the 1996 flora survey to make a meaningful comparison with this study's information about Site 74's seasonal and ephemeral wetlands. In any case, changes in wetland condition are very prone to being temporary consequences of each season's rainfall rather than trends.

It is too early to tell whether the 2018 excavation of a new, meandering channel for Dandenong Creek will bring about the intended ecological benefits or result in a drop in the water table and consequent deaths of groundwater-dependent flora and associated fauna.

Aerial photographs from 2001, 2011 and 2017 show that many eucalypts died between 2001 and 2011 (during the Millennium Drought) and few died between 2011 and 2017. That observation may be associated with the apparent disappearance from the site of Messmate Stringybark.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Construction of the Healesville Freeway, which could destroy all the site's vegetation;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of indigenous plant species and their dependent fauna due to drying of the floodplain and wetlands during prolonged, severe droughts. Droughts are predicted to become more severe and frequent as a result of climate change;
- Possible dropping of the water table due to the excavation in 2018 of a new, deeper channel for Dandenong Creek;
- Displacement of indigenous flora and fauna by Blackberry, Wandering Trad and other environmental weeds;
- Water pollution in Dandenong Creek, affecting vegetation, aquatic invertebrates, fish, frogs and waterbirds; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The zoning within 40 m or so of the creeks is quite complicated, varying between 'Urban Floodway Zone', 'Neighbourhood Residential Zone – Schedule 4' and (near H.E. Parker Reserve) 'Public Park and Recreation Zone'. The rest of the site is zoned 'Neighbourhood Residential Zone – Schedule 4'.

As mentioned above, a particularly large, old Manna Gum is listed as tree HO9 under the Heritage Overlay. However, the address in the overlay schedule is wrongly stated to be 'H.E. Parker Reserve, 154 Heathmont Road, Heathmont'. It is recommended to correct the error when a suitable planning amendment arises.

Removal of native vegetation throughout Site 74 is controlled under the Vegetation Protection Overlay (VPO) and the state-wide baseline planning controls of clause 52.17 of the Victoria Planning Provisions. Those vegetation controls also apply to the weedy parts of the Healesville Freeway property that have been excised from Site 74.

In addition, Schedule 4 of the Significant Landscape Overlay covers the whole site, requiring a permit for the removal of native or introduced canopy trees (subject to exemptions).

As discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of State biological significance such as Site 74. Therefore, it is recommended to remove the VPO entirely and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 74 as mapped on p. 613. The application of the Environmental Significance Overlay will provide consistency with the other side of the municipal boundary, where it already applies to the land abutting Site 74 under the Knox Planning Scheme.

It would be open to Maroondah City Council to expand the area covered by ESO1 to provide a simpler boundary, as was done with the existing VPO. Areas with no native vegetation, such as the abovementioned weedy areas excised from Site 74, would be unaffected by ESO1.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately 2¾ hours of ecological survey for this study on 8/7/18 and 8/1/20, including: (a) compiling a list of indigenous plant species (excluding mosses and liverworts) and their abundances; (b) documenting the details of rare plants and large eucalypts; (c) mapping the vegetation, vegetation condition, rare plants and large eucalypts; and (d) checking for other attributes of the site relevant to the standard criteria for assessing biological significance;
- A record of a Water Rat on Bungalook Creek by the Australian Platypus Conservancy on 6/5/19 – data available from the Atlas of Living Australia;
- *'Daylighting Dandenong Creek – Tree Survey and Protection Strategy'* by Dr Drew King of Jacobs Australia Pty Ltd, dated 22/2/17;
- Electrofishing records of Southern Shortfin Eel and Mosquitofish in Bungalook Creek from John McGuckin on 8/3/06 - data available from the Victorian Biodiversity Atlas;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork by John C. Reid in December 1995 and March 1996. The fieldwork included: (a) compilation of five plant lists (without abundance data) for different areas or types of vegetation; (b) a 20-minute bird census; and (c) incidental observations of frogs, birds and butterflies; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird.

Site 75. H.E. Parker Reserve, Heathmont

Biological Significance Level: *National* as the type locality of the globally endangered flat-pea species, *Platylobium infecundum*



Aerial photograph taken February 2017

Legend

Site 29c	Site 76	Wetlands
Site 29d	Properties	EVC boundary
Site 73	Crown land	HRFF Herb-rich Foothill Forest
Site 74	Railway line	RF Riparian Forest
Site 75	Creeks	SW Swampy Woodland
		VHF Valley Heathy Forest

N

1:4500

0 50 100 150 200 m

Boundary

Site 75 is shown with a dashed-blue outline and blue hatching above. The boundary follows property boundaries where yellow can be seen in the gaps between the blue dashes. Bungalook Creek and the municipal boundary (Dandenong Creek) form the site's southeastern boundary. The rest of the site boundary has been drawn to circumscribe native vegetation with minimal intrusion on community facilities, roads and car parks.

The use of Bungalook Creek as part of the site boundary matches the original version of the site (Lorimer *et al*. 1997). If this report were to have started from scratch, the boundary with Site 74 would have been realigned westward to the nearest property boundary, which divides council land from a reservation for the proposed Healesville Freeway.

In other areas where Site 75 abuts other sites, the division between the sites is based on differences in land use and ownership.

Land use and tenure

The orange-hatched parts of the site are Crown land. The rest is a council reserve used for sports, recreation, scouts, drainage, nature conservation, a shared path and a footbridge over Dandenong Creek. Melbourne Water has management authority and responsibilities for the bed and banks of both creeks.

General description

Site 75 has four polygons totalling 8.5 hectares in area. With the exception of creek channels and drainage lines, the natural slope is generally slight – typically 1:25 to 1:30. However, the natural terrain has been modified in places by excavations for sport facilities, pipes and drainage.

The two creeks along the site's south-southeastern boundary are very close to the northern limits of their floodplains, so there is only a small area of alluvium within the site, mainly in the southwest. The soil in the rest of the site is clay loam formed by weathering of siltstone.

Bungalook Creek follows a natural route along the site boundary but its condition is far from natural. Its banks are scoured by the pulsed flows that result from the urbanised catchment and its impervious surfaces. The combination of the scouring, historical vegetation clearing and abundant environmental weeds has left the creek's banks and the channel with little native vegetation other than some Manna Gums (*Eucalyptus viminalis*) and patches of Swamp Paperbark (*Melaleuca ericifolia*). The peninsula formed by a southward meander in Bungalook Creek supports the Ecological Vegetation Class (EVC) called Riparian Forest. The adjacent, rather steep slope toward the netball centre supports the EVC, Herb-rich Foothill Forest.

Despite Bungalook Creek's lack of naturalness, it is still biologically important for movement of mobile fauna such as Water Rats, birds and flying insects, partly because streams in general act as wildlife corridors and also because this site is at the junction of two such corridors.

The second corridor is Dandenong Creek, which flows along the site's southern edge. Until the late 1960s, the creek flowed along the middle of the Crown land shown on the aerial photograph above with orange hatching. The creek was then replaced by a straightened floodway and low-flow pipe along the current municipal boundary. A small segment of the original creek channel was left stranded, to become the largest wetland marked on the aerial photograph on the previous page. That wetland and the keyhole-shaped one to its southwest are quite biologically significant, particularly as they are two of only three places in Maroondah where Spotted Knotweed (*Persicaria praetermissa*) grows wild.

A new, deeper, meandering channel for Dandenong Creek was excavated in 2018, after the aerial photograph above was taken. The channel has been planted with indigenous species, which are (at the time of writing, February 2020) mostly immature and sparse. Other plants (indigenous and introduced) are steadily colonising the banks.

A 1945 aerial photograph shows Site 75 to have a mixture of open grass and young regrowth. Few trees had crown diameters over 10 m, whereas many now have crown diameters over 15 m. This situation is typical of native vegetation in the Melbourne region.

Today, the two areas with the most natural vegetation are north of the eastern oval and west-southwest of the tennis courts. The former area has the most biologically significant vegetation due to the presence of a particularly important population of a globally endangered species of creeper – see below.

Across the whole site, this study detected 106 naturally-occurring, indigenous plant species.

Relationship to other land

Site 75 is just one of several contiguous sites of biological significance, the others being Sites 69, 73, 74, 76, 79, 80 and the railway corridor of Sites 29c & 29d. They are recognised separately in this report because of their different land uses. The key map of sites on p. 1 provides a broader context than the aerial photograph on p. 576.

That conglomerate of sites is connected by corridors along Bungalook Creek, Tarralla Creek and Dandenong Creek to other sites of biological significance such as Eastfield Park (Site 61), the Healesville Freeway reservation near Dorset Road (Site 64), Connolly Crescent Reserve (Site 72b), the Simpsons Court escarpment (Site 79), Scott Street Reserve (Site 80) and Bayswater Park in the City of Knox. The railway line provides a link to high-quality habitat on the 'Uambi' property (Site 32).

The habitat of each of the creek corridors is fragmented and the hydrology and channels of their streams have mostly been heavily modified from their natural states. Nevertheless, one can still readily observe the corridors being used by fauna such as eels, waterbirds and parrots. For more information about the biological significance of the corridors, see Site 62 (Tarralla Creek) on p. 465, Site 69 (Dandenong Creek) on p. 530 and Site 131 (Bungalook Creek) on p. 797. For information about the railway corridor, see Site 29d on p. 230.

The passage of birds and flying insects between all the abovementioned habitat areas improves the viability of the plant populations through dispersal of pollen and propagules.

The *'Maroondah Habitat Corridor Strategy'* (Context 2005) gives both the Bungalook Creek corridor and the Dandenong Creek corridor 'Very high relative corridor conservation priority'.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation composition below include only naturally-occurring, indigenous plant species except where stated otherwise. Because only two hours of flora survey were done for this study, some of the information below relies on a longer flora survey in 1995–1996. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion) north and northeast of the ovals

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) followed Mealy Stringybark (*E. cephalocarpa*). Narrow-leaved Peppermint (*E. radiata*) is fairly abundant and there are approximately twenty Red Stringybark (*E. macrorhyncha*). Bundy (*E. goniocalyx*) is scarce.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*) or Cherry Ballart (*Exocarpos cupressiformis*). Silver Wattle (*Acacia dealbata*) is fairly abundant. Black Wattle (*A. mearnsii*) and Golden Wattle (*A. pycnantha*) are scarce.

Large and medium shrubs: Patchily dense. Dominated variously by Sweet Bursaria (*Bursaria spinosa*) or thickets of Victorian Christmas-bush (*Prostanthera lasianthos*). Sifton Bush (*Cassinia sifton*), Hop Goodenia (*Goodenia ovata*) and Prickly Tea-tree (*Leptospermum continentale*) are also fairly abundant. The following additional species are scarce: Hop Wattle (*Acacia stricta*), Prickly Moses (*A. verticillata*), Common Cassinia (*Cassinia aculeata*), Yarra Burgan (*Kunzea leptospermoides*), Manuka (*Leptospermum scoparium*), Tree Everlasting (*Ozothamnus ferrugineus*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*), Shrubby Fireweed (*S. minimus*) and Cotton Fireweed (*S. quadridentatus*) were scarce during this study's flora survey but numbers could be much higher following suitable conditions of weather and soil disturbance.

Ferns: *Pteridium esculentum* is fairly abundant in a small part of the area.

Climbers: Common Apple-berry (*Billardiera scandens*) is fairly abundant.

Creepers: The endangered flat-pea *Platylobium infecundum* is abundant, mainly north of the pavilion for cricket and football, where it dominates the ground flora. The wood-sorrel, *Oxalis exilis/perennans*, is slightly less abundant. Kidney-weed (*Dichondra repens*) is dense but very localised. Bidgee-widgee (*Acaena novae-zelandiae*) and Ivy-leaf Violet (*Viola hederacea*) are scarce.

Grasses, rushes and sedges: Abundant, with no one species dominant over much of the area. In part, the dominant species is Weeping Grass (*Microlaena stipoides*), and in a small area, it is Red-anther (or Silvertop) Wallaby-grass (*R. pallidum*). The following species are also abundant: Veined Spear-

grass (*Austrostipa rudis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Clustered Wallaby-grass (*R. racemosum*) and Purplish Wallaby-grass (*R. tenuius*). Slightly less abundant are Reed Bent-grass (*Deyeuxia quadriseta*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Slender Wallaby-grass (*R. penicillatum*), Kangaroo Grass (*Themeda triandra*) and Small Grass-tree (*Xanthorrhoea minor*). The following species are scarce: Short-stem Sedge (*Carex breviculmis*), Green Rush (*Juncus gregiflorus*), Pale Rush (*J. pallidus*), Tall Sword-sedge (*Lepidosperma elatius*), Slender Sword-sedge (*L. gunnii*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Soft Tussock-grass (*Poa morrisii*) and Common Bog-rush (*Schoenus apogon*). Immediately outside the site's northern boundary, the presence of Red-fruit Saw-sedge (*Gahnia sieberiana*) and Spreading Rope-rush (*Empodisma minus*) indicate Lowland Forest.

Other groundcover: Dominated by Black-anther Flax-lily (*Dianella revoluta*). Yellow Rush-lily (*Tricoryne elatior*) is abundant but not dominant due to its wiry structure. The following species are fairly abundant: Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Common Raspwort (*Gonocarpus tetragynus*), Slender Bottle-daisy (*Lagenophora sublyrata*), Common Rice-flower (*Pimelea humilis*), Small Poranthera (*Poranthera microphylla*), Nodding Greenhood (*Pterostylis nutans*), Grass Trigger-plant (*Stylidium armeria*) and Trim Sun-orchid (*Thelymitra* ?*peniculata*). Pale Grass-lily (*Caesia parviflora*) and Pale Flax-lily (*Dianella longifolia*) are both scarce.

Herb-rich Foothill Forest (EVC 23, **Vulnerable** in the Gippsland Plain bioregion) on the steep slope next to Bungalook Creek, and south of a line through the centres of the ovals but excluding gullies, wetlands and creek channels

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*), joined by Manna Gum (*E. viminalis* subsp. *viminalis*) near The Greenway and on the steep slope overlooking Bungalook Creek (due to proximity to Riparian Forest). Red Stringybark (*E. macrorhyncha*) is fairly abundant. The following species are scarce: Mealy Stringybark (*E. cephalocarpa* – two only), Yellow Box (*E. melliodora*, near the Valley Heathy Forest), Swamp Gum (*E. ovata*) and Narrow-leaved Peppermint (*E. radiata*).

Lower trees: Dominated by Silver Wattle (*Acacia dealbata*), followed by Black Wattle (*A. mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*). Blackwood (*A. melanoxylon*), Golden Wattle (*A. pycnantha*) and Swamp Paperbark (*Melaleuca ericifolia*) are scarce.

Large and medium shrubs: Patchy. Denser patches are dominated variously by Hop Goodenia (*Goodenia ovata*) or Victorian Christmas-bush (*Prostanthera lasianthos*). Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*) and Tree Everlasting (*Ozothamnus ferrugineus*) are fairly abundant. Shiny Cassinia (*Cassinia longifolia*), Yarra Burgan (*Kunzea leptospermoides*) and Australian Dusty Miller (*Spyridium parvifolium*) are scarce.

Small shrubs: None seen.

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) has a dense colony plus scattered individuals. Cotton Fireweed (*S. quadridentatus*) was scarce during this study's flora survey but numbers could be much higher following suitable conditions of weather and soil disturbance.

Ferns: *Pteridium esculentum* forms dense patches and Common Maidenhair (*Adiantum aethiopicum*) is fairly abundant on some of the gentle slopes.

Climbers: Common Apple-berry (*Billardiera scandens*) is fairly abundant. Wonga Vine (*Pandorea pandorana*) has colonised the reserve in the past two decades and has become fairly abundant, threatening to displace pre-existing indigenous flora and fauna.

Creepers: Kidney-weed (*Dichondra repens*) and the wood-sorrel, *Oxalis exilis/perennans*, are fairly abundant.

Grasses, rushes and sedges: Abundant. Dominated by Weeping Grass (*Microlaena stipoides*). The following species are fairly abundant: Veined Spear-grass (*Austrostipa rudis*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Clustered Wallaby-grass (*R. racemosum*), Bristly Wallaby-grass (*R. setaceum*) and Purplish Wallaby-grass (*R. tenuius*). The following species are scarce: Short-stem Sedge (*Carex breviculmis*), Reed Bent-grass (*Deyeuxia quadriseta*), Pale Rush (*Juncus pallidus*), Slender Sword-sedge (*Lepidosperma gunnii*), Variable Sword-sedge (*L. laterale*), Wattle Mat-rush (*Lomandra filiformis* subspp. *coriacea* and *filiformis*), Sword Tussock-grass (*Poa ensiformis*), Red-

anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Common Bog-rush (*Schoenus apogon*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Dominated by Pale Flax-lily (*Dianella longifolia*), followed by Black-anther Flax-lily (*D. revoluta*) and Yellow Rush-lily (*Tricoryne elatior*). Tasman Flax-lily (*D. tasmanica*) and Rosy Hyacinth-orchid (*Dipodium roseum*) are both scarce.

Riparian Forest (EVC 18, **Vulnerable** in the Gippsland Plain bioregion) on the floodplain beside Bungalook Creek

Canopy trees: Dominated by Manna Gum (*Eucalyptus viminalis* subsp. *viminalis*).

Lower trees: Strongly dominated by the introduced Desert Ash (*Fraxinus angustifolia*) and Sweet Pittosporum (*Pittosporum undulatum*). The only indigenous subcanopy tree species observed within the Riparian Forest were just outside Site 75 on the opposite side of Bungalook Creek, in Site 74. Those species are represented by patches of Silver Wattle (*Acacia dealbata*) and Swamp Paperbark (*Melaleuca ericifolia*) and a few Black Wattle (*A. mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*).

Medium to large shrubs: Apart from a few Hop Goodenia (*Goodenia ovata*), indigenous shrubs have been completely shaded out by Sweet Pittosporums and replaced by blackberries.

Small shrubs: None.

Ferns: None.

Climbers: None (but the introduced Japanese Honeysuckle (*Lonicera japonica*) is fairly abundant).

Creepers: None.

Grasses, rushes and sedges: Weeping Grass (*Microlaena stipoides*) is localised and Sword Tussock-grass (*Poa ensiformis*) is scarce.

Other groundcover: None recorded.

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion). This EVC is taken to include both: (a) the southeast-flowing gully north of the pavilion for the eastern oval; and (b) a strip beside the Dandenong Creek Trail that is believed to have once been Swampy Riparian Woodland but now lacks riparian processes due to modification (and particularly deepening) of the creek channel.

Canopy trees: Dominated by Swamp Gum (*Eucalyptus ovata*). There are also some Messmate Stringybarks (*E. obliqua*) and three Yarra Gums (*E. yarraensis*).

Lower trees: Moderately dense. North of the oval pavilion, Blackwood (*Acacia melanoxylon*) is dominant and Swamp Paperbark (*Melaleuca ericifolia*) is fairly abundant. Beside the Dandenong Creek Trail, Silver Wattle (*Acacia dealbata*) and Swamp Paperbark are co-dominant, while Black Wattle (*A. mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*) are scarce.

Medium to large shrubs: Patchy. North of the oval pavilion, the main species are Hop Goodenia (*Goodenia ovata*) and Prickly Currant-bush (*Coprosma quadrifida*), while Tree Everlasting (*Ozothamnus ferrugineus*) is scarce. Beside the Dandenong Creek Trail, Hop Goodenia and Victorian Christmas-bush (*Prostanthera lasianthos*) dominate and Prickly Currant-bush is fairly abundant.

Small shrubs: None seen.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) was scarce at the time of this study but it and other *Senecio* species are probably more abundant in good years.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches.

Climber: Mountain Clematis (*Clematis aristata*) and Small-leafed Clematis (*C. decipiens*) are scarce, north of the oval pavilion. Wonga Vine (*Pandorea pandorana*) is scattered in both areas of Swampy Woodland but it is best regarded as non-indigenous as it is a recent arrival and threatens the pre-existing flora and fauna. No genuinely indigenous climbers were seen beside Dandenong Creek.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) and the wood-sorrel, *Oxalis exilis/perennans*, are fairly abundant beside the Dandenong Creek Trail. No indigenous creepers were seen north of the oval pavilion.

Grasses, rushes and sedges: Due to environmental modifications, the diversity is heavily reduced from a natural state and Tall Sword-sedge (*Lepidosperma elatius*) is the only indigenous grassy species present in both areas identified here as Swampy Woodland. North of the oval pavilion, Tall Sedge

(*Carex appressa*), Green Rush (*Juncus gregiflorus*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Tall Sword-sedge are fairly abundant, while Broom Rush (*Juncus sarophorus*) is scarce. Beside the Dandenong Creek Trail, Weeping Grass (*Microlaena stipoides*) is abundant, while Tall Sword-sedge and Slender Wallaby-grass (*Rytidosperma penicillatum*) are fairly abundant and the following species are scarce: Veined Spear-grass (*Austrostipa rudis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Sword Tussock-grass (*Poa ensiformis*).

Other groundcover: Severely depleted. The only species found north of the oval pavilion was Tasman Flax-lily (*Dianella tasmanica*), which is abundant. Beside the Dandenong Creek Trail, the only species found was Black-anther Flax-lily (*D. revoluta*), which is scarce.

Wetland (EVC 74, **Endangered** in the Gippsland Plain bioregion) in the three wetlands west-southwest of the tennis courts, marked on the aerial photograph on p. 585

Trees: Swamp Paperbark (*Melaleuca ericifolia*) is abundant in the two larger wetlands.

Shrubs and shrubby herbs: Prickly Currant-bush (*Coprosma quadrifida*) is fairly abundant in the largest wetland. No other shrubs were seen within the wetlands but Hop Goodenia (*Goodenia ovata*) grows at the edges.

Climbers: A single Wonga Vine (*Pandorea pandorana*) occurs in one wetland but it cannot be regarded as an indigenous component of the vegetation.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*), Rainforest Crane's-bill (*Geranium homeanum*) and the wood-sorrel, *Oxalis exilis/perennans*, are fairly abundant. The scrambler, Angled Lobelia (*Lobelia anceps*), is also fairly abundant in the westernmost wetland.

Ferns: Eight Rough Tree-ferns (*Cyathea australis*) grow in the most western wetland. Tender Brake (*Pteris tremula*) is similarly abundant in the same wetland but only as a result of a recent expansion of the species' range into Maroondah.

Grasses, rushes and sedges: Dominated by Tall Sedge (*Carex appressa*) and Tassel Sedge (*Carex fascicularis*), each of which is represented by both wild and planted individuals. Swamp Club-rush (*Isolepis inundata*) and Green Rush (*Juncus gregiflorus*) are fairly abundant.

Other species: Lesser Joyweed (*Alternanthera denticulata*) and Spotted Knotweed (*Persicaria praetermissa*) are both abundant. Lesser Loosestrife (*Lythrum hyssopifolia*) and Slender Knotweed (*P. decipiens*) are fairly abundant. Water Plantain (*Alisma plantago-aquatica*) was recorded previously and will probably return during wet years.

Artificial stream channel (no EVC or conservation status have been assigned by the state government)

A new channel was excavated for Dandenong Creek during this study and little vegetation had returned naturally in the new channel in time to be reported here. Planted species are omitted from what follows.

Trees: Swamp Paperbark (*Melaleuca ericifolia*) is scarce.

Other woody plants: None.

Shrubby herbs: None.

Climbers: None.

Creepers: None.

Ferns: None.

Grasses, rushes and sedges: Common Reed (*Phragmites australis*) is fairly abundant. Loose-flower Rush (*Juncus pauciflorus*) is scarce, perhaps only present as a result of recent planting.

Aquatic species: Slender Knotweed (*Persicaria decipiens*) is abundant. Water-pepper (*Persicaria hydropiper*) is fairly abundant. Water Plantain (*Alisma plantago-aquatica*) and Curly Pondweed (*Potamogeton* ?*crispus*) are very scarce.

Other species: Hairy Willow-herb (*Epilobium hirtigerum*) is abundant. Robust Willow-herb (*E. billardiereanum* subsp. *intermedium*), Lesser Loosestrife (*Lythrum hyssopifolia*) and Water-pepper (*Persicaria hydropiper*) are fairly abundant.

Significant plants

Globally endangered

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. There is a sizeable population between the reserve's main driveway, the scout hall and the pavilion next to the ovals. No count has been taken. About a dozen more grow less than 10 m north of Site 75, in Site 29d (the railway corridor).

From a scientific perspective, the plants in and near H.E. Parker Reserve are more important than any others of the species because they are at the 'type locality' of *Platylobium infecundum*. That means a specimen of the species (called a 'Type') was taken from the same place to scientifically define the whole species. In this case, the Type is designated as '*I.R.Thompson 1104*' of 4th October 2008 and the location was recorded as 'Near railway line at entrance to HE Parker Reserve, Heathmont Road, Heathmont'. The specimen is kept in the National Herbarium of Victoria.

A population of any species at its type locality helps to display the characteristics of the species in its natural habitat in ways that a specimen, alone, cannot do; e.g. its seasonal variability, life history, fecundity and relationships with other organisms. Any other population of the species (or what appears to be the species) is likely to be slightly different, genetically, from the Type and might one day be determined to be a different taxon.

Rare (but not otherwise threatened) in Victoria

Yarra Gum (*Eucalyptus yarraensis*) is a Victorian endemic species listed by the state government as 'rare but not otherwise threatened in Victoria'. There is a cluster of three Yarra Gums on the brow of the new creek channel of Dandenong Creek, 65 m east of the tennis courts. It is not clear whether they will survive the root severance and soil compaction that occurred during the excavations.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Site 75 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Aphelia pumilio* (Dwarf Aphelia) – a specimen of this minute plant was collected at H.E. Parker Reserve by the late John C. Reid in 1996, probably west of the tennis courts. Reid's detection of the species is the only such record in Maroondah's history. The species might well be still present in the reserve but it is likely to elude even a quite thorough search because of its tiny size and lack of visible flowers;
- *Centrolepis aristata* (Pointed Centrolepis) – another minute species that was recorded in 1996 and that may well persist despite not being detected in this study's brief flora survey. It was found just west of the tennis courts;
- *Correa reflexa* var. *reflexa* (Common Correa) – a single, apparently wild specimen of the local form of this species was found north of the eastern oval, near the driveway. The species was also recorded in that area in the previous (1996) flora survey;
- *Eucalyptus macrorhyncha* (Red Stringybark) – in this study, approximately twenty were counted north of the ovals and another seven southwest of the western oval;
- *Gynatrix pulchella* (Hemp Bush) – scarce in 1996 and not detected in this study;
- *Persicaria praetermissa* (Spotted Knotweed) – abundant in the two largest wetlands in the site's southwest, also present (presumably planted) in the nearby small, artificial wetland. The only other known wild occurrence in Maroondah's history is at Scott Street Reserve (Site 80). The species is also abundant at Yarrabing Reserve in Wantirna, 2¾ km west of H.E. Parker Reserve;
- *Potamogeton* ?*crispus* (Curly Pondweed) – two plants growing in a pool in Dandenong Creek appear most likely to be this species but without being able to reach them, they may be the similar *P. ochreatus*; and
- *Senecio minimus* (Shrubby Fireweed) – in this study, one was seen north of the ovals and approximately 54 in an area 10–40 m southwest of the western oval. Numbers are likely to vary greatly from year to year.

Significant fauna

The Australian Platypus Conservancy recorded a Water Rat on Bungalook Creek near the railway bridge on 6/5/19. The only other modern records in Maroondah are on Mullum Mullum Creek in Ringwood (Site 24).

Fauna habitat

- The creek channels provide habitat for Water Rats and hardy fish, aquatic invertebrates and waterbirds;
- The wetlands and depressions provide habitat for waterbirds, frogs and aquatic invertebrates, including yabbies. The frogs and invertebrates are a source of prey for other fauna;
- The structure and composition of the more natural areas of vegetation represent basic habitat for forest birds, bats, possums, lizards, frogs and invertebrates;
- Tree hollows provide roost sites or nest sites for some animals, including bats;
- There are some large, old eucalypts (Messmate Stringybarks), which are of high value as habitat trees;
- Council has installed nest boxes to augment the natural tree hollows;
- Logs provide cover for invertebrates and small terrestrial vertebrates (e.g. lizards and frogs);
- The location on the habitat corridors of Dandenong Creek, Bungalook Creek and the railway line greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National

Type locality

As discussed above, the type locality for the endangered flat-pea species, *Platylobium infecundum*, is near the entrance to H.E. Parker Reserve, where a sizeable population of the species grows within the site. Standard criterion 5.2 assigns **National** significance to such a site.

Threatened plant species

Platylobium infecundum is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. A sizeable population occurs in Site 75, particularly between H.E. Parker Reserve's main driveway and the pavilion for the ovals. The species' global distribution is confined to a small part of Victoria. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance.

Site 75's three known Yarra Gums are part of a larger population scattered along Dandenong Creek, including in Sites 75 and 128. The species does not occur naturally outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of State significance.

The section above headed 'Significant plants' includes a list of Site 75's species whose risk of dying out in Maroondah is in the 'critically endangered' category. Of those species, the populations of *Eucalyptus macrorhyncha*, *Persicaria praetermissa* and *Senecio minimus* clearly meet the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating. The same would also be true of *Potamogeton crispus*, if its identity can be confirmed by either wading to it or collecting a fragment with a pole.

A targeted, seasonally-appropriate flora survey would be required to determine whether *Aphelia pumilio* or *Centrolepis aristata* remain in the site. In the absence of such a survey, it seems appropriate to assume that the 1996 flora survey that detected them is still relevant. On that basis, the 1996 records meet the same standard criterion as *Persicaria praetermissa*, representing Local significance.

Threatened fauna species

Referring to the list above headed 'Significant fauna', the observation of a Water Rat in Bungalook Creek in 2019 makes Site 75 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. As for the flora just discussed, these conditions lead to a Local significance rating.

Regionally threatened Ecological Vegetation Classes

Site 75's Valley Heathy Forest meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Valley Heathy Forest is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of State significance.

The area of Herb-rich Foothill Forest southwest of the western oval also meets the definition of a 'patch'. That EVC is listed by the state government as 'vulnerable' within the relevant bioregion – the Gippsland Plain. The author is confident that, if a 'habitat hectares' assessment were to be done, the habitat score would be at least 0.3. On that basis, it meets standard criterion 3.2.3 for a site of State significance.

The site's overall 'National' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to: (a) differences in the criteria; (b) the recent detection of Yarra Gums in the site; and (c) recognition of the conservation status of *Platylobium infecundum*, Valley Heathy Forest and Herb-rich Foothill Forest, none of which had not even been named in 1997.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve as well as immediate neighbours and people walking or cycling along Dandenong Creek.

As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside the creeks and wetlands helps to stabilise the soil and remove a small amount of water pollution.

The natural ambience of the reserve is expected to contribute to the enjoyment and wellbeing of users of the reserve. That may be particularly important for the scouts whose hall is in the reserve, as nature helps the development of children's minds (Section 1.3 of Volume 1).

Similar benefits are spread more widely by birds, butterflies and other animals moving out of the site into neighbouring streets and gardens.

The site's natural ambience also encourages people to get exercise by walking or running there.

While the members of Heathmont Bushcare provide ecological benefits to the bushland during working bees, the bushland reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The site's vegetation contributes substantially to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Many of these values are amplified by the reserve's heavy usage for sport, recreation and scouting.

In addition, the site's riparian location has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, most of the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Based on scrutiny of aerial photographs, approximately 500 m² of remnant eucalypt cover in 2001 was no longer present in 2018. Most of that loss was due to eucalypt deaths and the rest was mostly due to expansion of the netball facilities in 2018.

The aerial photographs also show that the 500 m² of canopy loss has been outweighed by gains due to growth of eucalypt crowns to spread over land that had no apparent native vegetation in 2001.

Change in the ecological condition of habitat

Aerial photographs from 2001, 2011 and 2017 show that many eucalypts died between 2001 and 2011 (during the Millennium Drought) followed by a much slower mortality rate between 2011 and 2017. That observation is typical of Maroondah's remnant eucalypts.

There is too little information predating this study to draw further inferences about changes in the site's ecological condition.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of indigenous plant species and their dependent fauna due to drying of the floodplain and wetlands during prolonged, severe droughts. Droughts are predicted to become more severe and frequent as a result of climate change;
- Possible dropping of the water table due to the excavation in 2018 of a new, deeper channel for Dandenong Creek. The greatest impact would be on the wetlands and eucalypts, with secondary effects on the rest of the ecosystem;
- Displacement of indigenous flora and fauna along Bungalook Creek by Blackberry, Wandering Trad and other environmental weeds;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Water pollution in Dandenong Creek, affecting vegetation, aquatic invertebrates, fish, frogs and waterbirds.

Strategic planning

The strip of land between the municipal boundary and the parallel path north of Dandenong Creek is zoned 'Urban Floodway Zone'. The rest of the site is zoned 'Public Park and Recreation Zone'.

Removal of native vegetation throughout Site 75 is controlled under the Vegetation Protection Overlay (VPO) and the state-wide baseline planning controls of clause 52.17 of the Victoria Planning Provisions. Those vegetation controls also apply to the parts of H.E. Parker Reserve that are here excised from Site 75, such as the ovals, tennis courts and netball complex.

In addition, the Significant Landscape Overlay covers the whole site, requiring a permit for the removal of native or introduced canopy trees (subject to exemptions).

For the reasons discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of National biological significance such as Site 75. Therefore, it is recommended to remove the VPO entirely and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 75 as mapped on p. 585. The abutting land in Knox is already subject to the Environmental Significance Overlay (shown hatched in purple on the aerial photograph on p. 530).

It would be open to Maroondah City Council to expand the area covered by ESO1 to provide a simpler boundary, as was done with the existing VPO. Areas with no native vegetation, such as the sports facilities, would be unaffected by ESO1.

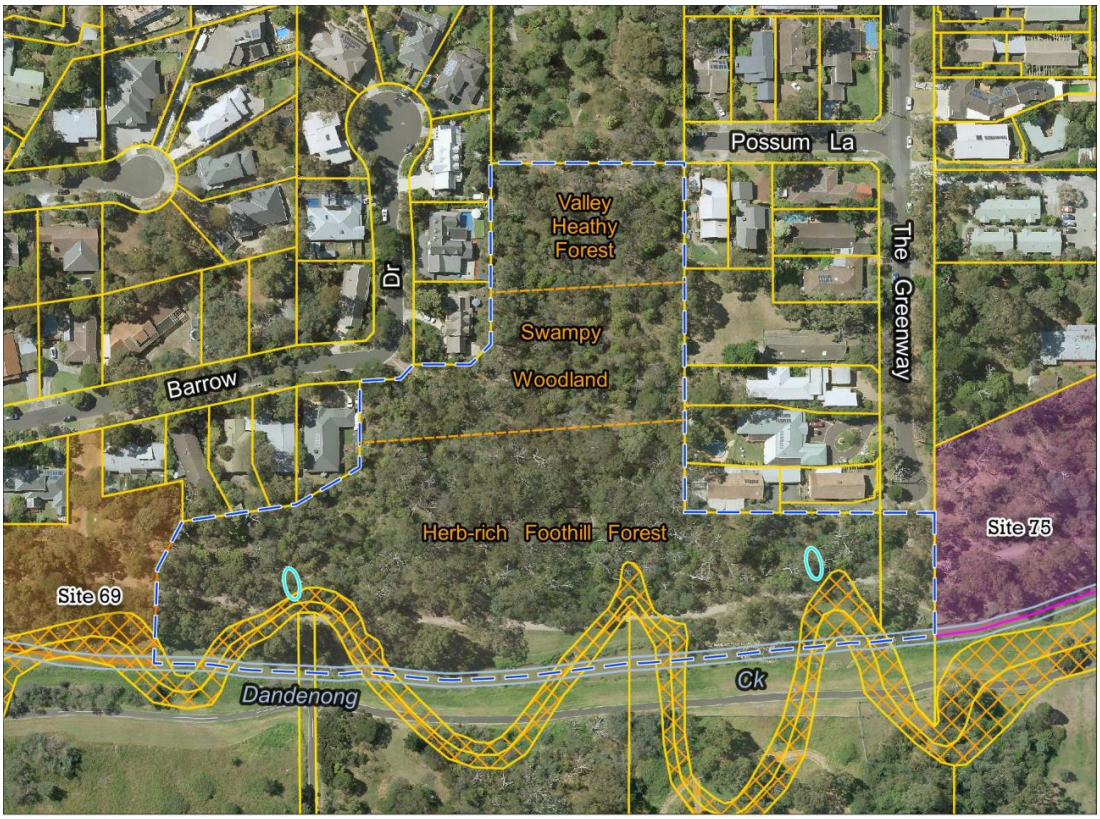
Information sources

The analysis above draws on the following sources of information about the site:

- A total of approximately six hours of ecological survey for this study on 11/2/18, 22/4/18 and 11/2/20, including: (a) compiling a list of indigenous plant species (excluding mosses and liverworts) and their abundances for each of twelve parts of the site; (b) documenting and mapping rare plants; (c) recording birds, frogs and possums observed during the survey; and (d) checking for other attributes of the site relevant to the standard criteria for assessing biological significance;
- A record of a Water Rat on Bungalook Creek by the Australian Platypus Conservancy on 6/5/19 – data available from the Atlas of Living Australia;
- Lists of birds (all common species) from contributors to eBird in 1996, 2014 and 2019 – see the eBird website;
- Lists of birds (all common species) from volunteers of the Bird Observers Club of Australia in 1998–1999 and autumn 2017 – data available from the Atlas of Living Australia;
- *'Daylighting Dandenong Creek – Tree Survey and Protection Strategy'* by Dr Drew King of Jacobs Australia Pty Ltd, dated 22/2/17;
- Electrofishing records of Southern Shortfin Eel and Mosquitofish in Bungalook Creek from John McGuckin on 8/3/06 - data available from the Victorian Biodiversity Atlas;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork by John C. Reid in December 1995 and March 1996. The fieldwork included: (a) compilation of eight plant lists (without abundance data) for different areas or types of vegetation; (b) a 20-minute bird census; (c) a mammal hair survey using one hair funnel; and (d) incidental observations of frogs, birds and butterflies; and
- Aerial photographs from 1945, 2001, 2011 and 2017, and satellite imagery from 2018.

Site 76. Dexters Bush, Heathmont

Biological Significance Level: *State* due to the presence of threatened vegetation types



Legend

Properties
Crown land
EVC boundary (approx.)
Ephemeral wetlands
Site 69
Site 75
Site 76

Aerial photograph taken February 2017

N

1:2500
0 20 40 60 80 100 m

Boundary

Site 76 is shown with a dashed-blue outline above. The boundary follows property boundaries where yellow can be seen in the gaps between the blue dashes. The municipal boundary with the City of Knox (Dandenong Creek) forms the site's southern boundary. The boundary with Site 69 follows a fence that extends south-southwest from a property corner, and then south along the shortest line to Dandenong Creek.

Site 76, as adopted here, replaces Sites 76, 77 and 78 of Lorimer *et al.* (1997). It encompasses all of the original Sites 76 and 77, part of the original Site 78 and a small area west of the original Site 78. The original sites were treated separately in 1997 because of differences between public land, private land and Trust for Nature land. Now, all the land is public land.

Site 76 is treated separately from Site 69 because Site 76 contains much more biologically significant habitat. The location of the boundary with Site 75 is somewhat arbitrary but the two sites deserve to be treated separately because Site 75 is managed largely for sport and Site 76 is managed largely for nature conservation.

Land use and tenure

The area cross-hatched in orange on the aerial photograph above is Crown land. The land directly south of the dead end of The Greenway is part of that road's reservation. The rest of the land north of the Crown Land is a council reserve used for drainage (Dandenong Creek), nature conservation, passive recreation and pedestrian thoroughfare. The land south of the Crown land is reserved for roads (including the proposed Healesville Freeway) and used for drainage (Dandenong Creek). Melbourne Water has management authority and responsibilities for the bed and banks of Dandenong Creek.

General description

Site 76 is named 'Dexters Bush' in this report because that is the registered name of the central part of the site before Maroondah City Council acquired all the site's land. Liz and Mick Dexter donated that central area to the Trust for Nature in 1988.

The site is 2.9 hectares in area. With the exception of the bank of Dandenong Creek, the slope is slight, averaging 1:30. The soil is alluvium deposited by Dandenong Creek, which flows along the site's southern edge.

At the time of European settlement, the creek flowed along the middle of the Crown land shown on the aerial photograph above with orange cross-hatching. In c. 1970, the creek was replaced by a straightened channel along the current municipal boundary. The bed of the straightened channel appears to be lower than the natural creek, thereby lowering the water table. Remnants of the original creek and its bank remain at the extremities of the bends, mainly in the form of ephemeral wetlands. However, those wetlands have held water with decreasing frequency during this century and the wetland plants have mostly died out.

A 1945 aerial photograph shows the northern half of the site to have been cleared and mostly cultivated not long before the photograph was taken. The southern half had young regrowth forest. The crowns of the eucalypts and pines were up to about 7 m in diameter – less than half the size of mature trees. This situation is typical of native vegetation in the Melbourne region.

Pines came to dominate much of the site's northern half over the subsequent four decades. The pines were cleared from the original Dexters Bush in c. 1993. The regenerating vegetation contained many rare indigenous plant species of swampy floodplains, such as Ace of Spades (*Epacris gunnii*). However, most of those species died out over the following decade. The cause appears to be that the seeds which led to the regeneration were laid down in the soil before Heathmont was urbanised, when far fewer pipes and impervious surfaces were present to promote runoff and drain the land. The modern drainage system and climate change have changed the availability of soil moisture too much for the rare plants to thrive and in many cases to survive.

Attempts by Heathmont Bushcare to re-establish Ace of Spades and some similar species in Site 76 have failed repeatedly, for the same reason that they died out. Ace of Spades is now presumed to have died out throughout Maroondah except for planted plants, which are expected to die without reproducing.

However, the former pine plantation in the centre of the site remains the main stronghold in Maroondah of two plant species of swampy ground: Short Purple-flag (*Patersonia fragilis*) and Tufted Blue-lily (*Thelionema caespitosum*). The only other site in Maroondah or for many kilometres around is Bungalook Conservation Reserves in Kilsyth South (Site 66).

More generally, Site 76 today contains a mixture of naturally-occurring and planted indigenous plants. The author found 112 naturally-occurring, indigenous species in his most recent botanical survey, in 2015–2016. Introduced plants are kept at low densities except around the site's edges. Many of the mature eucalypts in and near the site died during the Millennium Drought and the canopy has not recovered well in the intervening decade.

Relationship to other land

Site 76 is just one of several contiguous sites of biological significance, the others being Sites 69, 73, 74, 75, 79, 80 and the railway corridor of Sites 29c & 29d. They are recognised separately in this report because

of their different land uses. The key map of sites on p. 1 provides a broader context than the aerial photograph on p. 596. Sites 69 and 75 abut Site 76 and Sites 29c & 29d are just under 350 m to the north.

That conglomerate of sites is connected by corridors along Bungalook Creek, Tarralla Creek and Dandenong Creek to other sites of biological significance such as Eastfield Park (Site 61), the Healesville Freeway reservation near Dorset Road (Site 64), Connolly Crescent Reserve (Site 72b), the Simpsons Court escarpment (Site 79), Scott Street Reserve (Site 80) and Bayswater Park in the City of Knox. The railway line provides a link to high-quality habitat on the 'Uambi' property (Site 32).

The habitat of each of the creek corridors is fragmented and the hydrology and channels of their streams have mostly been heavily modified from their natural states. Nevertheless, one can still readily observe the corridors being used by fauna such as eels, waterbirds and parrots. For more information about the biological significance of the corridors, see Site 62 (Tarralla Creek) on p. 465, Site 69 (Dandenong Creek) on p. 530 and Site 131 (Bungalook Creek) on p. 797. For information about the railway corridor, see Site 29d on p. 230.

The passage of birds and flying insects between all the abovementioned habitat areas improves the viability of the plant populations through dispersal of pollen and propagules.

The *'Maroondah Habitat Corridor Strategy'* (Context 2005) gives the Dandenong Creek corridor 'Very high relative corridor conservation priority' because of its importance in connecting core areas of habitat such as Site 76.

Bioregion: Gippsland Plain

Habitat types

As discussed above, the site's native vegetation has had a chequered history and the availability of soil moisture has changed substantially. As a result, the boundaries between vegetation types has become blurred and probably distorted compared with the pre-European state. The boundary between the site's Ecological Vegetation Classes (EVCs) marked on the aerial photograph is indicative only. Based on surface geology, it seems likely that the regrowth of Valley Heathy Forest currently in the site was Swampy Woodland before the site was cleared and cultivated in the first half of the 20th Century.

The descriptions of vegetation composition below include only naturally-occurring, indigenous plant species except where stated otherwise.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*). Narrow-leaved Peppermint (*E. radiata*), Swamp Gum (*E. ovata*) and hybrids between the two are also fairly abundant. There are two Bundies (*E. goniocalyx*).

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*), followed by Blackwood (*Acacia melanoxylon*). Black Wattle (*Acacia mearnsii*) and Golden Wattle (*A. pycnantha*) are scarce.

Medium to large shrubs: Yarra Burgan (*Kunzea leptospermoides*) and Manuka (*Leptospermum scoparium*) and fairly abundant, while Golden Bush-pea (*Pultenaea gunnii*) is scarce. Hedge Wattle (*A. paradoxa*) is also fairly abundant but may be present solely due to planting. The following scarce species may also be entirely planted: Prickly Currant-bush (*Coprosma quadrifida*), Snowy Daisy-bush (*Olearia lirata*) and Victorian Christmas-bush (*Prostanthera lasianthos*).

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is present but much scarcer than in pristine Valley Heathy Forest.

Shrubby herbs: None seen in this study.

Ferns: None detected.

Climbers: None seen in this study.

Creepers: Ivy-leaf Violet (*Viola hederacea*) was scarce at the time of this study but may be more abundant at other times.

Grasses, rushes and sedges: Dominated by Weeping Grass (*Microlaena stipoides*), followed by Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Pale Rush (*Juncus pallidus*). The following species are somewhat less abundant: Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*Lomandra longifolia* subspp. *exilis* and *longifolia*), Clustered Wallaby-grass (*Rytidosperma racemosum*), Bristly Wallaby-grass (*R. setaceum*), Purplish Wallaby-grass (*R. tenuius*) and (probably due to planting) Red-fruit Saw-sedge (*Gahnia sieberiana*). Green Rush (*Juncus gregiflorus*) is represented by a single plant, attributable to the proximity to Swampy Woodland.

Other groundcover: Pale Grass-lily (*Caesia parviflora*), Pale Flax-lily (*Dianella longifolia*), Black-anther Flax-lily (*Dianella revoluta*) and Tasman Flax-lily (*Dianella tasmanica*) are fairly abundant. Common Raspwort (*Gonocarpus tetragynus*) is scarce.

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion)

Canopy trees: Severely depleted due to the history of pines. Most of the remaining eucalypts are Swamp Gums (*Eucalyptus ovata*). Messmate Stringybark (*E. obliqua*) and Mealy Stringybark (*E. cephalocarpa*) are scarce.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). Silver Wattle (*Acacia dealbata*), Blackwood (*A. melanoxylon*) and Swamp Paperbark (*Melaleuca ericifolia*) are also fairly abundant.

Medium to large shrubs: Fairly abundant and surprisingly rich in species even though several species have died out over the past two decades. Yarra Burgan (*Kunzea leptospermoides*) and Manuka (*Leptospermum scoparium*) dominate, followed by Golden Bush-pea (*Pultenaea gunnii*). Shiny Cassinia (*Cassinia longifolia*), Common Heath (*Epacris impressa*), Hop Goodenia (*Goodenia ovata*) and Victorian Christmas-bush (*Prostanthera lasianthos*) are fairly abundant or widespread. Hedge Wattle (*Acacia paradoxa*) and Prickly Currant-bush (*Coprosma quadrifida*) are scarce. The following additional species were recorded in the 1990s: Prickly Moses (*Acacia verticillata*), Sweet Bursaria (*Bursaria spinosa*), Common Cassinia (*Cassinia aculeata*), Sifton Bush (*Cassinia sifton*), Prickly Currant-bush (*Coprosma quadrifida*), Hop Bitter-pea (*Daviesia latifolia*), Ace of Spades (*Epacris gunnii*), Yellow Hakea (*Hakea nodosa*), Prickly Tea-tree (*Leptospermum continentale*), Woolly Tea-tree (*L. lanigerum*), Snowy Daisy-bush (*Olearia lirata*) and Tree Everlasting (*Ozothamnus ferrugineus*). Some of these species are likely to reappear.

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is scarce.

Shrubby herbs: None seen in this study.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over a substantial area. Common Maidenhair (*Adiantum aethiopicum*) was recorded in the 1990s but possibly not quite inside the Swampy Woodland.

Climber: A single plant of Common Apple-berry (*Billardiera mutabilis*) was recorded in this study. Downy Dodder-laurel (*Cassytha pubescens*) was recorded in the 1990s.

Creepers: Centella (*Centella cordifolia*) is scarce.

Grasses, rushes and sedges: Abundant and very rich in species. Dominated by Red-fruit Saw-sedge (*Gahnia sieberiana*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Weeping Grass (*Microlaena stipoides*). Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) is abundant. Spreading Rope-rush (*Empodisma minus*), Pale Rush (*Juncus pallidus*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Purplish Wallaby-grass (*R. tenuius*) and Common Bog-rush (*Schoenus apogon*) are somewhat less abundant but not scarce. Among the scarce species, Slender Bog-rush (*Schoenus lepidosperma*), Broad-leaf Rush (*Juncus planifolius*), Common Rapier-sedge (*Lepidosperma filiforme*) and Tasmanian Wallaby-grass (*Rytidosperma semiannulare*) are notable as good ecological indicators of Swampy Woodland.

Other groundcover: Pale Grass-lily (*Caesia parviflora*), Common Raspwort (*Gonocarpus tetragynus*), Tufted Blue-lily (*Thelionema caespitosum*) and Peppertop Sun-orchid (*Thelymitra brevifolia*) are all abundant; Black-anther Flax-lily (*Dianella revoluta*) and Short Purple-flag (*Patersonia fragilis*) somewhat less so. There is a single, dense colony of approximately 300 Trim Greenhood (*Pterostylis concinna*). Although they are among the scarcer species, Long Purple-flag (*Patersonia occidentalis*) and Cut-leaf Xanthosia (*Xanthosia dissecta*) are good ecological indicators. In the 1990s, Tiny Sundew (*Drosera pygmaea*) and the globe-pea, *Sphaerolobium minus*, were also present, in abundance.

Herb-rich Foothill Forest (EVC 23, **Vulnerable** in the Gippsland Plain bioregion)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) followed by Manna Gum (*E. viminalis*). (Some of the latter have been planted.) Mealy Stringybark (*E. cephalocarpa*) and Swamp Gum (*E. ovata*) are also present. Narrow-leaved Peppermint (*E. radiata*) is scarce.

Lower trees: Dominated variously by Silver Wattle (*Acacia dealbata*), Cherry Ballart (*Exocarpos cupressiformis*) or Swamp Paperbark (*Melaleuca ericifolia*). Blackwood (*A. melanoxylon*) is also fairly abundant. Black Wattle (*A. mearnsii*) is scarce.

Medium to large shrubs: Abundant and very rich in species. Dominated variously by Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*), Yarra Burgan (*Kunzea leptospermoides*) or Victorian Christmas-bush (*Prostanthera lasianthos*). Silver Banksia (*Banksia marginata*) and Common Correa (*Correa reflexa*) are also fairly abundant. The following species are scarce: Prickly Moses (*Acacia verticillata*), Common Cassinia (*Cassinia aculeata*), Shiny Cassinia (*Cassinia longifolia*), Sifton Bush (*Cassinia sifton*), Common Heath (*Epacris impressa*), Prickly Tea-tree (*Leptospermum continentale*), Manuka (*Leptospermum scoparium*), Tree Everlasting (*Ozothamnus ferrugineus*), Golden Bush-pea (*Pultenaea gunnii*), Large Kangaroo Apple (*Solanum laciniatum*) and Australian Dusty Miller (*Spyridium parvifolium*). Austral Indigo (*Indigofera australis*) and Rough Bush-pea (*Pultenaea scabra*) were also recorded in the 1990s.

Small shrubs: This study detected three Common Flat-pea (*Platylobium obtusangulum*), five Erect Guinea-flower (*Hibbertia riparia*) and one Common Beard-heath (*Leucopogon virgatus*). These species reflect the close proximity to Valley Heathy Forest. Grey Parrot-pea (*Dillwynia cinerascens*) was also recorded in the 1990s.

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) is fairly abundant. Annual Fireweed (*S. glomeratus*) and Rough Fireweed (*S. hispidulus*) were scarce at the time of this study but they may be more abundant in good years.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over substantial areas. There are approximately a dozen Screw Ferns (*Lindsaea linearis*), attributable to proximity to Swampy Woodland and Valley Heathy Forest. There is at least one patch of Common Maidenhair (*Adiantum aethiopicum*).

Climbers: Common Apple-berry (*Billardiera mutabilis*) is fairly abundant. Coarse Dodder-laurel (*Cassytha melantha*) and Downy Dodder-laurel (*Cassytha pubescens*) are scarce.

Scrambler: There is one patch of Small-leaf Bramble (*Rubus parvifolius*).

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is abundant. Kidney-weed (*Dichondra repens*) and the wood-sorrel, *Oxalis exilis/perennans*, are scarce. Creeping Bossiaea (*Bossiaea prostrata*) was recorded in 1995.

Grasses, rushes and sedges: Abundant and very rich in species. Dominated variously by Tall Sword-sedge (*Lepidosperma elatius*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*), Sword Tussock-grass (*Poa ensiformis*), Red-anther Wallaby-grass (*Rytidosperma pallidum*), Clustered Wallaby-grass (*R. racemosum*) or Small Grass-tree (*Xanthorrhoea minor*). The following species are only a little less abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Kneed Wallaby-grass (*Rytidosperma geniculatum*). The following species are somewhat less abundant but not scarce: Tall Spear-grass (*Austrostipa pubinodis*), Veined Spear-grass (*Austrostipa rudis* subsp. *australis*), Short-stem Sedge (*Carex breviculmis*), Reed Bent-grass (*Deyeuxia quadriseta*), Red-fruit Saw-sedge (*Gahnia sieberiana*), Hollow Rush (*Juncus amabilis*), Slender Sword-sedge (*Lepidosperma gunnii*), Variable Sword-sedge (*L. laterale*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Cluster-headed Mat-rush (*L. longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Velvet Wallaby-grass (*R. pilosum*), Bristly Wallaby-grass (*R. setaceum*), Purplish Wallaby-grass (*R. tenuius*), Common Bog-rush (*Schoenus apogon*) and Kangaroo Grass (*Themeda triandra*). Among the scarcer species, Common Tussock-grass (*Poa labillardierei*) and Tasmanian Wallaby-grass (*Rytidosperma semiannulare*) are the best ecological indicators. Another good indicator is Slender Tussock-grass (*Poa tenera*), which was present in 1996.

Other groundcover: The following species are fairly abundant: Honey-pots (*Acrotriche serrulata*), Milkmaids (*Burchardia umbellata*), Pale Grass-lily (*Caesia parviflora*), Pale Flax-lily (*Dianella longifolia*), Black-anther Flax-lily (*Dianella revoluta*), Rosy Hyacinth-orchid (*Dipodium roseum*),

Scented Sundew (*Drosera aberrans*), Small Poranthera (*Poranthera microphylla*) and Maroonhood (*Pterostylis pedunculata*). The following species are scarce: Grass Trigger-plant (*Stylidium armeria*), Chocolate Lily (*Arthropodium strictum*), Button Everlasting (*Coronidium scorpioides*), Pale Flax-lily (*Dianella longifolia*), Tasman Flax-lily (*Dianella tasmanica*), Common Raspwort (*Gonocarpus tetragynus*), Long Purple-flag (*Patersonia occidentalis*), Common Rice-flower (*Pimelea humilis*) and Yellow Rush-lily (*Tricoryne elatior*). A number of additional species were recorded in the 1990s.

Wetland (EVC 74, **Endangered** in the Gippsland Plain bioregion)

Site 76's ephemeral wetlands are now barely distinguishable from the surrounding Herb-rich Foothill Forest. The following description relies heavily on data from the 1990s, when abundances were not recorded.

Woody plants: Swamp Paperbark (*Melaleuca ericifolia*) from adjacent vegetation extends into the wetlands.

Creepers: Lesser Joyweed (*Alternanthera denticulata*) – not present during this study.

Scramblers: Slender Knotweed (*Persicaria decipiens*) – not present during this study.

Grasses, rushes and sedges: Tassel Sedge (*Carex fascicularis*), Green Rush (*Juncus gregiflorus*), Pale Rush (*J. pallidus*), Tall Rush (*J. procerus*), Broom Rush (*J. sarophorus*) and Tall Sword-sedge (*Lepidosperma elatius*). Only Green Rush, Tall Rush and Tall Sword-sedge were present during this study.

Stream channel (no EVC or conservation status have been assigned by the state government)

This section of stream channel was not botanically surveyed separately from the rest of Dandenong Creek through Maroondah – see Site 69 (p. 530).

Significant plants

Rare (but not otherwise threatened) in Victoria

Thirty-three plants of a subspecies of Veined Spear-grass – namely *Austrostipa rudis* subsp. *australis* – were found in Site 76 during this study. They are all within 10 m north of the path beside Dandenong Creek and within the central third, east-west. A few others may have escaped detection due to similarity to the more abundant subspecies *rudis* in the absence of fertile material. Subspecies *australis* is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Site 76 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Banksia marginata* (Silver Banksia) – approximately eleven stems in the central-south of the site, probably some of them suckering off shared rootstocks;
- *Correa reflexa* var. *reflexa* (Common Correa) – fairly abundant in the eastern and central thirds of the Herb-rich Foothill Forest;
- *Drosera pygmaea* (Tiny Sundew) – not recorded since the mid-1990s, when it was abundant;
- *Empodisma minus* (Spreading Rope-rush) – Fairly abundant in the Swampy Woodland. The only other records in Maroondah this century are at Bungalook Conservation Reserves (Site 66, where abundant), three plants on private land in Kilsyth South (Site 67), one at 'Uambi' (Site 32) and one on the railway reserve near the entrance to H.E. Parker Reserve (in Site 29d);
- *Epacris gunnii* (Ace of Spades) – not recorded since the mid-1990s, when it was abundant;
- *Eucalyptus macrorhyncha* (Red Stringybark) – not recorded since the 1990s, when it was scarce;
- *Hakea nodosa* (Yellow Hakea) – as above;
- *Hypoxis hygrometrica* (Golden Weather-glass) – recorded once, in December 1997, and possibly overlooked at other times because the species is extremely cryptic except during its brief flowering season of a few days per year;

- *Lepidosperma filiforme* (Common Rapier-sedge) – only one plant appears to remain from the small number recorded in 1994;
- *Leptospermum lanigerum* (Woolly Tea-tree) – not recorded since the 1990s, when it was scarce;
- *Patersonia fragilis* (Short Purple-flag) – fairly abundant, one of only two populations ever recorded in Maroondah;
- *Poa tenera* (Slender Tussock-grass) – not recorded since 1996, when it was scarce;
- *Pterostylis concinna* (Trim Greenhood) – the number of rosettes in the site's single colony varies from year to year and was estimated by the author as 300 in May 2018. The only other wild plants of the species recorded in Maroondah's history are eleven at the former Croydon High School sanctuary (Site 44), where it was discovered in 2019;
- *Pultenaea scabra* (Rough Bush-pea) – not recorded since 1995, when it was scarce;
- *Schoenus lepidosperma* (Slender Bog-rush) – recorded as abundant in 1994 but this study detected only one healthy plant and a few dying plants, all near the north-south path through the Swampy Woodland. The only other known surviving population in Maroondah comprises three plants at Bungalook Conservation Reserves, Kilsyth South (Site 66);
- *Senecio minimus* (Shrubby Fireweed) – fairly abundant in the site's southeast and appearing sporadically elsewhere;
- *Sphaerolobium minus* (Globe-pea) – abundant for a few years in the regrowth following removal of pines in c. 1993 but not recorded since; and
- *Thelionema caespitosum* (Tufted Blue-lily) – abundant in the Swampy Woodland. The only other population known in Maroondah is at Bungalook Conservation Reserves (Site 66), where numbers have dwindled to perhaps less than twenty.

Significant fauna

The following fauna species recorded in Site 76 are rare in Maroondah:

- Whistling Kite – recorded on eBird and the Atlas of Living Australia by Benjamin Viola in 2019; and
- Southern Boobook – recorded on Birdline by Martin Dwelly on 23/1/12 and approximately 3 months earlier, with a comment that he had not heard it previously in 14 years of living nearby.

Fauna habitat

- The creek channel provides habitat for hardy fish, aquatic invertebrates and waterbirds;
- The structure and composition of the more natural areas of vegetation represent basic habitat for forest birds, bats, possums, lizards, frogs and invertebrates;
- Tree hollows provide roost sites or nest sites for some animals, including bats;
- Logs provide cover for invertebrates and small terrestrial vertebrates (e.g. lizards and frogs);
- The location on the Dandenong Creek habitat corridor greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

Site 76's Swampy Woodland easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Swampy

Woodland is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

The site's Valley Heathy Forest is just large enough to also qualify as a 'patch' and it is also an endangered EVC. It therefore is also of **State** significance.

The Herb-rich Foothill Forest easily qualifies as a 'patch'. It is listed as vulnerable (not endangered), so it only rates State significance under standard criterion 3.2.3 if at least 0.25 ha of it has a 'habitat score' of at least 0.3. The author is confident of that being the case, although no habitat score has actually been determined. With that proviso, the core area of Herb-rich Foothill Forest is assessed here to be of **State** significance.

Rare plant species

Referring to the section above headed 'Significant plants', this study detected thirty-three plants of *Austrostipa rudis* subsp. *australis* in Site 76. That subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

The section above headed 'Significant plants' includes a list of Site 76's species whose risk of dying out in Maroondah is in the 'critically endangered' category. The populations of eight of those species are either clearly viable and/or make major contributions to the species' total population in Maroondah. They clearly meet the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'Regional' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria and recognition of the conservation statuses of the site's EVCs since 1997.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting or passing through the site as well as immediate neighbours.

As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation in and beside Dandenong Creek helps to stabilise the soil and remove a small amount of water pollution.

As explained in Section 1.3 of Volume 1, there is good evidence that people's health, wellbeing, quality of life and childhood development benefit from exposure to nature. Therefore, Site 76's natural ambience is expected to bring such benefits to people visiting the site, passing through it or living nearby. The natural ambience also encourages people to get exercise by walking through the site.

Similar benefits are spread more widely by birds, butterflies and other animals moving out of the site into neighbouring streets and gardens.

The site's vegetation contributes substantially to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

The site's location beside a major stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

While the members of Heathmont Bushcare provide ecological benefits to the bushland during working bees, the bushland reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

Changes

Change in the extent of habitat

Based on scrutiny of aerial photographs and vegetation mapping by Lorimer *et al*. (1997), there has been no discernible change in the extent of habitat within the current boundary of Site 76 since 1997. However, the original version of Site 76 of Lorimer *et al*. (1997) contained approximately 0.5 ha of additional (low-grade) habitat to the northwest that has been lost to residential development on Barrow Drive.

Change in the ecological condition of habitat

Aerial photographs from 2001, 2011 and 2017 show that many eucalypts died between 2001 and 2011, during the Millennium Drought. The rate of deaths between 2011 and 2017 has been much lower but probably still greater than natural attrition.

The sections above headed 'Habitat types' and 'Significant plants' indicate that many indigenous plant species have died out or greatly dwindled since the 1990s. The main reason appears to be 'extinction debt': The long-term viability of swamp plants was severely compromised more than fifty years ago when the availability of soil moisture was reduced by drainage schemes and the straightening of Dandenong Creek.

The wetlands mapped and documented by Lorimer *et al*. (1997) are almost unrecognisable now because they contain water much less frequently. That appears likely to be due to climate change and increased prevalence of impervious surfaces in the site's small catchment.

On the positive side, the efforts of Maroondah City Council's bush crew and Heathmont Bushcare have significantly reduced the prevalence of environmental weeds and thereby helped some indigenous plants to thrive. Planting may have assisted the viability of some species but most of the planted plants appear to be dying without having reproduced.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of indigenous plant species and their dependent fauna due to drying of the floodplain and wetlands during prolonged, severe droughts. Droughts are predicted to become more severe and frequent as a result of climate change. Tree deaths would be the most obvious outcome but groundcover species would represent the greatest loss of biodiversity. Residential development and increased impervious surfaces in the site's small catchment are likely to exacerbate the problem;
- Water pollution in Dandenong Creek, affecting vegetation, aquatic invertebrates, fish, frogs and waterbirds; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The part of the site within approximately 60 m of Dandenong Creek is zoned 'Urban Floodway Zone'. The rest of the site is zoned 'Neighbourhood Residential Zone – Schedule 2'.

Removal, lopping and destruction of native vegetation is controlled throughout Site 76 under the state-wide baseline planning controls of clause 52.17 of the Victoria Planning Provisions. It is further controlled under the Vegetation Protection Overlay (VPO) except in the road reservation of The Greenway. The VPO also covers some residential land along Barrow Drive, as a legacy from before that land was subdivided and developed.

In addition, Schedule 3 of the Significant Landscape Overlay covers the whole site, requiring a permit for the removal of native or introduced canopy trees (subject to exemptions).

For the reasons discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of State biological significance such as Site 76. Nor is it appropriate to retain the VPO on the Barrow Drive residential lots. Therefore, it is recommended to remove the VPO entirely and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 76 as mapped on p. 596. The abutting land in Knox is already subject to the Environmental Significance Overlay (shown hatched in purple on the aerial photograph on p. 530).

Information sources

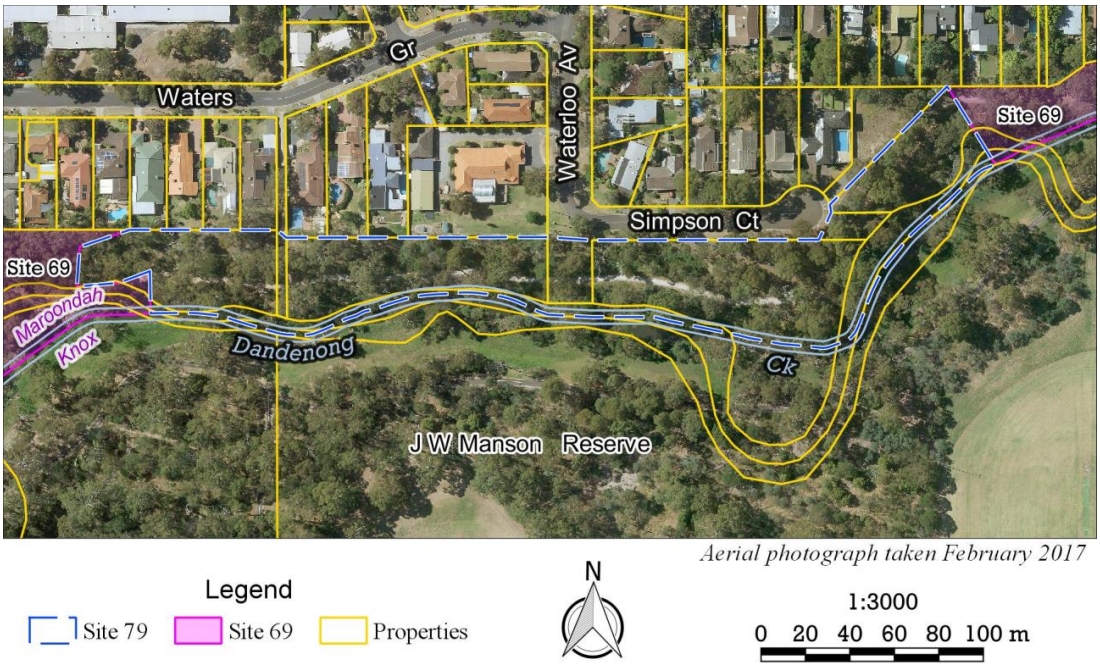
The analysis above draws on the following sources of information about the site:

- Over 21 hours of ecological survey of Site 76 by the author between 31/7/15 and 26/5/18, including: (a) compiling nine lists of indigenous and introduced plant species (including mosses and liverworts) and their abundances for different parts of the site; (b) documenting and mapping vegetation types and plant species that are rare or scarce within the site; and (c) checking for other attributes of the site relevant to the standard criteria for assessing biological significance;
- Nearly three hours of ecological survey of Site 76's Swampy Woodland and the land to its south, by the author on 19/5/13, including: (a) compiling three lists of indigenous and introduced plant species (including mosses and liverworts) and their abundances for different parts of the site; and (b) documenting and mapping vegetation types and plant species that are rare or scarce within the site;
- A 2019 bird list by Benjamin Viola, including the significant species, Whistling Kite, recorded on eBird and the Atlas of Living Australia;
- Other bird lists on eBird and the Atlas of Living Australia;
- A plant list for the (then) Trust for Nature property by David Lockwood, Jason Stewart and others on 6/12/19;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on fieldwork by John C. Reid and the present author during November 1995 to March 1996. The fieldwork included: (a) compilation of seven plant lists (without abundance data) for different areas or types of vegetation; (b) a mammal hair survey using one hair funnel; and (c) incidental observations of frogs, birds and butterflies;
- Four quadrats surveyed by James A. Todd and the present author on 24/11/94 (nos. N22001–4 in the state Flora Information System, apparently missing from the Victorian Biodiversity Atlas);
- A plant list (without abundances) for the former Dexter land compiled by the present author on 26/4/92;
- As above but by Andrew N. Paget on 19/9/86; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

Sites 77 & 78 of Lorimer *et al*. (1997) are here absorbed into an expanded Site 76 – see above.

Site 79. Simpsons Court Escarpment, Heathmont

Biological Significance Level: *State or Regional* due to the presence of a vulnerable vegetation type



Aerial photograph taken February 2017

Legend
Site 79 Site 69 Properties

N

1:3000
0 20 40 60 80 100 m

Boundary

The boundary of Site 79 is shown as a dashed-blue outline above. The southern boundary follows the municipal boundary, which is the middle of the Dandenong Creek channel. The northern boundary follows property boundaries except at the southeast of the turning circle of Simpsons Court. The western edge corresponds to the boundary between native understorey and a mown area. The northeastern edge is a straight line from a property corner to the closest point on Dandenong Creek.

Land use and tenure

The land is managed for recreation, nature conservation, pedestrian thoroughfare and drainage. The land between the meandering yellow lines that cross back and forth over the current-day Dandenong Creek channel on the aerial photograph is Crown land. The 4-metre-wide, north-south strip between 7 & 9 Waters Grove is formally part of the municipal road network and it provides a walkway and pipe corridor. The rest of the land is a Maroondah City Council reserve. The state government's 'Vicnames' register of place names indicates that most of the site is officially part of J.W. Manson Reserve, the name normally used for the public land on the southern side of Dandenong Creek.

Melbourne Water is responsible for management of the bed and banks of Dandenong Creek. Maroondah City Council and Heathmont Bushcare manage the rest of Site 79.

General description

Site 79 occupies 1.5 hectares that includes a steep escarpment and the abutting channel of Dandenong Creek. The height of the escarpment is 17 m and the natural slope is typically 1:2.5 but up to 1:1.5. The slope is greater where cut-and-fill has been used to construct footpaths through the site. The floodplain of Dandenong Creek is on the opposite side of the creek, with very low relief.

Site 79 is the only place outside the Dandenong Ranges where Dandenong Creek has carved a steep escarpment. The only comparable topography in Maroondah is beside Mullum Mullum Creek in Ringwood (Site 24 and formerly Site 25 prior to the construction of the Ringwood Bypass Road). The similar topography has led to similar native vegetation, which is a riparian variant of the Ecological Vegetation Class (EVC) called 'Herb-rich Foothill Forest'.

The Crown land mentioned above was the creek channel some time before the creek was straightened in c. 1969.

The soil on the slope is derived from *in situ* weathering of Silurian, thin-bedded siltstone and sandstone.

An aerial photograph from 1945 shows the site with young regrowth. The thinly scattered trees had crowns typically 7 m in diameter, compared with 15 m today. The site now has a few large pines that would have been planted into the regrowth when it was young. The naturally-occurring native understorey today is rather scarce in most of the site but it has been augmented by extensive planting of indigenous species. This study detected thirty-four naturally-occurring plant species and sixteen planted species.

Relationship to other land

Together, Site 79 and J.W. Manson Reserve form a single area of quality habitat and a single site of biological significance. The sites are only recognised separately because they are administered by different municipal councils. J.W. Manson Reserve is Knox City Council's 'Site of Biological Significance 47' (Lorimer 2010).

The combination of the two sites represent a node of quality habitat on the Dandenong Creek habitat corridor (Site 69), which extends east and west of Site 79. The corridor provides a fragmented habitat connection to other nodes at Sites 72–80, Site 82 and sites in Knox such as Bayswater Park, Yarrunga Reserve and the Winton Wetlands (Lorimer 2010).

A scattering of remnant eucalypts and planted Australian native trees to the north of Site 79 provide a rudimentary habitat connection to Heathmont Park (Site 31).

The passage of birds and flying insects between all the abovementioned habitat areas improves the viability of the plant populations through dispersal of pollen and propagules.

The *'Maroondah Habitat Corridor Strategy'* (Context 2005) gives the Dandenong Creek corridor a 'Very high relative corridor conservation priority'.

Bioregion: Gippsland Plain

Habitat type

The descriptions of vegetation composition below include only indigenous plant species. The species mentioned occur naturally in the site except where otherwise stated. 'EVC' means 'Ecological Vegetation Class'.

Herb-rich Foothill Forest (EVC 23, **Vulnerable** in the bioregion) – Manna Gum riparian variant

Physical environment: steep south- to southeast-facing slope abutting the creek and floodplain, not on alluvium.

Canopy trees: Dominated by Manna Gum (*Eucalyptus viminalis* subsp. *viminalis*) and Yellow Box (*E. melliodora*). Bundy (*E. goniocalyx*) in moderately abundant on the upper slope. Narrow-leaved Peppermint (*E. radiata*) is scarce.

Lower trees: Silver Wattle (*Acacia dealbata*) is dense in small parts of the site, as are planted Golden Wattles (*A. pycnantha*). Black Wattle (*A. mearnsii*), Blackwood (*A. melanoxylon*), Cherry Ballart (*Exocarpos cupressiformis*) and Swamp Paperbark (*Melaleuca ericifolia*) are fairly abundant.

Medium to large shrubs: Rather depleted. The most abundant wild, indigenous species are Sweet Bursaria (*Bursaria spinosa*) and Prickly Currant-bush (*Coprosma quadrifida*). Wild Sifton Bush (*Cassinia sifton*), Hop Goodenia (*Goodenia ovata*) and Victorian Christmas-bush (*Prostanthera*

lasianthos) are scarce but additional Hop Goodenias and a range of other indigenous shrubs have been planted. In the previous flora survey (1995), there were also wild plants of Common Cassinia (*C. aculeata*), Common Heath (*Epacris impressa*), Hemp Bush (*Gynatrix pulchella*), Tree Everlasting (*Ozothamnus ferrugineus*) and Austral Dusty Miller (*Spyridium parvifolium*).

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) is fairly abundant and Cotton Fireweed (*S. quadridentatus*) is scarce.

Small shrubs: Pink-bells (*Tetratheca ciliata*) was recorded in 1995 but not seen in this study's brief inspection.

Ferns: Austral Bracken (*Pteridium esculentum*) is the dominant species beneath the shrubs. There is a patch of Common Maidenhair (*Adiantum aethiopicum*) and a single Rough Tree Fern (*Cyathea australis*).

Climbers: Mountain Clematis (*Clematis aristata*) is scarce.

Scrambler: There is a patch of Small-leaf Bramble (*Rubus parvifolius*).

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is scarce. Kidney-weed (*Dichondra repens*) was present in 1995 and probably remains.

Grasses, rushes and sedges: Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is most abundant, followed by Clustered Wallaby-grass (*Rytidosperma racemosum*). Veined Spear-grass (*Austrostipa rudis* subsp. *australis* and subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Hollow Rush (*Juncus amabilis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Weeping Grass (*Microlaena stipoides*) are fairly abundant. Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*) is scarce.

Other groundcover: Wild species are extremely depleted. The only species found in this study were Pale Flax-lily (*Dianella longifolia*) and Common Raspwort (*Gonocarpus tetragynus*), both of which are very scarce. A few other species have been planted.

Stream channel (no EVC or conservation status have been assigned by the state government)

This section of stream channel was not botanically surveyed separately from the rest of Dandenong Creek through Maroondah – see Site 69 (p. 530).

Significant plants

Rare (but not otherwise threatened) in Victoria

A subspecies of Veined Spear-grass – namely *Austrostipa rudis* subsp. *australis* – is represented by at least one plant in the site. A few others may have escaped detection in this study due to similarity to the more abundant subspecies *rudis* in the absence of fertile material. Subspecies *australis* is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

Eucalyptus macrorhyncha (Red Stringybark), *Gynatrix pulchella* (Hemp Bush) and *Muellerina eucalyptoides* (Creeping Mistletoe) were recorded at Site 79 in the previous flora survey in 1995, without an indication of abundances. Each of those species falls into the 'critically endangered' category of risk of dying out in Maroondah. They appear to have died out other than for planted plants of *Gynatrix*.

Fauna habitat

- The creek channel provides habitat for hardy fish, aquatic invertebrates and waterbirds;
- The structure and composition of the forest represent suitable habitat for a range of forest birds, bats, possums and invertebrates;
- The many wattle trees in the site represent a good food resource of Sugar Gliders but it is not known whether Sugar Gliders are present;
- The forest and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- Tree hollows provide roost sites or nest sites for some animals, including bats;

- The location on the Dandenong Creek habitat corridor greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), approximately 1.2 ha of Site 79 rates 'C' (fair) and approximately 0.2 ha rates 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State or Regional

Regionally threatened Ecological Vegetation Class

With the aid of revegetation, the core of the site's Herb-rich Foothill Forest meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The present author is uncertain whether its 'habitat score' under the Victorian Vegetation Quality Assessment method is more or less than 0.3. Given the 'vulnerable' status of Herb-rich Foothill Forest, a habitat score below 0.3 would give the site 'Regional' significance under standard criterion 3.2.3, whereas a higher habitat score would represent State significance. A formal assessment of the habitat score would be required to resolve which level of significance is correct.

Rare plant species

Referring to the section above headed 'Significant plants', Site 79 is known habitat for *Austrostipa rudis* subsp. *australis*, albeit with only a single known individual. That subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

The reserve's overall 'State' or 'Regional' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of Herb-rich Foothill Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and its paths, as well as neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to contribute to the health, wellbeing, childhood development and quality of life of people who pass through regularly or live adjacent.

Some of those benefits are spread into nearby streets and gardens by birds, butterflies and other animals moving between the site and other areas of habitat.

The site's location beside a major stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

While the members of Heathmont Bushcare provide ecological benefits to the bushland during working bees, the bushland reciprocates by bringing together people for a common, nurturing purpose. There are consequent benefits to the volunteers and to community spirit and cohesion.

The site preserves something of the area's natural landscape and enhances the area's 'green and leafy' character. The vegetation and the associated birds help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

An aerial photograph from 2001 shows Site 79 to have been almost fully covered with native vegetation. That remains the case in 2020, so there has been no material change in the extent of habitat.

Change in the plant species present

Fifteen wild, indigenous plant species that were recorded in the 1995 flora survey were not seen in this study (or, in the case of Creeping Mistletoe, only seen dead). Some but not all of those species may have been overlooked in this study due to the brevity of the site inspection. Conversely, four species observed in this study were not recorded in 1995. Overall, it appears likely that there has been a net loss of 5–10 indigenous plant species and that most of them will not reappear naturally.

Change in the ecological condition of habitat

The apparent loss of wild, indigenous plant species suggests a decline in the ecological condition of the habitat for those species. That is supported by a comparison between the information in the section above headed 'Ecological condition' and the corresponding information by Lorimer *et al*. (1997), which derived from fieldwork in 1995. In 1995, the ecological condition of 0.05 ha of Site 79 was classified as rating 'B' (good), whereas none appears to reach that level now. However, that is only a tiny fraction of the whole site. The 1997 report classified approximately 0.5 ha as rating 'D' (poor) whereas this study classified only 0.2 ha that low. That improvement is due to the extensive revegetation that has taken place since 1995.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Debilitation or death of indigenous plants by over-competition from pines. Over-competition will have its worst effects during drought, which is predicted to worsen with climate change;
- Bracken out-competing indigenous plants beneath it, including seedlings of taller species;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Water pollution in Dandenong Creek, affecting vegetation, aquatic invertebrates, fish, frogs and waterbirds.

Strategic planning

The whole of Site 79 is zoned 'Urban Floodway Zone'. Removal of native vegetation is controlled under the Vegetation Protection Overlay (VPO) and the state-wide baseline planning controls of clause 52.17 of the Victoria Planning Provisions. In addition, Schedule 3 of the Significant Landscape Overlay requires a permit for the removal of native or introduced canopy trees (subject to exemptions).

Consistent with the principles of Section 11.1.2 of Volume 1, it is recommended to replace the VPO with the proposed schedule ESO1 of the Environmental Significance Overlay. The abutting land in Knox is already subject to the Environmental Significance Overlay (shown hatched in purple on the aerial photograph on p. 530).

Information sources

The analysis above draws on the following sources of information about the site:

- One hour of flora survey for this study, including: (a) compiling a list of indigenous plant species (excluding mosses and liverworts) and their abundances; (b) mapping and documenting the details of rare or scarce plants; (c) checking for fauna habitat; and (d) checking for any other attributes relevant to the standard criteria for assessing biological significance;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on fieldwork by John C. Reid on 1/12/95, including compilation of a list of plant species (without abundances); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas or eBird. Surprisingly, the state government's mapping of native vegetation shows that there is no native vegetation in the site and that the pre-settlement vegetation was Swampy Woodland, despite the steep slope.

Site 80. Scott Street Reserve, Heathmont

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundary

The boundary of Site 80 is shown as a dashed-blue outline above. The southern boundary follows the municipal boundary, which is the middle of the Dandenong Creek channel. The site extends westwards to the footpath of Wantirna Road. It extends eastwards to the kerb alignment of Marlborough St and to a footbridge over Dandenong Creek. The rest of the boundary follows property boundaries.

Land use and tenure

The land is managed for recreation, nature conservation, pedestrian thoroughfare and drainage. The property between the pair of meandering yellow lines that cross back and forth over the current-day Dandenong Creek channel on the aerial photograph is Crown land; the land to its north is a Maroondah City Council reserve and the land to the south is a reserve owned by either Knox City Council or Melbourne Water. Melbourne Water is responsible for management of the bed and banks of Dandenong Creek and Maroondah City Council manages the rest of Site 80.

General description

Site 80 occupies 2.5 hectares of floodplain, wetland and creek channel on Dandenong Creek. Except for the creek channel, there is less than 2 m variation in elevation throughout the site. The soil is alluvium.

The Crown land mentioned above was the creek channel some time before the creek was straightened in c. 1969. The heavy engineering that straightened the creek also destroyed nearly all the native vegetation in the southern half of Site 80. The exception is a pair of large, old Manna Gums (*Eucalyptus viminalis*) 60 m downstream of the footbridge that apparently survived and still stands today. Otherwise, most or all of the vegetation in the southern half of the site (and perhaps the whole site) is regrowth that post-dates the creek straightening.

Because the stream and the floodplain hydrology were profoundly changed by the creek straightening (as intended), the regrowth is different in character from the prior vegetation. The large Manna Gums suggest that the Ecological Vegetation Class (or EVC) on the creek bank pre-straightening was 'Riparian Forest' or the riparian form of 'Herb-rich Foothill Forest'. However, with the exception of the Manna Gums, the regrowth today better matches Swampy Woodland. In fact, all the natural, treed vegetation in the site other than the Manna Gums conforms to Swampy Woodland, which was probably the natural EVC in the northern half of the site.

A 1960 Royal Australian Army Survey Corp Map shows a minor tributary of Dandenong Creek flowing southward past the dead end of Scott Street and through what are now the two wetlands shown on the aerial photograph above. The wetlands are therefore vestiges of the original creek system, now cut off from Dandenong Creek. The wetlands are well vegetated with indigenous wetland plants except in times of drought.

Outside the wetlands, the site's greatest concentration of naturally-occurring indigenous understorey plants occurs within typically 10 m of the wetlands. Otherwise, the site's indigenous understorey plants have overwhelmingly been planted or are the descendants of planted plants. This study detected sixty-three naturally-occurring, indigenous plant species and forty-six planted species.

Relationship to other land

Site 80 is so small that its birdlife and many of its other fauna can meet only a small part of their habitat needs within the site. The animals therefore move between the site and other nearby habitat.

Fortunately, as seen in the key map on p. 1, there is a substantial amount of other habitat in close proximity and extending far along the Dandenong Creek corridor. Site 80 acts as a node of habitat along the corridor. To the east (upstream), the corridor includes Site 69, which is contiguous with habitat nodes at Sites 72–79 and sites in Knox such as Manson Reserve. Site 69 also includes habitat on the opposite side of Wantirna Road, where it abuts the Ringwood Public Golf Course (Site 128), the Heatherdale Creek wetlands (Site 82) and many sites of biological significance in the City of Knox, such as Yarrunga Reserve and the Winton Wetlands (Lorimer 2010).

There is also habitat just across Marlborough Road from Site 80 in Heathmont College (Site 81), seen best on the aerial photograph on p. 621.

The passage of birds and flying insects between all the abovementioned habitat areas improves the viability of the plant populations through dispersal of pollen and propagules.

The *'Maroondah Habitat Corridor Strategy'* (Context 2005) gives the Dandenong Creek corridor a 'Very high relative corridor conservation priority'.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation composition below include only naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion)

Canopy trees: Dominated by Swamp Gum (*Eucalyptus ovata*) in the northern half of the site and Manna Gums (*E. viminalis*) to the south. Some Mealy Stringybark (*E. cephalocarpa*) and a single Narrow-leaved Peppermint (*E. radiata*) are also present.

Lower trees: Moderately dense, dominated by Silver Wattle (*Acacia dealbata*) and Blackwood (*A. melanoxylon*). Swamp Paperbark (*Melaleuca ericifolia*) is fairly abundant. Cherry Ballart (*Exocarpos cupressiformis*) is scarce.

Medium to large shrubs: Sweet Bursaria (*Bursaria spinosa*), Hop Goodenia (*Goodenia ovata*) and Large Kangaroo Apple (*Solanum laciniatum*) are fairly abundant. There are also a few wild Sifton Bush (*Cassinia sifton*), Snowy Daisy-bush (*Olearia lirata*), Tree Everlasting (*Ozothamnus ferrugineus*) and Victorian Christmas-bush (*Prostanthera lasianthos*). Strangely, Prickly Currant-bush (*Coprosma quadrifida*) is only present due to planting.

Small shrubs: None seen.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) is abundant. There was only a trace of Shrubby Fireweed (*S. minimus*) and Cotton Fireweed (*S. quadridentatus*) at the time of this study but they are probably more abundant in good years.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over a substantial area.

Climber: Coarse Dodder-laurel (*Cassytha melantha*) was recorded in prior flora surveys but not during this study.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is fairly abundant.

Grasses, rushes and sedges: Abundant and rich in species. Weeping Grass (*Microlaena stipoides*) is most abundant, followed by Veined Spear-grass (*Austrostipa rudis*) and Common Reed (*Phragmites australis*). The following species are moderately abundant or widespread in the site: Common Blown Grass (*Lachnagrostis filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Clustered Wallaby-grass (*R. racemosum*), Tasmanian Wallaby-grass (*R. semiannulare*) and Bristly Wallaby-grass (*R. setaceum*). The following species are scarce: Short-stem Sedge (*Carex breviculmis*), Thatch Saw-sedge (*Gahnia radula*), Hollow Rush (*Juncus amabilis*), Finger Rush (*J subsecundus*) and Sword (or Purple-sheathed) Tussock-grass (*Poa ensiformis*).

Other groundcover: Severely depleted. During this study, the only other wild, indigenous species to be found were Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*) and Common Cudweed (*Euchiton involucratus*), each represented by a single plant.

Wetland (EVC 74, **Endangered** in the Gippsland Plain bioregion) – modified vestiges of a former creek

Trees: Swamp Paperbark (*Melaleuca ericifolia*) grows around the edges of the wetlands.

Shrubs: At the time of this study's fieldwork, a few young Large Kangaroo Apple (*Solanum laciniatum*) had established in periphery of the wetlands, which were dry at the time.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Shrubby Fireweed (*S. minimus*) were very scarce at the time of this study but they are probably more abundant at the right phase of the wetting and drying cycle.

Climbers: None.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) and Rainforest Crane's-bill (*Geranium homeanum*) are fairly abundant.

Ferns: None.

Grasses, rushes and sedges: At the time of this study's survey, the wetlands were dry, allowing Common Blown Grass (*Lachnagrostis filiformis*) to temporarily become the dominant species. The following were also abundant: Tassel Sedge (*Carex fascicularis*), Australian Sweet-grass (*Glyceria australis*), Hollow Rush (*Juncus amabilis*) and Loose-flower Rush (*Juncus pauciflorus*). Tall Sedge (*Carex appressa*), Green Rush (*Juncus gregiflorus*) and Weeping Grass (*Microlaena stipoides*) were moderately abundant. The following species were scarce: Fen Sedge (*Carex gaudichaudiana*), Pale Rush (*Juncus pallidus*), Tall Rush (*Juncus procerus*), Broom Rush (*Juncus sarophorus*) and Clustered Wallaby-grass (*Rytidosperma racemosum*). Swamp Club-rush (*Isolepis inundata*) and Austral Rush (*Juncus* ?*australis*) in 2004 – the last flora survey when the wetlands held water.

Other groundcover: In its dry state during this study, the following species were abundant: Hairy Willow-herb (*Epilobium hirtigerum*), Lesser Loosestrife (*Lythrum hyssopifolia*), Slender Knotweed (*Persicaria decipiens*), Common Reed (*Phragmites australis*), Water Plantain (*Alisma plantago-aquatica*) and Spotted Knotweed (*Persicaria praetermissa*). Robust Willow-herb (*Epilobium billardiereanum* subsp. *intermedium*) was fairly abundant. In the 2004 flora survey, Swamp Crassula (*Crassula helmsii*), Water-ribbons (*Cycnogeton* ?*procerum*) and Common Duckweed (*Lemna disperma*) were also present, and they may return during wet conditions. Lesser Joyweed (*Alternanthera denticulata*) and Thin Duckweed (*Spirodela punctata*) have also been recorded in wet years and they may well return under similar conditions.

Stream channel (no EVC or conservation status have been assigned by the state government)

Trees: Swamp Paperbark (*Melaleuca ericifolia*) grows on the slope.

Other woody plants: None.

Shrubby herbs: None.

Climbers: None.

Creepers: None.

Ferns: None.

Grasses, rushes and sedges: Green Rush (*Juncus gregiflorus*) and Common Reed (*Phragmites australis*) are moderately abundant. Toad Rush (*Juncus bufonius*), Loose-flower Rush (*Juncus pauciflorus*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Weeping Grass (*Microlaena stipoides*) are scarce.

Aquatic species: Slender Knotweed (*Persicaria decipiens*) and Blunt Pondweed (*Potamogeton ochreatus*) are fairly abundant in the water.

Significant plants

Rare (but not otherwise threatened) in Victoria

A subspecies of Veined Spear-grass – namely *Austrostipa rudis* subsp. *australis* – is represented by at least four plants in the site, effectively part of the same population as the seven plants found at Heathmont College (Site 81). Others may well have escaped detection in this study due to similarity to the more abundant subspecies *rudis* in the absence of fertile material. Subspecies *australis* is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Presumed extinct in Maroondah

Cycnogeton ?*procerum* (Water-ribbons) appears to have died out in Maroondah during the Millennium Drought, including at Site 80. Waterbirds may reintroduce it in future but the new, drier climate means that Water Ribbons appears unlikely to recur more than transiently or as a result of planting.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded at Site 80 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Carex gaudichaudiana* (Fen Sedge) – during the dry conditions of this study's fieldwork, one patch grew in the northern wetland and five in the southern wetland. The only other records from Maroondah this century are at Eastfield Park (Site 61), the Healesville Freeway Reservation (Site 64), on Dandenong Creek (in Site 69) and on the Little Bungalook Creek floodplain (Site 72a);
- *Persicaria praetermissa* (Spotted Knotweed) – fairly abundant in the southern wetland and formerly present also in the northern wetland. The only other record in Maroondah's history is at H.E. Parker Reserve (Site 75); and
- *Senecio minimus* (Shrubby Fireweed) – only one plant was seen in this study but larger numbers are likely in wetter years.

Significant fauna

The following species at Site 80 are rare in Maroondah:

- Striped Marsh Frog – an estimated seventy individuals were heard in the wetlands during the previous ecological survey in 2005. They may have died out during the Millennium Drought but their persistence cannot be discounted in the absence of a subsequent survey when the wetlands hold water; and
- Imperial Hairstreak Butterfly – a large colony was observed at all life stages on stunted Silver Wattles in the middle of the site during 2018 – see the photograph in Figure 6 in Volume 1. The only other known colonies in Maroondah since the Millennium Drought are beside Brushy Creek near Diane Crescent in Croydon and beside Mullum Mullum Creek downstream of Ringwood Street in Ringwood.

Fauna habitat

- The creek channel provides habitat for hardy fish, aquatic invertebrates and waterbirds;
- The wetlands and depressions provide habitat for waterbirds, frogs and aquatic invertebrates, including yabbies. The frogs and invertebrates are a source of prey for other fauna;
- The structure and composition of the treed vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates;
- The treed vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- Tree hollows provide roost sites or nest sites for some animals, including bats;
- The site's many logs provide cover for invertebrates and small terrestrial vertebrates (e.g. lizards and frogs);
- The location on the Dandenong Creek habitat corridor greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997):

- The creek and its banks are in condition 'D' (poor);
- The rest of the site's native vegetation (including revegetation) is in condition 'C' (fair).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

With the aid of revegetation, part of the site's Swampy Woodland vegetation meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Swampy Woodland is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of State significance.

Rare or threatened plant species

Referring to the section above headed 'Significant plants', Site 80 is known habitat for *Austrostipa rudis* subsp. *australis*, which also grows over the road in Site 81. That subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened*

Plants in Victoria – 2014'. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Referring further to the 'Significant plants' section, Site 80's populations of *Carex gaudichaudiana* (Fen Sedge), *Persicaria praetermissa* (Spotted Knotweed) and *Senecio minimus* (Shrubby Fireweed) all fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The reserve's overall 'State' significance rating differs from the 'Municipal' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of Swampy Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and its paths, as well as neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to contribute in a small way to the health, wellbeing, childhood development and quality of life of visitors and those using the paths along Dandenong Creek.

Some of those benefits are spread into neighbouring streets and gardens by birds, butterflies and other animals moving between the site and other areas of habitat.

The site's location beside a major stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

The site preserves something of the area's natural landscape and enhances the area's 'green and leafy' character. The vegetation and the associated birds help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Based on an aerial photograph from 2001, this study estimates that there was 1.6 ha of native vegetation in Site 80 at that time. It is also estimated that there is now 2.0 ha of native vegetation. The increase of 0.4 ha is due to a combination of revegetation and growth of eucalypts.

Change in the ecological condition of habitat

Compared with the author's flora surveys of the site in 1995–1996 and 2004–2005, this study found a substantial deterioration of the wetlands due to dryness and encroachment of Kikuyu. A number of species of wetland flora and fauna have disappeared. However, wetlands are very dynamic and resilient environments, so recovery may be possible in wet years if the climate does not dry much further.

The forested vegetation also appears to have lost a number of wild, indigenous plant species. The most likely causes are the drying landscape and the proliferation of bracken. Thinning of the bracken may allow some of the apparently lost species to reappear.

Overall, the ecological condition of the forested vegetation has improved because planting has redressed the former shortage of understorey, from grasses to subcanopy trees. A multilayered structure is important for many birds, lizards, frogs and invertebrates, to provide cover and a diversity of food sources.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous flora and fauna from the northern wetland by Kikuyu, which is spreading aggressively from the abutting aged care property;
- Debilitation of indigenous plants by over-competition for water from the unnaturally high densities of planted eucalypts, some of which are not indigenous (e.g. Red Box). Over-competition will have its worst effects during drought, which is predicted to worsen with climate change;
- Bracken out-competing indigenous plants beneath it, including seedlings of taller species;
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species;
- Water pollution in Dandenong Creek, affecting vegetation, aquatic invertebrates, fish, frogs and waterbirds; and
- Feral honeybees occupying tree hollows that would otherwise be available for indigenous fauna.

Strategic planning

East of the abutting aged care property, the zoning of Site 80 is 'Low Density Residential Zone'. The rest of the site is zoned 'Urban Floodway Zone'.

The Heritage Overlay protects two large, old Manna Gums beside the east-west path through the site.

Removal of native vegetation throughout the site is controlled under the Vegetation Protection Overlay (VPO) and the state-wide baseline planning controls of clause 52.17 of the Victoria Planning Provisions. The VPO also applies to a small area that has been developed for the aged care facility – a legacy from before the facility was built.

In addition, the Significant Landscape Overlay covers the whole site, requiring a permit for the removal of native or introduced canopy trees (subject to exemptions).

As discussed in Section 11.1.2 of Volume 1, the VPO is not appropriate for a site of State biological significance such as Site 80. That is particularly true where works other than vegetation removal are important (e.g. drainage works), as in this case. Nor is it appropriate to retain the VPO on the aged care property.

Therefore, it is recommended to remove the VPO entirely and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 80 as mapped on p. 613. The application of the Environmental Significance Overlay will provide consistency with the opposite side of Dandenong Creek.

Information sources

The analysis above draws on the following sources of information about the site:

- Six hours of ecological survey for this study on 1/2/18 and 11/2/18, including: (a) compiling six separate lists of indigenous and introduced plant species (including mosses and liverworts) for different parts of the site, including the revegetation; (b) documenting the details of rare or scarce plants; (c) mapping

the vegetation and rare plants; (d) incidental fauna observations; (e) checking for fauna habitat; and (f) checking for any other attributes relevant to the standard criteria for assessing biological significance;

- *'Bushland Management Plan for Scott Street Reserve, Heathmont 2005'* by the present author. Nearly twelve hours of fieldwork were undertaken in June 2004 and February 2005, including descriptions of the vegetation composition, compilation of lists of indigenous and introduced plant species, incidental fauna observations, and checks for fauna habitat, ecological threats, management issues and populations of scarce or threatened plant species;
- Occasional visits to the site by the author between 1997 and 2003;
- An on-site meeting with Mr Barry Robinson of the First Friends of Dandenong Creek in 2005 concerning the site's history and bird life;
- A list of birds observed by a Birds Australia member during a 2-hectare search around the Marlborough Road footbridge on 10/12/98. The list is available through the Atlas of Living Australia. Only common birds were observed;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on fieldwork by John C. Reid and the present author during summer 1995–1996, including a flora survey, 20-minute bird census and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2003, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas or eBird. The only current-day native vegetation mapped within the site by the state government is actually mainly revegetation, and most of the remnant vegetation has been overlooked.

Site 81. Heathmont College & Marlborough Primary School

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundary

Site 81 contains the two polygons outlined in dashed-blue above. Most of the site is within the shared grounds of Heathmont College and Marlborough Primary School. The remainder of the site is on the nature strip of Marlborough Road, between the footpath and the school fence.

The original version of Site 81 in the report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), covered the whole school. However, only parts of the school were regarded as significant. Importantly, the significant vegetation included an area east of the main pedestrian entrance to Heathmont

College on Waters Grove, which is excluded here. In 1997, that area was rated as the most natural vegetation in the schoolgrounds but it has since been reduced to mown lawn with thinly scattered eucalypts.

Land use and tenure

Heathmont College and Marlborough Primary School are government schools. The adjacent streets are council roads.

General description

Site 81's northern polygon occupies 0.69 hectares and is significant because it contains a rare species of grass (*Austrostipa rudis* subsp. *australis*) and a patch of 'Swampy Woodland' and 'Valley Heathy Forest', both of which are endangered vegetation types (or 'Ecological Vegetation Classes').

The southern polygon occupies 0.18 hectares. It is too small to be biologically significant in its own right but it is included in Site 81 because it provides a habitat link with Site 80 (Scott Street Reserve) and it enlarges the genetic pool of plant species in the northern polygon.

The southern polygon and the north-south-oriented part of the northern polygon are on the floodplain of Dandenong Creek. The slope there is typically 1:40, the native soil is alluvium and the native vegetation is 'Swampy Woodland'.

The east-west-oriented section of the site's northern polygon rises above the floodplain. It has a gentle, southwest-facing slope of typically 1:12. The soil is a clay loam derived from Silurian siltstones and mudstones. The vegetation is 'Valley Heathy Forest'.

The slopes and soil types mentioned above exclude a narrow strip of the site abutting the playing field seen on the aerial photograph. That strip is occupied by a steep batter of clay fill rising to the playing field.

An aerial photograph from 1945 shows that most of what is now the schoolgrounds was covered with young, low regrowth of native vegetation, the broadest plants being about 4 m in diameter. Young regrowth was typical of native vegetation in the Melbourne area in 1945. The southwest corner of the current-day schoolgrounds (including the southern polygon of Site 81) differed in being grassy and probably grazed. That explains why the southern polygon today has fewer indigenous plant species than the northern polygon.

Although native vegetation has grown up over the whole of Site 81, the regeneration has included some environmental weeds. Today, Sweet Pittosporum, Blackberry, Ivy, Wandering Trad and Bulbil Watsonia are among the species displacing native vegetation.

Relationship to other land

Site 81 is so small that its birdlife and many of its flying insects can meet only part of their habitat needs within the site. The birds and insects therefore move between the site and other nearby habitat.

Fortunately, there is a substantial amount of other habitat in close proximity and extending along the Dandenong Creek corridor. The closest habitat is just across Marlborough Road in Scott Street Reserve (Site 80), seen on the aerial photograph on p. 621. That reserve abuts Dandenong Creek and its vegetated banks (Site 69), which (in turn) is contiguous with Sites 72–79 and sites such as Manson Reserve in the municipality of Knox. There is also a fragmented canopy of habitat trees (particularly remnant eucalypts) within the schoolgrounds.

Residences and nature strips to the east of Site 81 contain a modest density of trees and shrubs suitable as habitat for some forest birds and indigenous flying insects.

The passage of birds and flying insects between these habitat areas improves the viability of the plant populations.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation composition below include only naturally-occurring, indigenous plant species. They are sketchy and rely in part on a 1996 flora survey because a full plant list was not compiled in this study. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Narrow-leaved Peppermint (*E. radiata*).

Lower trees: Includes only Black Wattle (*A. mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*).

Medium to large shrubs: Sifton Bush (*Cassinia sifton*) and Yarra Burgan (*Kunzea leptospermoides*) are the most conspicuous species.

Grasses, rushes and sedges: Wallaby-grasses (*Rytidosperma* species) are abundant and Veined Spear-grass (*Austrostipa rudis*) is present in substantial numbers.

Swampy Woodland (EVC 937, **Endangered** in the Gippsland Plain bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*). Swamp Gum (*E. ovata*) is also present.

Lower trees: Moderately dense, comprising Silver Wattle (*Acacia dealbata*), Blackwood (*A. melanoxylon*), Cherry Ballart (*Exocarpos cupressiformis*) and Swamp Paperbark (*Melaleuca ericifolia*).

Medium to large shrubs: Patchily dense. Among the denser species are Sifton Bush (*Cassinia sifton*), Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*) and Yarra Burgan (*Kunzea leptospermoides*). Tree Everlasting (*Ozothamnus ferrugineus*) is also conspicuous, at least during wetter phases of the drought cycle.

Small shrubs: Severely depleted, represented only by Common Flat-pea (*Platylobium obtusangulum*).

Ferns: Austral Bracken (*Pteridium esculentum*) is present.

Grasses, rushes and sedges: Abundant and rich in species, among which are Veined Spear-grass (*Austrostipa rudis* subsp. *rudis* and subsp. *australis*), Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Weeping Grass (*Microlaena stipoides*) and a range of wallaby-grass species (*Rytidosperma*).

Significant plants

Rare (but not otherwise threatened) in Victoria

A subspecies of Veined Spear-grass (namely *Austrostipa rudis* subsp. *australis*) is represented by at least seven plants near the base of the batter west of the playing field. Others may well have escaped detection in this study's brief site inspection, particularly since part of the site had been mown. This rare subspecies is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

Golden Weatherglass (*Hypoxis hygrometrica* var. *hygrometrica*) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. It was recorded in the previous flora survey, in 1996. No count was recorded. The species may still be present but it is so cryptic that it would not have been detected in this study's brief inspection.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, possums and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including bats;

- The native vegetation and its litter (though reduced by mowing) provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The near-continuity of treed habitat that extends southwest through Scott Street Reserve (Site 80) to the Dandenong Creek habitat corridor greatly amplifies the habitat values above; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.25 ha of Site 81 falls into category 'C' (fair) and the remainder (roughly 0.65 ha) falls into category 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The Swampy Woodland in the site's northern polygon includes an area that meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Swampy Woodland is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of State significance.

Rare plant species

The Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a small population in Site 81 that appears to be quite viable. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

The reserve's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of Swampy Woodland.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the school community and those living close by. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's natural ambience is expected to contribute in a small way to the health, wellbeing, childhood development and quality of life of the school community.

Some of those benefits are spread into neighbouring streets and gardens by birds, butterflies and other animals moving between the site and other areas of habitat.

The site preserves something of the area's natural landscape in a location important to many children and young adults. The vegetation and the associated birds help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, approximately 0.19 ha of tree cover was lost through the whole schoolgrounds during that period. A small fraction of it had understorey and most of it has been replaced with paving or buildings. An exception is what was, in 1996, the most natural area of native vegetation, east of the main pedestrian entrance to Heathmont College from Waters Grove. That area is now mown lawn with thinly scattered eucalypts.

The aerial photographs also show that many tree crowns have expanded over land that had no native vegetation cover in 2001. The total area of increased tree cover is impracticable to calculate but it appears to be comparable to the area of tree cover that has been removed over the same period.

Change in the ecological condition of habitat

Compared with a flora survey in 1996, the brief site inspection for this study did not detect any change in the ecological condition of vegetation within the parts of the schoolgrounds that now comprise Site 81. As just noted, the most natural area of the whole schoolgrounds in 1996 is now in very poor ecological condition.

Threats

This study's brief site inspection identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by 'environmental weeds' such as Sweet Pittosporums, Ivy, Wandering Trad and Bulbil Watsonias;
- Mowing in places, and at times of the year, that favour environmental weeds over indigenous plants;
- Inadvertent killing of significant indigenous plants (including the rare spear-grass) while spraying herbicide on the site's noxious weeds; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Heathmont College and Marlborough Primary School are zoned 'Public Use Zone - Education'. The surroundings (including the nature strip in Site 81) are zoned 'Neighbourhood Residential Zone – Schedule 3'. Removal of native vegetation in the schoolgrounds and nature strip is controlled under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. In addition, Schedule 3 of the Significant Landscape Overlay covers the whole neighbourhood, requiring a permit for the removal of native or introduced canopy trees (subject to exemptions).

Although there are already planning controls over vegetation removal within Site 81, the State level of biological significance deserves additional planning protection. Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 81 as outlined in blue on the aerial photograph on p. 621.

Information sources

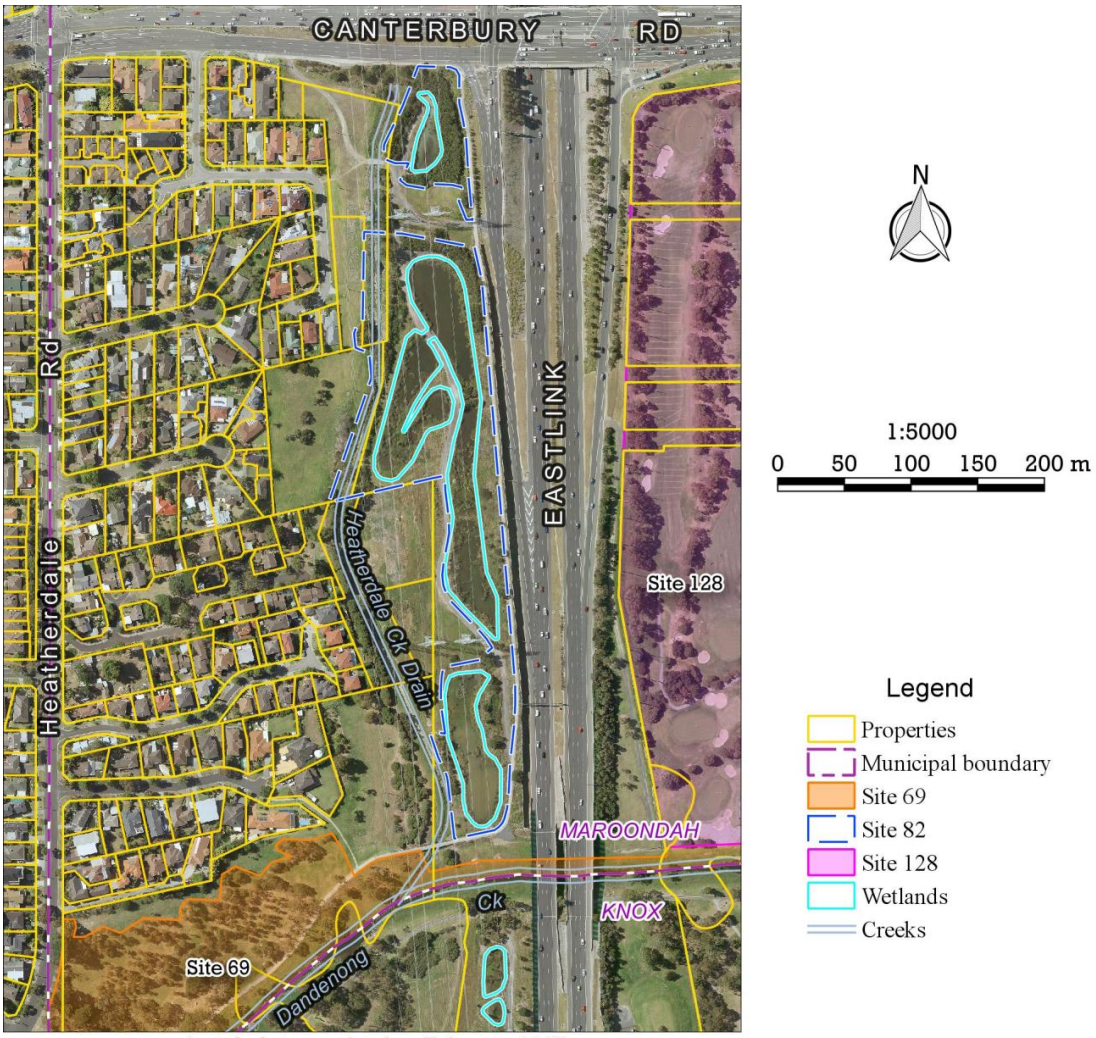
The analysis above draws on the following sources of information about the site:

- A brief site inspection for this study on 18/1/19, including: (a) a search for significant plant species (finding seven *Austrostipa rudis* subsp. *australis*); and (b) checking for any other attributes recognised in the standard criteria for sites of biological significance, including the extent of vegetation with at least 10% cover of native understorey;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the schoolgrounds was based on fieldwork by John C. Reid on 4/1/96 that included a flora survey and incidental fauna observations; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird. A 1985 plant list from Andrew Paget which the Victorian Biodiversity Atlas maps as being from this site appears to be from a broader area that may not even have included the site.

Site 82. Heatherdale Creek Wetlands, Ringwood

Biological Significance Level: *State* due to the presence of habitat for the endangered Blue-billed Duck; *Regional* in other respects



Aerial photograph taken February 2017

Boundaries, land use and tenure

Site 82 comprises the two polygons with dashed-blue outlines above. The northern, eastern and southern boundaries follow (but do not include) the Eastlink Trail, which is a shared path. The rest of the boundaries are drawn to follow the edge of native vegetation. Some revegetation plots just west of the site boundary are excluded from the site because most of the plants in them have died and they appear to be given too little maintenance for them to warrant recognition as potential future habitat. One section of the concrete-lined Heatherdale Creek drain is included because of indigenous plants on the earthen banks and in cracks between the concrete.

Land use and tenure

The site is a Crown land road parcel except for the small fraction within the channel of the Heatherdale Creek drain, whose ownership is unknown. The primary functions of the Crown land part of the site are

treatment of stormwater runoff from Eastlink and as a corridor for electricity transmission lines. The Heatherdale Creek drain is obviously for drainage, as a replacement for the original Heatherdale Creek.

General description

Site 82 occupies 3.4 hectares, represented by 1.4 hectares of artificial wetlands, 1 hectare of revegetated embankment beside the Eastlink road and trail, and 1 hectare of floodplain and drain.

Prior to the construction of Eastlink, the site's southern half was part of the Dandenong Creek floodplain. It had two natural wetlands and surrounding riparian forest and scrub, together forming the original version of Site 82 of Lorimer *et al.* (1997). Then, earth was built up to allow Eastlink to pass over Dandenong Creek, covering almost all the original version of Site 82. The small remainder of the original version of Site 82 was completely cleared and excavated to create artificial wetlands.

In the site's northern half, a hill once rose to the east of the Heatherdale Creek drain. During 2005–2007, most of the hill was removed to create more wetlands, leaving behind the current-day embankment beside the Eastlink Trail.

The wetlands have been heavily planted with robust wetland plants, most of which are not indigenous to Maroondah. A modest number of indigenous plants have colonised the wetlands.

The banks of the wetlands and the embankment between the wetlands and Eastlink have been revegetated in mulched beds. Most of the planted species are indigenous. Interestingly, extensive herbicide usage in the revegetation plots had, at the time of this study's inspection, created bare ground which indigenous plants had colonised in profusion. Although the number of colonising species was very small, they included one species listed as rare throughout Victoria, namely Floodplain Groundsel (*Senecio campylocarpus*).

Across the whole site, this study detected thirteen naturally-occurring, indigenous plant species and twenty-two planted species.

Like the Croydon Library pond (Site 135), Site 82 is an artificial landscape with biological significance principally for the artificial habitat it provides for rare waterbirds. Both sites have been colonised by rare or uncommon wetland plants.

Relationship to other land

Site 82 is essentially an appendage to the Dandenong Creek Corridor, which forms Site 69 in this report and Site 26 on the Knox side of the creek (Lorimer 2010). From the perspective of Site 82's most significant organisms – waterbirds and wetland plants – the closest significant habitats are at Winton Wetlands (Knox Site 51, 170 m south-southwest) and Koomba Park (Knox Site 58, 1.3 km south-southwest). However, local waterbirds can readily be seen daily flying greater distances between wetlands, their habitat being made up of a network of numerous wetlands over the Dandenong Creek floodplain. Many wetland plants are dispersed by waterbirds and the remainder are mostly dispersed by wind, often over long distances. Therefore, proximity to similar habitat is less important for Site 82 than for a forest environment.

Eastlink divides Site 82 from the Ringwood Public Golf Course (Site 128). Some waterbirds are expected to cross Eastlink during the birds' peregrinations.

Bioregion: Gippsland Plain

Habitat types

In the following, 'EVC' means 'Ecological Vegetation Class'.

Floodplain wasteland and revegetated road embankments. No EVC is applicable. The site's natural vegetation appears to have been Riparian Forest (EVC 18).

Canopy trees: Remnant Swamp Gums (*Eucalyptus ovata*) are scattered thinly. Yellow Box (*E. melliodora*) and Manna Gum (*E. viminalis*) were also present before being cleared for Eastlink. A

few (non-indigenous) River Red Gums (*E. camaldulensis*) are present along the Heatherdale Creek drain as a result of planting many years ago.

Lower trees: Black Wattles (*Acacia mearnsii*) are scattered around the site and at least some of them appear to be natural. Swamp Paperbark (*Melaleuca ericifolia*) is dense in places but it is too hard to tell how much of it is natural. Prior to Eastlink's construction, those sub-canopy species were accompanied by Silver Wattle (*A. dealbata*) and Cherry Ballart (*Exocarpos cupressiformis*). Blackwood (*A. melanoxylon*) has been planted abundantly in parts of the site's revegetation.

Medium to large shrubs: No convincingly remnant shrubs remain since Eastlink's construction, though it is possible that some of the Sweet Bursarias (*Bursaria spinosa*) are descendants of plants recorded in 1996. The declared noxious weeds, Montpellier Broom (*Genista monspessulana*) and Gorse (*Ulex europaeus*), are abundant in some areas of the site. Prior to Eastlink's construction, Sifton Bush (*Cassinia sifton*), Hop Goodenia (*Goodenia ovata*) and Tree Everlasting (*Ozothamnus ferrugineus*) were present.

Small shrubs: None were recorded in this study or in 1996.

Shrubby herbs: At the time of this study's inspection, some patches of ground laid bare by herbicide spraying near the Eastlink Trail had been colonised by substantial numbers of Cotton Fireweed (*Senecio quadridentatus*) and the rare Floodplain Groundsel (*S. campylocarpus*). The population sizes of both species are expected to fluctuate greatly from year to year according to rainfall and site disturbance (including herbicide usage). Rough Fireweed (*S. hispidulus*) is scarce. Shrubby Fireweed (*S. minimus*) was present in 1996 and may well appear again from time to time.

Ferns: None were recorded in this study or in 1996.

Climbers: None were recorded in this study but Coarse Dodder-laurel (*Cassytha melantha*) was recorded in 1996.

Creepers: None were recorded in this study or in 1996.

Grasses, rushes and sedges: Common Blown Grass (*Lachnagrostis filiformis*) was abundant in sparsely-vegetated areas at the time of this study's inspection. Broom Rush (*Juncus sarophorus*) is scattered through the abandoned pasture beneath the electricity transmission lines. Pale Rush (*J. pallidus*) is scarce. Prior to construction of Eastlink, the 1996 flora survey also recorded Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Common Love-grass (*Eragrostis brownii*), Thatch Saw-sedge (*Gahnia radula*), Variable Sword-sedge (*Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Weeping Grass (*Microlaena stipoides*).

Other groundcover: At the time of this study's inspection, ground laid bare by herbicide spraying near the Eastlink Trail had been colonised by thousands of Robust Willow-herbs (*Epilobium billardiereanum* subsp. *intermedium*). Hairy Willow-herb (*E. hirtigerum*) is fairly abundant and widespread. Prior to construction of Eastlink, the 1996 flora survey also recorded Slender Onion-orchid (*Microtis parviflora*), Common Rice-flower (*Pimelea humilis*) and Yellow Rush-lily (*Tricoryne elatior*).

Wetland (EVC 74, which is listed as Endangered in the Gippsland Plain bioregion but that rating is not applied by the Department of Environment, Land, Water and Planning to artificial wetlands)

Woody plants: Swamp Paperbark (*Melaleuca ericifolia*) has been planted around the wetland edges and is encroaching into them slightly.

Shrubby herbs: A single plant of the rare Floodplain Groundsel (*Senecio campylocarpus*) was observed at the edge of the water during this study. The questionably indigenous Purple Loosestrife (*Lythrum salicaria*) is planted fairly abundantly at the edges of the wetlands. The introduced Square-stem St John's Wort (*Hypericum tetrapterum*) dominates some edges of the wetlands.

Ferns and their allies: None were seen in this study but Pacific Azolla (*Azolla rubra*) was present in 1996 and is likely to reappear from time to time. Ferny Azolla (*A. pinnata*) is also likely to appear.

Climbers: None.

Creepers: Swamp Crassula (*Crassula helmsii*) has been planted abundantly around the wetlands. No naturally-occurring indigenous creepers have been recorded. The introduced Wandering Trad (*Tradescantia fluminensis*) forms a dense layer in the shallows of the northernmost wetland.

Grasses, rushes and sedges: Tall Sedge (*Carex appressa*) and Tassel Sedge (*C. fascicularis*) were present prior to the construction of Eastlink and they have been included in the planting of the

current-day artificial wetlands. The following additional species were present in 1996 but were evidently destroyed by Eastlink: Swamp Club-rush (*Isolepis inundata*), Hollow Rush (*Juncus amabilis*), Slender Joint-leaf Rush (*J. fockei*), Green Rush (*J. gregiflorus*), Pale Rush (*J. pallidus*), Broom Rush (*J. sarophorus*) and Common Reed (*Phragmites australis*). The artificial wetlands are dominated by planted species: Tall Spike-rush (*Eleocharis sphacelata*) and the non-indigenous Marsh Club-rush (*Bolboschoenus* ?*medianus*) and River Club-rush (*Schoenoplectus tabernaemontani*). The non-indigenous Jointed Twig-rush (*Baumea articulata*) is also planted abundantly. The introduced Drain Flat-sedge (*Cyperus eragrostis*) is abundant and there is a patch of the introduced Great Reedmace (*Typha latifolia*).

Other groundcover: Robust Willow-herb (*Epilobium billardiereanum* subsp. *intermedium*) and Hairy Willow-herb (*E. hirtigerum*) are fairly abundant and widespread. Prior to construction of Eastlink, the 1996 flora survey also recorded Water Plantain (*Alisma plantago-aquatica*), Lesser Joyweed (*Alternanthera denticulata*), Common Duckweed (*Lemna disperma*), Thin Duckweed (*Spirodela punctata*), Slender Knotweed (*Persicaria decipiens*) and Spotted Knotweed (*P. praetermissa*). Of these, the Water Plantain and Slender Knotweed are present in the current-day artificial wetlands but perhaps only due to planting. Water-ribbons (*Cycnogeton procerum*) has also been planted.

Concrete drain. No EVC is applicable. The plants below grow in cracks between the concrete.

Trees: None.

Other woody plants: None.

Shrubby herbs: None.

Climbers: None.

Creepers: The introduced Water Buttons (*Cotula coronopifolia*) is scarce.

Ferns: None.

Grasses, rushes and sedges: There is a substantial colony of the indigenous Nodding Club-rush (*Isolepis cernua*). There are also single plants of the non-indigenous species, Salt Club-rush (*Bolboschoenus caldwellii*) and River Club-rush (*Schoenoplectus tabernaemontani*), which must have originated from seeds of plants planted upstream.

Other: Almost none.

Significant plants

Rare (but not otherwise threatened) in Victoria

Senecio campylocarpus (Floodplain Groundsel) is listed by the state government as 'rare but not otherwise threatened in Victoria'. The population observed during this study growing in mulch on the embankment east of the wetlands (where herbicide had recently been sprayed) was estimated as forty plants. The count was uncertain due to intermingling with the somewhat similar *Senecio quadridentatus*. One other individual was observed close by at the edge of a wetland. Others could easily have been overlooked, particularly due to the brevity of this study's inspection. The population size is expected to vary greatly from year to year according to rainfall and occurrences of disturbances that stimulate the species' germination, (as in the case of the herbicide spraying prior to this study's inspection.

Critically endangered in Maroondah

Persicaria praetermissa (Spotted Knotweed) and *Senecio minimus* (Shrubby Fireweed) were recorded in Site 82 in the previous (1996) flora survey. Both species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. They appear to have not survived the construction of Eastlink but the *Senecio* may well reappear from time to time from windblown seed.

Significant fauna

Endangered in Victoria

- Blue-billed Duck – a pair reported by a Birds Australia volunteer on 31/10/18; and
- Intermediate Egret – a single individual reported through eBird on 10/12/17 by Stephen Sims.

Vulnerable in Victoria

- Hardhead - Birds Australia volunteers recorded one on 24/7/15, a pair on 31/10/18 and one on 10/1/19;
- Eastern Great Egret – recorded on eBird by David Flemming on 10/12/17 and by Birds Australia volunteers on 24/6/15, 2/5/17, 18/12/17 and 6/5/18 – one individual each time;
- Black Falcon - a Birds Australia volunteer recorded one individual on 10/1/19; and
- White-throated Needletail – 52 individuals were recorded by a Birds Australia volunteer on 18/12/17, but the presence of this aerial species above a site does not mean the site is important for the species' habitat.

Near-threatened in Victoria

- Latham's Snipe – one seen by Stephen Sims on 22/1/19 and reported through eBird.

Rare in Maroondah

- White-necked Heron – one seen by Tim Bawden on 15/8/15 and reported through eBird;
- Black-shouldered Kite – one individual recorded by a Birds Australia volunteer on 19/7/18;
- Collared Sparrowhawk – one seen by Stephen Sims on 11/4/19 and reported through eBird.
- Buff-banded Rail – one individual seen in this study and one recorded by a Birds Australia volunteer on 6/5/15;
- Sacred Kingfisher – one individual recorded on eBird by David Flemming on 19/11/17; also seen by Lorimer *et al*. (1997);
- Striated Pardalote – one seen by Stephen Sims on 15/2/19 and reported through eBird;
- Yellow-faced Honeyeater – one individual recorded on eBird by David Flemming on 19/11/17 and one by a Birds Australia volunteer on 21/11/16;
- Dusky Woodswallow – nine individuals recorded by a Birds Australia volunteer on 31/10/18; and
- Striped Marsh Frog – nine heard in the site's south during this study (in the middle of the day on 12/1/20) and reported fairly regularly by people volunteering through the Melbourne Water Frog Census.

Fauna habitat

The wetlands provide habitat for waterbirds, frogs and aquatic invertebrates. The frogs and invertebrates are a source of prey for other fauna such as egrets.

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997):

- The wetlands and some of the surrounding vegetation are in rating 'C' (fair); and
- The rest of the site is in rating 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Threatened fauna species

Referring to the section above headed 'Significant fauna', two waterbird species (Blue-billed Duck and Intermediate Egret) listed as endangered in Victoria have been recorded recently in Site 82's wetlands. The distribution of both species extends beyond Victoria. Criterion 3.1.2 of the standard criteria assign State significance to 'All sites with populations of a taxon listed and critically endangered or endangered and not endemic to Victoria'.

It might be argued that occasional visits by one or two birds does not constitute a 'population' of a species within a site, which would mean the State level of significance would not apply. The current author regards the occurrence of an Intermediate Egret as a likely rare visit and that it does not warrant State significance. The Blue-billed Ducks are much more likely to be regular visitors. Blue-billed Ducks move daily around the Dandenong Creek floodplain, where they can be observed on many waterbodies with water of adequate depth. The present author therefore regards Site 82's wetlands as probably representing a small but not negligible part of the Dandenong Creek floodplain's habitat of Blue-billed Ducks. **State** significance is assigned on that basis. A targeted campaign of monitoring for the species' presence in the site would provide a sounder basis for making such a decision.

Hardhead and Eastern Great Egret have been recorded repeatedly in Site 82 in recent years and the habitat for them appears quite good. Both species are listed by the state government as vulnerable in Victoria and both species' distributions extend beyond Victoria. Standard criterion 3.1.2 assigns Regional significance to a site under such conditions.

The records of Black Falcon and White-throated Needletail at Site 82 are regarded here as not reflecting conditions within the site; i.e. the site does not represent habitat for a population for those species. No significance is therefore assigned for those species under the standard criteria.

Of the other species listed in the section above headed 'Significant fauna', some of them may not be locally threatened (despite being locally rare) and only the Striped Marsh Frog is convincingly present as more than rare visits. Standard criterion 3.1.5 is therefore not applied to them.

Rare or threatened plant species

As explained in the section above headed 'Significant plants', Site 82 has a substantial population of Floodplain Groundsel. The species occurs in Victoria, Tasmania, NSW and the ACT. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The wetlands and their fringing vegetation were specifically created to treat stormwater runoff from Eastlink.

Evaporation and transpiration from the wetlands and plants (respectively) cool the air in hot weather.

Wetlands and their fauna (particularly waterbirds and frogs) are expected to be regarded as aesthetically pleasing by many people using the Eastlink Trail and also by people such as dog-walkers who were observed in this study to be walking on tracks west of the wetlands. Exposure to nature is known to contribute to people's health, wellbeing and quality of life.

The site's riparian location has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

As described above, the site's habitat was almost totally transformed by construction of Eastlink in 2005–2007. The 6,400 m² of wetland and riparian forest habitat in the original version of Site 82 was destroyed but 2.4 hectares of (somewhat inferior) habitat has been artificially created.

The section above headed 'Habitat types' documents the many indigenous plant species that died out as a result of Eastlink's construction.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Loss of indigenous plant species and their dependent fauna due to drying of the floodplain and wetlands during prolonged, severe droughts. Droughts are predicted to become more severe and frequent as a result of climate change;
- Displacement of indigenous flora and fauna by introduced plants, particularly Blackberry, Gorse and Montpellier Broom, but the current management regime is averting such an outcome; and
- The potential for toxic chemicals to wash into the site from a spill on Eastlink.

Strategic planning

The Crown land that makes up almost all the site is zoned 'Road Zone – Category 1' (for a main road). The Heatherdale Creek drain corridor is zoned 'Low Density Residential Zone'.

Removal of native vegetation throughout Site 82 is controlled under and the state-wide baseline planning controls of clause 52.17 of the Victoria Planning Provisions. The Vegetation Protection Overlay (VPO) provides an additional, higher level of vegetation control on the original version of Site 82, nearly all of which is now within the formation of the Eastlink Road.

The VPO is clearly inappropriate for the Eastlink Road, so it should be removed.

As discussed in Section 11.1.2 of Volume 1, the Environmental Significance Overlay (ESO) is appropriate for a site like Site 82 with biological significance associated with indigenous vegetation. The ESO is particularly appropriate in this case because of the sensitivity of the biological significance to works other than vegetation removal, such as drainage works. In addition, the abovementioned clause 52.17 provides an exemption for most planted vegetation, which is important in this case. Therefore, it is recommended to apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 82 as mapped on p. 627.

It would be open to Maroondah City Council to expand the area covered by ESO1 further west if there is a realistic desire to provide a habitat corridor along the Heatherdale Creek drain. (The failed revegetation plots there suggest that this has been an objective fairly recently.) ESO1 would have very little effect along that corridor until native vegetation is planted.

Information sources

The analysis above draws on the following sources of information about the site:

- 1¼ hours of ecological survey for this study on 12/1/20, including: (a) compiling a list of indigenous and introduced plant species (excluding mosses and liverworts) and their abundances in each of three areas, namely the wetlands, the Heatherdale Creek drain and the rest of the site; (b) documenting the details of rare plants; (c) mapping the site boundary, vegetation, rare plants and rare fauna; and (d) checking for other attributes of the site relevant to the standard criteria for assessing biological significance;
- Roughly 100 eBird records, 600 Birdata records and 15 Melbourne Water Frog Census records, mainly from 2015 to mid-2019 – all available *via* the Atlas of Living Australia;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the original version of this site was based on fieldwork by John C. Reid and the present author in January – February 1996. The fieldwork included: (a) compilation of a plant lists (without abundance data) for wetlands and another for dry-land vegetation; and (b) incidental observations of frogs, birds and butterflies; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas other than duplicates of some of the source material above. The state government's mapping of vegetation is based on conditions prior to the construction of Eastlink and is not relevant now.

Site 83. Wonga Road, Warranwood Road & Plymouth Road (Discontinued)

Biological Significance Level: *Not Significant*

Site 84 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised the remnant vegetation along:

- The north side of Plymouth Road from Luther College to Warranwood Road;
- Both sides of Warranwood Road from Plymouth Road to the Warranwood shops; and
- The east side of Wonga Road from Warranwood Road to Reids Lane.

In December 1995, the flora survey that led to the site's recognition recorded forty-two indigenous plant species. A brief site inspection for this study concluded that there has probably been a slight reduction in the number of species.

Lorimer *et al.* (1997) commented that mowing was reducing the habitat quality and preventing regeneration of plants. They also noted the expected imminent removal of 'a substantial part of the most intact vegetation near the corner of Warranwood and Plymouth Roads'. There is now no native vegetation in that area. Roadwork elsewhere along Warranwood Road has removed additional native vegetation.

On the other hand, the surviving eucalypts are now larger than in the 1990s and revegetation along Plymouth Road has expanded and matured.

The stated reason for recognising the site as locally significant in 1997 was that it was 'part of a fragmented wildlife corridor which tenuously connects to vegetated roadsides along Brysons Road (Site 84) and to Narr Maen Reserve south (Site 21) and Yarra Valley Anglican School (Site 22)'.

Even without the further fragmentation that has occurred to the already-tenuous corridor described in 1997, the site does not meet the state government's current criteria for a site of biological significance – see below. However, it does retain other values, which are discussed in the section below headed 'Other values'.

Biological significance rating

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

No part of Site 83 meets any of the standard criteria for sites of biological significance because:

- The site falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the roadside is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The site is not believed to be part of an existing habitat corridor (as per standard criteria 1.2.6) or have potential to become one (as per standard criterion 1.3) because it does not provide an ecological connection or 'stepping-stone' between more substantial areas of habitat;
- Standard criterion 2 is not met because the roadside does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because no rare or threatened species are present and none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the roadside does not include an important representative example of any natural vegetation type or significant variant thereof;

- Standard criterion 5.1 is not met because the roadside is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the roadside is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit pedestrians, nearby residents and (in the case of wind reduction) road users. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The tree canopy probably encourages some forest birds such as Eastern Rosellas and Australian King-Parrots into the area and hence into the lives of nearby residents.

The site's vegetation contributes to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Strategic planning

As for all public roads in Victoria, Brysons Road is covered by the state-wide planning controls over removal, destruction or lopping of native vegetation. In addition, all trees above a threshold size are protected under Schedule 4 of the Significant Landscape Overlay. There appears to be no need to change or augment these controls.

Site 84. Bysons Road, Warranwood (Discontinued)

Biological Significance Level: *Not Significant*

Site 84 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised the remnant eucalypts and occasional indigenous groundcover on the eastern roadside of Brysons Road along its whole length (but with gaps).

The twenty-four indigenous plant species recorded in the site in May 1996 appear to be little different from now, based on this study's very brief inspection. Comparing aerial photographs from 2001 and 2017, very little of the eucalypt cover appears to have been lost over that period and the sizes of the eucalypts have grown noticeably.

Although the site's vegetation has changed little since it was regarded as locally significant in the 1997 report, it does not meet the state government's current criteria for a site of biological significance – see below. However, it does retain other values, which are discussed in the section below headed 'Other values'.

Biological significance rating

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

No part of Site 84 meets any of the standard criteria for sites of biological significance because:

- The site falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the roadside is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The site is not believed to be part of an existing habitat corridor (as per standard criteria 1.2.6) or have potential to become one (as per standard criterion 1.3) because it does not provide an ecological connection or 'stepping-stone' between more substantial areas of habitat;
- Standard criterion 2 is not met because the roadside does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because no rare or threatened species are present and none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the roadside does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the roadside is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the roadside is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit nearby residents and (in the case of wind reduction) road users. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The tree canopy probably encourages some forest birds such as Eastern Rosellas and Australian King-Parrots into the area and hence into the lives of nearby residents.

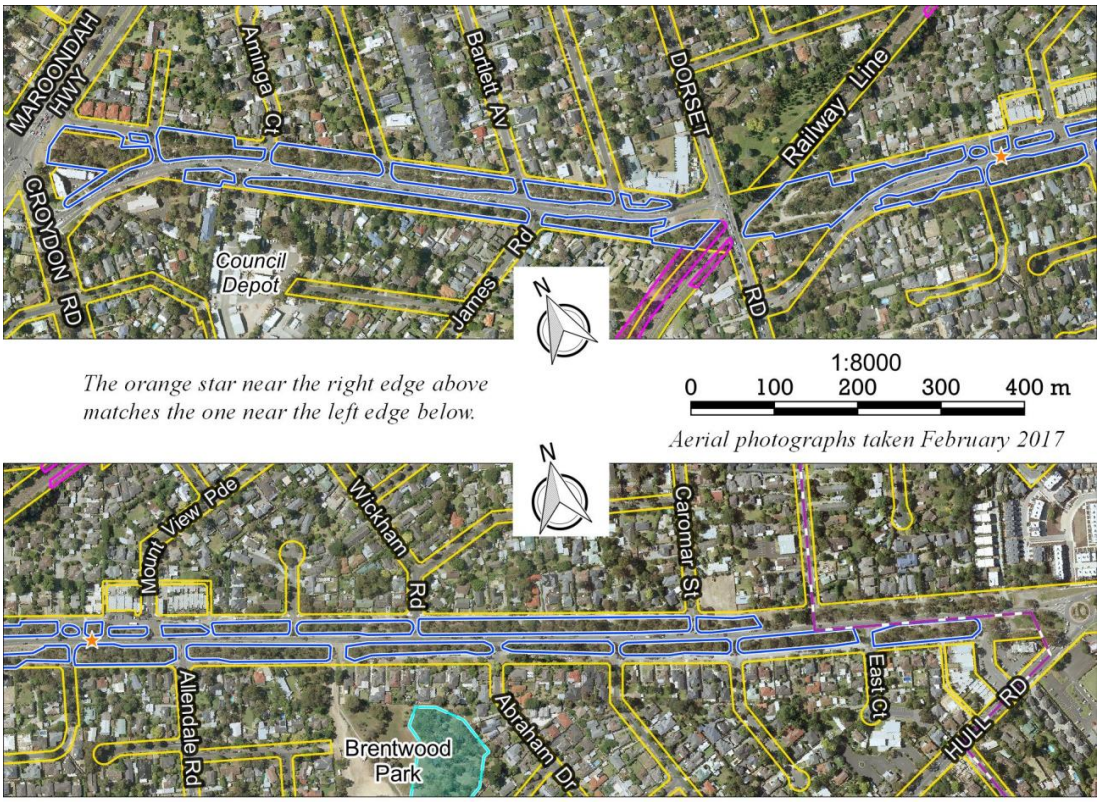
The site's vegetation contributes to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Strategic planning

As for all public roads in Victoria, Brysons Road is covered by the state-wide planning controls over removal, destruction or lopping of native vegetation. In addition, all trees above a threshold size are protected under Schedule 4 of the Significant Landscape Overlay. There appears to be no need to change or augment these controls.

Site 85. Lincoln Road, Croydon

Biological Significance Level: *Regional* near Caromar Street due to a rare grass,
Local elsewhere



Boundary, land use and tenure

Lincoln Road is a municipal road. Site 85 comprises the parts of the road reservation outlined in mid-blue on the aerial photograph above. It includes the original Site 105 of Lorimer *et al*. (1997), which occupies the two westernmost polygons. The amalgamation of sites 85 and 105 has been done because there appears to be no clear reason to maintain the distinction between them.

As with all sites in this volume, the precise boundary of Site 85 is available in a shapefile for geographic information systems.

General description

Site 85 is 2.2 km in length and occupies a total of 6.9 hectares in twenty-nine separate polygons. The terrain is gently undulating. The soil is clay loam, mostly derived from *in situ* weathering of Silurian siltstone. The three exceptions are where the clay loam has slipped downslope in minor drainage lines. That has occurred at the eastern end of the site and in the vicinity of the council depot and the northwestern corner of Brentwood Park.

As is usual along roadsides through urban residential areas, the amount and condition of native vegetation varies greatly depending on the history of actions of people living along the road. The natural understorey has been destroyed in front of most properties, the most notable exceptions being near Allendale Road and in the 200 m eastward from Dorset Road.

Until 2019, the most natural part of the site was around the Caromar Street corner, but roadworks and resident activity have destroyed most of the pre-existing native vegetation and its subsequent regeneration. Despite that destruction, at least one plant of the rare grass, *Austrostipa rudis* subspecies *australis*, has regenerated, with the hope of more to follow.

Across the whole site, this study detected forty-one naturally-occurring, indigenous plant species.

Another important feature of the site is the relatively large number of large or very large, old eucalypts.

In an effort to redress the history of understorey removal from the roadside, Maroondah City Council has planted large numbers of indigenous species in much of the site.

Relationship to other land

As can be seen from the aerial photographs on p. 639, Site 85 intersects with the fragmented habitat corridor along the Lilydale Railway Line (Site 60). The western end of Site 85 almost adjoins an avenue of remnant eucalypts along Croydon Road. All three of these fragmented strips of vegetation are likely to assist the movement of common birds and flying insects around northeastern Croydon, where other habitat is quite scarce. Without these connections, there would have been less likelihood of the author observing cockatoos and kookaburras nesting beside Lincoln Road.

The habitat within Site 85 is augmented by remnant eucalypt cover on two properties abutting the southern edge of Site 85, 35–100 m east of Dorset Road.

There is a gap of only 65 m between Site 85 and Site 140 in Brentwood Park. Each site's fauna is likely to be increased by the proximity to habitat in the other site.

The road reservation of Lincoln Road was given 'Low relative corridor conservation priority' in the *'Maroondah Habitat Corridors Strategy'* (Context 2005). It was described as providing 'links along Lincoln Road from the eastern boundary of the municipality west to Birts Hill and Richardsons Road to meet with the link along Plymouth Road…. It also links to the Wicklow Hills Corridor, the Birts Hill to Elana Ct Reserve link …, and Croydon Road to Warrien Reserve'.

Bioregion and habitat types

Site 85 straddles the boundary between the Gippsland Plain bioregion in the west and the Highlands - Southern Fall in the east. In this site, the bioregions are distinguished by the Ecological Vegetation Classes (EVCs) present, with Valley Heathy Forest being associated with the Gippsland Plain and Valley Grassy Forest being associated with the Highlands - Southern Fall. Swampy Riparian Complex spans both bioregions.

The site's vegetation has been substantially altered from a natural state, leaving the remnant eucalypts and Common Flat-pea (*Platylobium obtusangulum*) as the only species capable of discriminating between Valley Heathy Forest and Valley Grassy Forest.

West of Dorset Road, the vegetation all fits Valley Heathy Forest, with an abundance of Messmate Stringybarks (*Eucalyptus obliqua*), a substantial number of Mealy Stringybarks (*Eucalyptus cephalocarpa*) and Common Flat-pea also present until recent years. Adjoining parts of the Croydon Road roadside are clearly Valley Heathy Forest.

Valley Heathy Forest is listed by the state government as 'endangered' in the Gippsland Plain bioregion.

The pattern of vegetation types is more complicated east of Dorset Road, where the terrain is slightly steeper and two minor drainage lines affect soil moisture and soil structure. For a distance of 200 m east of Dorset Road, the presence of six Candlebarks (*E. rubida*) on the northern side of the road is a reliable

indicator of Valley Grassy Forest and hence the Highlands - Southern Fall. On the opposite side of the road, the vegetation west of Allendale Road (approximately) better fits Valley Heathy Forest (and hence the Gippsland Plain) due to the dominance of Mealy Stringybark and Messmate Stringybark. In the vicinity of the northwest corner of Brentwood Park, the dominance of Swamp Gums (*E. ovata*) on a minor drainage line indicates Swampy Riparian Complex. The same applies eastwards from near East Court. The rest of the stretch east of Dorset Road is best regarded as Valley Grassy Forest, particularly where there are Yellow Boxes (*E. melliodora*). However, the presence of occasional Mealy Stringybarks east of Brentwood Park shows some influence of Valley Heathy Forest.

Valley Grassy Forest is listed by the state government as 'vulnerable' in both the Gippsland Plain bioregion and the Highlands - Southern Fall bioregion. Swampy Riparian Complex is listed as 'endangered' in both bioregions.

The vegetation assessment just described is preferred to the rather different pattern shown in the state government's mapping of pre-settlement vegetation. The state government's mapping of current-day vegetation wrongly shows no native vegetation along Lincoln Road except within c. 150 m of Dorset Road, reflecting the government's lack of any flora data from the area.

Significant plants

Rare (but not otherwise threatened) in Victoria

This study detected a single plant of the rare subspecies of Veined Spear-grass, *Austrostipa rudis* subsp. *australis*, approximately 15 m west of the Caromar St corner. The land had been recently disturbed by roadworks and there is a substantial likelihood that more plants of the subspecies will germinate. More generally, the subspecies is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded beside Lincoln Road can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus globoidea* (White Stringybark) – a single, wild individual grows 35 m from Maroondah Highway, opposite 3 Lincoln Road, Croydon. Its trunk diameter exceeds the state government's benchmark for a 'large tree'. Such a large, ancient representative of such a locally threatened species is significant for natural heritage;
- *Eucalyptus macrorhyncha* (Red Stringybark) – three wild individuals grow on the northern roadside between Croydon Road and Bartlett Avenue. They are all in good health, which is rare in Maroondah in 2020. The one just west of Aminga Court is another 'large tree' and therefore significant for natural heritage; and
- *Eucalyptus rubida* (Candlebark) – a prominent 'large tree' grows on the southern roadside just west of East Court and there are six smaller individuals in the 200 m east from Dorset Road. Their health was assessed in this study to be typically 80% of full health, using the state government's 'Vegetation Quality Assessment' method. As for the two preceding species, the significance of the tree to natural heritage is increased by its large size and associated great age.

Fauna habitat

- This study counted twenty-five remnant eucalypts that qualify as 'large trees'. Such trees are of high value as habitat trees. Kookaburras and cockatoos are among the birds that nest in them;
- The corridor of eucalypts and sub-canopy trees represents suitable habitat for common forest birds, bats, possums and invertebrates – particularly where there are associated shrubs (which are mostly planted); and
- The connection with abutting habitat along Croydon Road and in Sites 60 and 140 amplifies the value of the abovementioned habitat.

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the site's vegetation varies between rating 'C' (fair) and 'D' (poor). Apportionment between these categories is impracticable along a roadside with such a patchy history, depending on the actions of individual residents over many decades. Revegetation has raised some areas to rating 'C' from what would otherwise have been rating 'D'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Regional near Caromar St, otherwise Local

Threatened plant species

Referring to the section above headed 'Significant plants', the solitary plant of *Austrostipa rudis* subsp. *australis* seen in this study 15 m west of Caromar Street may well be joined by others during the process of regeneration following recent roadworks. That area therefore represents 'known habitat' for the subspecies, in the sense of the standard criteria. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **Regional** significance.

That significance level should apply to the known habitat of the subspecies and any of the surroundings that are important for maintaining the viability of the population. A reasonable representation of that area would extend the full width of the northern nature strip from the footpath to the road gutter and from 60 m west of Caromar Street to 25 m east of Caromar Street. This proposal takes into account the composition of the existing vegetation and its stage of recovery from roadworks.

Referring further to the section above headed 'Significant plants', the site's populations of *Eucalyptus macrorhyncha* and *Eucalyptus rubida* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a **Local** significance rating.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 85 facilitates movement of common birds and probably flying insects through the local landscape. In this way, the site fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to **Local** significance.

Regionally threatened Ecological Vegetation Classes

Two of the site's EVCs are listed by the state government as regionally 'endangered' and the other EVC is listed as regionally 'vulnerable'. However, the standard criteria only accord significance to the presence of threatened EVCs if at least 0.25 ha of the vegetation in question has at least 10% cover of native understorey. Site 85's vegetation does not meet that criterion because its understorey is so fragmented.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through

atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit road users, pedestrians and people living or working close to the road. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The semi-natural ambience of the roadside vegetation and the presence of birds attracted to it add amenity and a 'green and leafy' landscape character to the local landscape. The natural ambience is spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals moving to and from the site.

The natural landscape and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Road widening east of Dorset Road in 2018–2019 caused the loss of a modest fraction of the site's native vegetation. That included the majority of what Lorimer *et al*. (1997) described as the most significant part of the whole site, near the Caromar Street corner. Lorimer *et al*. also stated that 'The most intact indigenous ground flora is mostly restricted to the outermost edge of high roadside cuttings, which are difficult to reach with a lawn mower'. Some of those cuttings were cut back during the road widening (including at Caromar St), destroying the vegetation on them.

Council has planted many indigenous plants along the roadside over the past quarter-century, significantly improving the site's value as habitat and for preservation of the natural landscape.

There is too little prior data to determine quantitative measures of change in Site 85.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Destruction of native vegetation (including the rare *Austrostipa rudis* subsp. *australis* by indiscriminate herbicide spraying and vegetation cutting by residents of adjacent homes;
- Creation of new driveway crossovers for residential redevelopments;
- Premature death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change;
- Displacement of indigenous plants by hardy introduced plants, some of which are growing wild and some of which are periodically planted by residents; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The site's zoning is a complicated mixture of 'General Residential Zone (1)', 'Neighbourhood Residential Zone – Schedule 3' and 'Commercial 1 Zone'.

As with all road reservations in Victoria, the removal, lopping and destruction of native vegetation are regulated by the state-wide controls of clause 52.17 of the Victoria Planning Provisions. The removal, lopping and destruction of trees (native or not) above a threshold size are further regulated under the Significant Landscape Overlay. These existing planning controls appear adequate for the nature and magnitude of the site's vegetation and the type of threats it faces. This recommendation takes into account the ineffectiveness of planning controls to counter the main threats to such as site. That ineffectiveness is typified by the needless, near-complete destruction of the *Austrostipa rudis* subsp. *australis* that occurred in 2019 near Caromar Street, despite the existence of clause 52.17.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of approximately three hours of ecological survey for this study on 2/8/18, 18/1/19 and 22/11/19, including: (a) compiling separate lists of indigenous plant species (excluding mosses and liverworts) for each side of Dorset Road; (b) documenting the details of rare plants and significant trees; (c) mapping the vegetation and the locations of rare plants and large trees; and (d) noting wildlife habitat;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of this site was based on a flora survey of parts of the site by Lynlee Smith and the present author in 1995–1996; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the Victorian Biodiversity Atlas, Atlas of Living Australia or eBird.

Site 86. Yarra Road & Power Street, Croydon North (Discontinued)

Biological Significance Level: *Not significant*

The *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) described Site 86 as comprising a 'fragmented indigenous tree canopy' on 'both sides of Power Street between Yarra Road and Barnard Crescent, and Yarra Road between Layfield Street and Knee Lane'. The site was regarded as biologically significant as a fragmented wildlife corridor from habitat at Yarra Road Primary School (Site 54) to the Knee Lane roadside (Site 87) and Knee Lane Reserve (Site 102). Lorimer *et al.* made reference to the ongoing loss of mature trees and indigenous groundcover along Power Street due to residential development.

Since 1997, more vegetation has been lost along Power Street, and the amount and condition of native vegetation at Yarra Road Primary School and along Knee Lane have declined badly (see pp. 410 and 647). The original reasons for recognising Site 86 have therefore fallen away. No other reasons have been found to continue recognising the site as having biological significance under the state government's standard criteria (see below).

It should be noted, however, that the vegetation beside Yarra Road has matured and been augmented by revegetation. That is true not just in the section from Layfield Street to Knee Lane but for most of the way from 200 m northwest of Layfield Street to Plymouth Road. The roadside vegetation still does not meet the standard criteria for a site of biological significance but it does have other values, particularly for visual amenity and bringing birdlife into the lives of local residents. That is discussed in the section below headed 'Other values'.

Biological significance rating

This section assesses biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

No part of Site 86 or other parts of the Yarra Road roadside meet any of the standard criteria for sites of biological significance because:

- The vegetation falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the roadside is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The vegetation is not believed to be part of an existing habitat corridor (as per standard criteria 1.2.6) or have potential to become one (as per standard criterion 1.3) due to the site's isolation from more substantial habitat except Site 46 (Birt Hill) near Plymouth Road;
- Standard criterion 2 is not met because the roadside does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because no rare or threatened species are present and none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the roadside does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the roadside is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the roadside is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings. The assessment is of not just the original Site 86 but also the roadside vegetation along Yarra Road from the Plymouth Road intersection to the municipal boundary.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit pedestrians and nearby residents. Drivers along Yarra Road also benefit from the wind reduction.

As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The tree canopy probably encourages some forest birds such as Eastern Rosellas and Australian King-Parrots into the area and hence into the lives of pedestrians and nearby residents.

The site's vegetation contributes greatly to the area's 'green and leafy' character.

Strategic planning

All public roads in Victoria are covered by the state-wide planning controls over removal, destruction or lopping of native vegetation. In addition, Schedule 4 of the Significant Landscape Overlay protects trees above a threshold size along Yarra Road south of the intersection with Nangathan Way and Croydon Hills Drive. There appears to be no need to change or augment these controls.

Site 87. Knee Lane, Croydon North (Discontinued)

Biological Significance Level: *Not Significant*

Site 87 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised the southern roadside of Knee Lane west of Nangathan Way, Croydon North. It was signposted as a significant roadside for the presence of indigenous plants. The vegetation type was the endangered Valley Heathy Forest.

The 1997 report mentioned that the vegetation was 'in serious decline' due to actions by residents in the (then new) abutting houses. Those actions have compounded over the subsequent 22 years. The indigenous vegetation has been reduced to a narrow line of trees with a scattering of hardy groundcover species.

The surviving vegetation does not meet any of the standard criteria of Amos (2004) for sites of biological significance. The site therefore falls into the category, 'Not Significant', in the scheme of Amos (2004).

Strategic planning

As for all public roads in Victoria, Knee Lane is covered by the state-wide planning controls over removal, destruction or lopping of native vegetation. In addition, all trees above a threshold size are protected under Schedule 3 of the Significant Landscape Overlay. These controls have not prevented the deterioration of Site 87.

Because the site has lost its biological significance and planning controls have failed to prevent that, there appears to be no reason to apply any new planning control.

Site 88. Dorset Road, Croydon (Discontinued)

Biological Significance Level: *Not Significant*

Site 88 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised the trees and scattered shrubs on the eastern roadside of Dorset Road between Smith Avenue to the northern end of the Croydon District Golf Club (now 'The Range' housing estate). The site was recognised as a 'refuge for indigenous plants, previously signposted as a significant roadside but now in serious decline'. The vegetation is a remnant of a vegetation type now known as Valley Grassy Forest, which is listed by the state government as 'vulnerable' in the relevant bioregion (the 'Highlands - Southern Fall').

Development of 'The Range' destroyed most of the vegetation on its abutting roadside, which made up more than half the site. Much of that strip now has young revegetation. The rest of the site retains its tree cover, including eucalypts now noticeably larger than in 1997 as well as a few young Blackwoods (*Acacia melanoxylon*) and a Cherry Ballart (*Exocarpos cupressiformis*). The only shrubs in the site now are those planted in the revegetation beside 'The Range'.

Biological significance rating

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

No part of Site 88 meets any of the standard criteria for sites of biological significance because:

- The site falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the roadside is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The site is not believed to be part of an existing habitat corridor (as per standard criteria 1.2.6) or have potential to become one (as per standard criterion 1.3) due to the site's narrowness and isolation from other habitat except Site 59 ('The Range');
- Standard criterion 2 is not met because the roadside does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because: (a) none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more; and (b) the site's only species that is threatened at any scale is Candlebark (*Eucalyptus rubida*), which is represented only by a few young individuals that may well have been planted;
- Standard criterion 4 is not met because the roadside does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the roadside is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the roadside is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit pedestrians and nearby residents. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The tree canopy probably encourages some forest birds such as Eastern Rosellas and Australian King-Parrots into the area and hence into the lives of nearby residents.

The site's vegetation contributes to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Strategic planning

As for all public roads in Victoria, Dorset Road is covered by the state-wide planning controls over removal, destruction or lopping of native vegetation. In addition, all trees above a threshold size are protected under Schedule 3 of the Significant Landscape Overlay. There appears to be no need to change or augment these controls.

Site 89. Old Lilydale Road, Ringwood East (Discontinued)

Biological Significance Level: *Not Significant*

Site 89 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised the remnant vegetation along the median strip of Old Lilydale Road, Ringwood East. The report regarded it as being of Local biological significance but not requiring specific protection under the Maroondah Planning Scheme. The citation of the site's significance was, 'Discontinuous corridor of indigenous trees, likely to be good bird and possum habitat'.

The naturally-occurring, indigenous plant species detected by this study in 2020 included five tree species, one (questionably indigenous) shrub species and thirteen groundcover species. Some of the eucalypts are quite large and old, being visible as mature trees on a 1945 aerial photograph. Many of the larger remnant eucalypts have hollows, at least some of which are being used by wildlife (judging from the worn bark around them).

A 'National Tree Day' planting in 1999 began a long series of revegetation efforts along the median strip that has continued to 2019. This study's ecological survey recorded 32 planted indigenous species and one planted non-indigenous species. The CRISP community nursery has been quite active in revegetating and maintaining the site in recent years. Maroondah City Council does routine vegetation maintenance.

A few Sweet Bursarias (*Bursaria spinosa*) were the only planted species that this study found to have reproduced. The failure of the revegetation to reproduce and become self-sustaining appears to be because of extensive herbicide spraying. The spraying is keeping introduced plants under control but it is also killing seedlings of the naturally-occurring indigenous plants and the revegetation.

Notwithstanding that limitation, the site has a much greater range of indigenous plant species than in 1997 and the habitat for birds and insects is much better. The streetscape is now that of a 'bush boulevard'. The site is of greater biological significance and landscape value than in 1997. However, the state government's standard criteria for sites of biological significance (Amos 2004 – see p. 2 of this volume) do not recognise significance of such a site, as demonstrated in the formal assessment below.

The lack of recognition of such a site by the standard criteria should not be construed as an indication that the site has no significance in other respects.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the indigenous plant species except where stated otherwise.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*), followed by Messmate Stringybark (*E. obliqua*) and then Narrow-leaved Peppermint (*E. radiata*). There is a single Bundy (*E. goniocalyx*). A few Swamp Gums (*E. ovata*) have been planted.

Lower trees: Wild, indigenous subcanopy trees are reduced to two Cherry Ballarts (*Exocarpos cupressiformis*). They have been augmented by extensive planting of Silver Wattle (*Acacia dealbata*), Black Wattle (*A. mearnsii*), Blackwood (*A. melanoxylon*) and Golden Wattle (*Acacia pycnantha*). A few Hazel Pomaderris (*Pomaderris aspera*) have also been planted but they are not indigenous to Valley Heathy Forest.

Medium to large shrubs: Sifton Bush (*Cassinia sifton*) is the only naturally-occurring species that could be construed as indigenous. Many indigenous shrubs have been planted, the most abundant being

Snowy Daisy-bush (*Olearia lirata*). The non-indigenous White Correa (*Correa alba*) has also been planted.

Small shrubs: Absent.

Ferns: Absent.

Shrubby herbs: Cotton Fireweed (*Senecio quadridentatus*) is fairly abundant due to the frequent use of herbicide.

Climbers: Absent.

Creepers: Absent.

Grasses, rushes and sedges: This study found ten indigenous grassy species growing wild in the mown areas. Substantial patches are dominated by wild plants of the indigenous Clustered Wallaby-grass (*Rytidosperma racemosum*). Small patches of wild Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Thatch Saw-sedge (*Gahnia radula*) are scattered liberally throughout. Wild plants of Bristly Wallaby-grass (*R. setaceum*) and Purplish Wallaby-grass (*R. tenuius*) are abundant around the junction with Mount Dandenong Road. Weeping Grass (*Microlaena stipoides*) is fairly abundant but localised. The introduced Kikuyu (*Cenchrus clandestinus*) and Prairie Grass (*Bromus catharticus*) are dense in a substantial fraction of the lawns. Of the few planted grassy species, the most abundant are Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Common Tussock-grass (*Poa labillardierei*).

Other groundcover: Wild plants of Black-anther Flax-lily (*Dianella revoluta*) are scattered around tree bases outside the revegetation plots and a few of them have been planted. The only other naturally-occurring species detected in this study was Hairy Willow-herb (*Epilobium hirtigerum*), which had volunteered in bare ground created by herbicide spraying. No other planted species were detected.

Biological significance rating

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

No part of Site 89 meets any of the standard criteria for sites of biological significance because:

- The site falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the site is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The site is not believed to be part of an existing habitat corridor (as per standard criteria 1.2.6) or have potential to become one (as per standard criterion 1.3), because it provides only a tenuous connection between substantial areas of habitat;
- Standard criterion 2 is not met because the site does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because no rare or threatened species are present and none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more. However, that criterion might be met if the gaps between several of the existing revegetation plots were revegetated to reach the 0.25 ha threshold;
- Standard criterion 4 is not met because the site does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the site is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the site is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit nearby residents and (in the case of wind reduction) road users. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation encourages some forest birds such as Eastern Rosellas and Australian King-Parrots into the surrounding residential area and hence into the lives of nearby residents.

The site's vegetation adds a 'green and leafy' character to the area. It also preserves something of the area's natural landscape and is part of the area's natural heritage.

Strategic planning

The site is in a 'General Residential Zone'.

As for all public road reserves in Victoria, the site is covered by the state-wide planning controls over removal, destruction or lopping of native vegetation. Removal of canopy trees (native or otherwise) is further regulated under Schedule 4 of the Significant Landscape Overlay (SLO4).

Given that the site does not meet the state government's criteria for a site of biological significance, there appears to be no need to introduce additional planning protection for the site's vegetation.

Information sources

The analysis above draws on the following sources of information about the site:

- One hour of flora survey by the author on 28/1/20, including: (a) compiling a list of the names and abundances of all vascular plant species except minor wild, non-indigenous species; (b) mapping the vegetation and scarce plants; and (c) checking for any other features relevant to this report;
- Four iNaturalist records of beetles and a fungus-fly;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional relevant information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 90. Mt Dandenong Rd, Ringwood (Discontinued)

Biological Significance Level: *Not Significant*

Site 90 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised the median strip and some roadside trees on Mount Dandenong Road, Ringwood East, between Braeside Avenue and Joseph Street. The report regarded it as being of Local biological significance but not requiring specific protection under the Maroondah Planning Scheme. The site was deemed locally significant because it 'Provides a corridor of indigenous trees with scattered indigenous ground layer plants, particularly mat-rushes that are important for butterflies'.

The naturally-occurring, indigenous plant species detected by this study in 2020 included five tree species, three shrub species (all very scarce), one shrubby herb species and thirty-four groundcover species. Some of the eucalypts are very large and old, being visible as mature trees on a 1945 aerial photograph. Many of the larger remnant eucalypts have hollows, at least some of which are being used by wildlife (judging from the worn bark around them). Surprisingly, a few of the remnant wildflower species such as Rosy Hyacinth-orchid (*Dipodium roseum*) and Grass Trigger-plant (*Stylidium graminifolium* s.s.) are normally associated with more natural environments but they have managed to survive the regular mowing that occurs along the median strip.

The cover of remnant eucalypts has been augmented by a similar number of planted eucalypts and paperbarks, very few of which are indigenous species. Few understorey plants have been planted.

The state government's standard criteria for sites of biological significance (Amos 2004 – see p. 2 of this volume) do not recognise significance of a site like Site 90, as demonstrated in the formal assessment below. However, that should not be construed as an indication that the site has no significance in other respects.

Bioregion: Gippsland Plain

Habitat type

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*), followed by Narrow-leaved Peppermint (*E. radiata*) and then Messmate Stringybark (*E. obliqua*) and Bundy (*E. goniocalyx*). Four Red Stringybarks (*E. macrorhyncha*) and one Yellow Box (*E. melliodora*) were detected in this study but they have probably all been planted. A range of non-indigenous eucalypts such as River Red Gum (*E. camaldulensis*) have been planted, similar in number to the remnant eucalypts.

Lower trees: Wild, indigenous subcanopy trees are reduced to a few Black Wattle (*A. mearnsii*) seedlings, which may not survive mowing. A very small number of indigenous wattles and a Black She-oak (*Allocasuarina littoralis*) have been planted. Planted 'Australian native' subcanopy species are scattered through the site.

Medium to large shrubs: Sifton Bush (*Cassinia sifton*) is scattered through the site but its status as indigenous to Victoria is uncertain. This study detected one naturally-occurring seedling of Sweet Bursaria (*Bursaria spinosa*) stunted by mowing and one seedling of Shiny Cassinia (*C. longifolia*) that may suffer the same fate. The only other indigenous shrubs detected in this study were two Spreading Wattles (*Acacia genistifolia*), two Silver Banksias (*Banksia marginata*) and four Furze Hakeas (*Hakea ulicina*), all of which have been planted.

Small shrubs: Absent.

Shrubby herbs: Cotton Fireweed (*Senecio quadridentatus*) is scattered throughout.

Ferns: Absent.

Climbers: There is a single, young plant of Wonga Vine (*Pandorea pandorana*) as a result of that species' remarkable range expansion.

Creepers: There are a few clusters of Kidney-weed (*Dichondra repens*) and the wood-sorrel, *Oxalis exilis/perennans*. Creeping Bossiaea (*Bossiaea prostrata*) and Purple Coral-pea (*Hardenbergia violacea*) are each represented by a single plant.

Grasses, rushes and sedges: This study found twenty-two indigenous grassy species growing wild, all of them subjected to mowing. Much of the site's groundcover is dominated by wild plants of the indigenous Clustered Wallaby-grass (*Rytidosperma racemosum*), competing with Kikuyu (*Cenchrus clandestinus*). The following species are abundant but not dominant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Weeping Grass (*Microlaena stipoides*), Bristly Wallaby-grass (*R. setaceum*) and Purplish Wallaby-grass (*R. tenuius*). Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*) and Common Wallaby-grass (*Rytidosperma caespitosum*) are also fairly abundant. Among the less abundant indigenous species, a single Small Grass-tree (*Xanthorrhoea minor*) is notable.

Other groundcover: Wild plants of Black-anther Flax-lily (*Dianella revoluta*) and Yellow Rush-lily (*Tricoryne elatior*) are scattered fairly liberally around the site, east of Dublin Road. Creeping Cudweed (*Euchiton japonicus*) and Smooth Solenogyne (*Solenogyne dominii*) are scarce. This study found only a single plant of each of Rosy Hyacinth-orchid (*Dipodium roseum*), Lesser Loosestrife (*Lythrum hyssopifolia*) and Grass Trigger-plant (*Stylidium graminifolium* s.s.). All these species are indigenous.

Biological significance rating

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

Regionally threatened Ecological Vegetation Class

Standard criterion 3.2.3 accords State significance to any site with a 'patch' of native vegetation that belongs to an endangered ecological vegetation, such as Valley Heathy Forest. The definition of a 'patch' adopted by the standard criteria is at least 0.25 ha with native understorey cover of 10% or more. Much of Site 90 meets that criterion if (and only if) one includes lawn dominated by Clustered Wallaby-grass (*Rytidosperma racemosum*) but that is not accepted here. The abundance of Clustered Wallaby-grass is not natural but the result of mowing and extensive modification of the natural vegetation, i.e. it is a symptom of environmental modification rather than an indicator of a patch of native vegetation. Clustered Wallaby-grass was rare in local Valley Heathy Forest as recently as 1997, as indicated by the data of Lorimer *et al*. (1997), and it may not have been present at all prior to European settlement. It has since become so abundant in Maroondah that many local lawns are dominated by it, even in the absence of any other species that could be construed as indigenous. To recognise a site as being of State significance on the basis of a lawn of Clustered Wallaby-grass would be a travesty.

Other criteria

No part of Site 90 meets any of the other standard criteria for sites of biological significance because:

- The site falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the site is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The site is not believed to be part of an existing habitat corridor (as per standard criteria 1.2.6) or have potential to become one (as per standard criterion 1.3), because it provides only a tenuous connection between substantial areas of habitat;
- Standard criterion 2 is not met because the site does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because no rare or threatened species are present;
- Standard criterion 4 is not met because the site does not include an important representative example of any natural vegetation type or significant variant thereof;

- Standard criterion 5.1 is not met because the site is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the site is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit nearby residents and (in the case of wind reduction) road users. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation may encourage some forest birds such as Eastern Rosellas and Australian King-Parrots into the surrounding residential areas and hence into the lives of nearby residents.

The site's vegetation adds a 'green and leafy' character to the area. It also preserves something of the area's natural landscape and is part of the area's natural heritage.

Strategic planning

The site is zoned 'Road Zone – Category 1', for a main road.

As for all public road reserves in Victoria, the site is covered by the state-wide planning controls over removal, destruction or lopping of native vegetation. Removal of canopy trees (native or otherwise) is further regulated under Schedule 4 of the Significant Landscape Overlay (SLO4).

Given that the site does not meet the state government's criteria for a site of biological significance, there appears to be no need to introduce additional planning protection for the site's vegetation.

Information sources

The analysis above draws on the following sources of information about the site:

- One hour and fifty-five minutes of flora survey by the author on 28/1/20, including: (a) compiling a list of the names and abundances of all vascular plant species except minor wild, non-indigenous species; (b) mapping the vegetation and scarce plants; and (c) checking for any other features relevant to this report;
- Some iNaturalist and BowerBird records of insects and fungi by Martin Lagerway, available through the Atlas of Living Australia;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional relevant information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 91. Mount Dandenong Rd, Kilsyth (Discontinued)

Biological Significance Level: *Not Significant*

Site 91 of *'Sites of Biological Significance in Maroondah'* in 1997 comprised the southern roadside of Mount Dandenong Road between Gordon Street, Croydon and Colchester Road, Kilsyth. The reasons for the site being recognised were the presence of a corridor of trees with scattered indigenous groundcover plants. The vegetation type was the endangered Valley Heathy Forest.

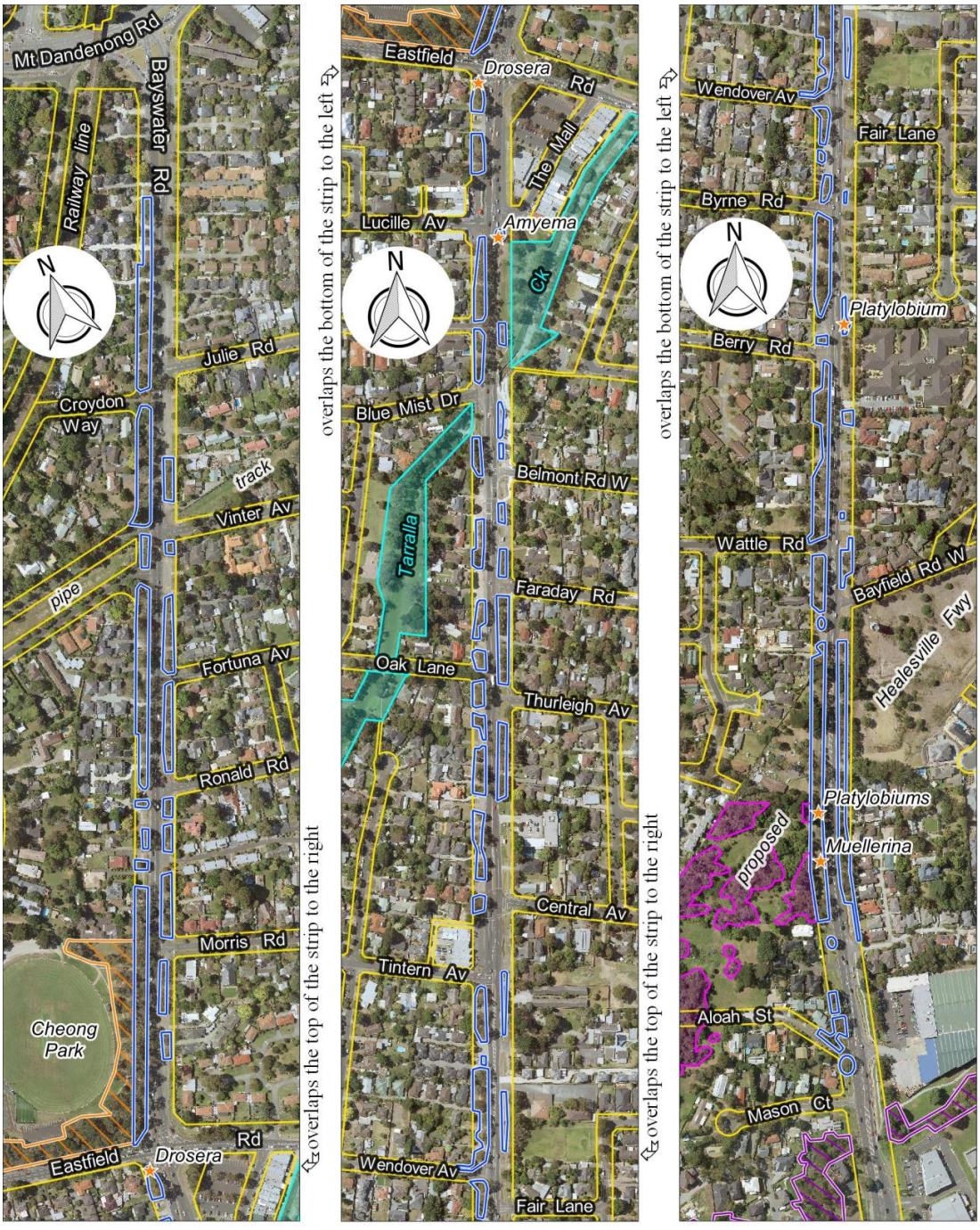
Within a few years of that assessment, all the native vegetation was destroyed during a project to duplicate the road. The vegetation that was planted on the new nature strip and median strip does not meet any of the standard criteria of Amos (2004) for sites of biological significance. The site therefore falls into the category, 'Not Significant', in the scheme of Amos (2004).

Strategic planning

As for all public roads in Victoria, Mount Dandenong Road is covered by the state-wide planning controls over removal, destruction or lopping of native vegetation. In addition, all plants above a threshold size are protected under the Significant Landscape Overlay (Schedule 3 in the west and Schedule 4 in the east). This study has not detected any reason to change that situation or apply any new planning control.

Site 92. Bayswater Road

Biological Significance Level: *National* at two locations due to an endangered plant species; *State* next to Cheong Park; *Local* elsewhere



Boundaries, land use and tenure

Site 92 contains 59 separate pieces of roadside of Bayswater Road, which is a single-carriageway main road. Each piece of the site is outlined in mid-blue on the aerial photograph above. The boundaries have been drawn to encompass the significant vegetation without encroaching on the road formation or abutting properties, except in the case of a rare mistletoe that hangs over the road near The Mall.

VicRoads has primary responsibility for the road but Maroondah City Council has been responsible for extensive revegetation in much of the stretch from Eastfield Road to Wattle Road.

As with all sites in this volume, the precise boundaries are available as a shapefile for geographic information systems.

General description

Site 92 occupies a total of 3.8 hectares of roadside. The natural land surface is mostly gently undulating with slopes between 1:10 and 1:15. The maximum natural slope is 1:8 in the far south of the site. However, there are some steep batters beside the road and driveway crossovers. Some of those batters support a surprising range of indigenous groundcover plants, including a plant of the globally-endangered flat-pea, *Platylobium infecundum*. This study detected a total of sixty-seven naturally-occurring, indigenous plant species.

The parts of the site with the greatest diversity of indigenous flora are:

- Beside Cheong Park (Site 35), where one finds all strata of native vegetation and some sensitive species such as Honeypots (*Acrotriche serrulata*), Tall Spear-grass (*Austrostipa pubinodis*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*) and Common Rice-flower (*Pimelea humilis*);
- On the eastern side, 50–180 m south of Faraday Road, with fewer, less sensitive species than above (due to mowing) but still with representatives of three strata of native vegetation;
- A tiny patch around a large, old Narrow-leaved Peppermint (*Eucalyptus radiata*) immediately south of the aged care facility at 229–239 Bayswater Road, where mowing has surprisingly not eliminated native grasses or wildflowers such as Chocolate Lily (*Arthropodium strictum*) and Yellow Rush-lily (*Tricoryne elatior*);
- 10–45 m north of Bayfield Road West, which has little indigenous tree cover and no indigenous shrubs but a range of native grasses and a few wildflower species such as Yellow Rush-lily; and
- Beside Site 134 (in the Healesville Freeway reservation), with all strata of native vegetation and a range of indigenous groundcover species.

There are also highly localised occurrences of significant species in unexpected places. The best example is a colony of approximately 90 Branched Sundews (*Drosera hookeri*) in lawn at the Eastfield Road intersection. That species is in the 'critically endangered' category of risk of dying out in Maroondah.

Maroondah City Council has been steadily increasing the amount of habitat along the road through planting since the turn of the century. However, all the abovementioned vegetation is natural.

Relationship to other land

As seen on the aerial photograph on the previous page, Site 92 abuts Site 35 (Cheong Park), Site 62 (Tarralla Creek) and Site 134 (the Healesville Freeway reservation west of Bayswater Road). It is also only 50 m from the Bungalook Creek corridor of Site 131.

For a distance of at least 500 m each side of Baywater Road, there is a substantial number of mature habitat trees on residential properties and nature strips, including natural indigenous eucalypts and planted 'Australian natives'.

The author's observations as a resident of the area during 2002–2016 have led him to conclude that a wide range of forest birds move through the area, foraging, roosting and nesting wherever resources are available

at the time. Many butterfly species and at least three frog species do likewise. The author has not detected a tendency for fauna to move preferentially along Bayswater Road rather than any other route.

On this basis, Bayswater Road can be regarded not so much as a habitat corridor but as an important habitat 'stepping-stone' within a matrix or network of habitat. The habitat corridors along Tarralla Creek (Site 62) and Bungalook Creek (Site 131) provide links to more distant habitat, as indicated by the key map of sites on p. 1.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: South of Wattle Road, the dominant species are Bundy (*Eucalyptus goniocalyx*) and Red Stringybark (*E. macrorhyncha*). Mealy Stringybark (*E. cephalocarpa*) is dominant elsewhere, with Messmate Stringybark (*E. obliqua*) sub-dominant in the central third. There are also substantial numbers of and Narrow-leaved Peppermint (*E. radiata*), as well as a scattering of Swamp Gum (*E. ovata*).

Lower trees: Blackwood (*Acacia melanoxylon*) is abundant. Silver Wattle is abundant north of Eastfield Road whereas Golden Wattle is abundant south of Wattle Road. Black Wattle (*A. mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*) are fairly abundant in the southern half of the site. Swamp Paperbark (*Melaleuca ericifolia*) is scarce and grows quite short for the species, as is normal in Valley Heathy Forest.

Medium to large shrubs: Sweet Bursaria (*Bursaria spinosa*) is abundant south of Wattle Road and scattered thinly from there to Eastfield Road. Hop Goodenia (*Goodenia ovata*) is fairly abundant south of Wattle Road. The following species are very scarce: Hedge Wattle (*Acacia paradoxa*), Shiny Cassinia (*Cassinia longifolia*), Sifton Bush (*Cassinia sifton*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*) and Yarra Burgan (*Kunzea leptospermoides*). Manuka (*Leptospermum scoparium*) is currently represented only by one dead plant, in the north of the site.

Small shrubs: Extremely depleted but the surviving species are very characteristic of Valley Heathy Forest. There is one plant each of Erect Guinea-flower (*Hibbertia riparia*), Grey Parrot-pea (*Dillwynia cinerascens*) and Common Flat-pea (*Platylobium obtusangulum*).

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches south of Wattle Road.

Climbers: Coarse Dodder-laurel (*Cassytha melantha*) is present south of Wattle Road.

Creepers: Very depleted, represented only by four patches of the flat-pea *Platylobium infecundum* and small numbers of Kidney-weed (*Dichondra repens*), Rainforest Crane's-bill (*Geranium* ?*homeanum*) and the wood-sorrel *Oxalis exilis/perennans*.

Grasses, rushes and sedges: Abundant and rich in species. Dominated variously by Thatch Saw-sedge (*Gahnia radula*) or (in mown areas) Clustered Wallaby-grass (*Rytidosperma racemosum*). The following species are also abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Weeping Grass (*Microlaena stipoides*), Bristly Wallaby-grass (*R. racemosum*) and Purplish Wallaby-grass (*R. tenuius*). The following species are widespread or moderately abundant: Common Wheat-grass (*Anthosachne scabra*), Tall Spear-grass (*Austrostipa pubinodis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Soft Tussock-grass (*Poa morrisii*), Leafy Wallaby-grass (*R. fulvum*) and Kangaroo Grass (*Themeda triandra*). There are small numbers of Short-stem Sedge (*Carex breviculmis*), the fine-leafed subspecies of Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *exilis* and subsp. *longifolia*) and Small Grass-tree (*Xanthorrhoea minor*). Other species of wallaby-grass (*Rytidosperma*) were observed in previous inspections but could not be detected in this study due to mowing and the times of year.

Other groundcover: Black-anther Flax-lily (*Dianella revoluta*) is widespread in the site and is even the dominant groundcover species in small areas. Spreading Crassula (*Crassula decumbens*) is dense in various small patches, often associated with Common Cotula (*Cotula australis*). Clusters of Hairy

Willow-herb (*Epilobium hirtigerum*), Hairy Solenogyne (*Solenogyne gunnii*) and Yellow Rush-lily (*Tricoryne elatior*) are scattered south of Eastfield Road. The following species are scarce or highly localised: Chocolate Lily (*Arthropodium strictum*), Pale Flax-lily (*Dianella longifolia* var. *longifolia*), Tasman Flax-lily (*Dianella tasmanica*), Branched Sundew (*Drosera hookeri*), Creeping Cudweed (*Euchiton* ?*japonicus*), Common Raspwort (*Gonocarpus tetragynus*), Common Rice-flower (*Pimelea humilis*) and Smooth Solenogyne (*Solenogyne dominii*).

Swampy Riparian Woodland (EVC 83, **Endangered** in the bioregion) from The Mall to Belmont Road West, plus a solitary Swamp Gum at the site's southern tip

Dominant canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*). Mealy Stringybark (*E. cephalocarpa*) is also present.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*). There is also a small patch of Swamp Paperbark (*Melaleuca ericifolia*).

Shrubs: All the indigenous shrubs present are believed to have been planted.

Ferns: None seen.

Climbers: None seen.

Creepers: None seen.

Grasses, rushes and sedges: Thatch Saw-sedge (*Gahnia radula*) is dense in small patches. Clustered Wallaby-grass (*Rytidosperma racemosum*) is abundant in lawn.

Other groundcover: Mosses are the only other indigenous plant species detected.

Significant plants

The locations of significant species mentioned below (except Red Stringybark) are highlighted with orange stars on the aerial photograph on p. 650.

Globally endangered

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. Three healthy, dense patches grow on the western side of Bayswater Road, 255–270 m south of Wattle Road. They measure 7 m × 2 m, 5 m × 3 m and 4 m × 4 m, each patch containing an indeterminant number of individuals. There is also a single plant on the roadside batter near the southwest corner of 225-227 Bayswater Road (near the Wendover Avenue intersection), damaged by mowing.

Critically endangered in Maroondah

The following naturally-occurring plant species can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – a single, healthy plant grows over the road pavement on a Mealy Stringybark 20 m south of the intersection with The Mall;
- *Drosera hookeri* (Branched Sundew) – a thriving colony of roughly 90 plants occupies an area 6 m long and 1 m wide in lawn immediately south of the pedestrian crossing sign at the southwest corner of the Bayswater Road – Eastfield Road intersection;
- *Eucalyptus macrorhyncha* (Red Stringybark) – seven grow opposite Wattle Road, one grows further north and eighteen grow further south. The health of the trees is generally good, unlike most members of the species in local forests; and
- *Muellerina eucalyptoides* (Creeping Mistletoe) – on 26/10/18, a single plant was growing on a Mealy Stringybark opposite 6 / 279-287 Bayswater Road. When re-inspected on 14/9/19, the tree had been removed.

Fauna habitat

- Although the tree canopy is fragmented, it provides suitable habitat for a range of forest birds moving through the urban matrix;
- The trees also provide suitable habitat for bats and invertebrates;

- Tree hollows offer roost sites or nest sites for some animals;
- There are at least 22 eucalypts whose trunk diameters exceed the threshold of 70 cm for them to be deemed 'large trees' under the state government's 'Vegetation Quality Assessment' method. Such trees are of high value as habitat trees;
- Shrubs provide additional food for birds;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants in some of the site is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

There is a high degree of fine-scale variability in the ecological condition of the site's 59 separate pieces. Characterising the condition is therefore difficult. Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the author estimates that about 0.4 ha rates 'C' (or fair) and the remaining 3.3 ha, 'D' (poor).

The health of the tree canopy is good. Using the method of the state government's 'Vegetation Quality Assessment' method, the average health of the site's trees with trunk diameters over 70 cm is 80–85%.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National to Local

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants in Site 92.

The flat-pea *Platylobium infecundum* is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. Its global distribution is confined to Victoria. At least four patches of the species grow in Site 92. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance.

The standard criteria do not provide for a site to have different levels of significance in different parts, as would be appropriate in this case. A reasonable approach would be to confine the National significance rating to the habitat that supports the continued existence of the *Platylobium* plants and provides buffering from threats to their existence. For the three dense patches south of Wattle Road, that would mean the land between the road gutter and the fenceline, as far north and south as the nearest driveway crossovers, plus a small part of the abutting VicRoads land (forming part of Site 134). For the solitary plant near Berry Road, national significance could be reasonably taken to include the whole segment of the site enclosing the plant, outlined in blue on the aerial photograph on p. 650.

The site's populations of *Amyema pendula* (Drooping Mistletoe), *Drosera hookeri* (Branched Sundew), *Eucalyptus macrorhyncha* (Red Stringybark) and *Muellerina eucalyptoides* (Creeping Mistletoe) each fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Regionally threatened Ecological Vegetation Classes

The part of the site abutting Cheong Park meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the vegetation meets standard criterion

3.2.3 for a site of **State** significance. The other segments of the site are too small to meet the definition of a 'patch' and therefore do not qualify under criterion 3.2.3.

Ecological connections

Referring to the section above headed 'Relationship to other land', Site 92 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's 'National' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of *Platylobium infecundum*, which had not even been described as a species in 1997. The 'State' significance of the patch abutting Cheong Park exceeds the former 'Local' rating due to differences in the criteria and the state government's recognition in c. 2002 of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The presence of forest beside main roads may have psychological or practical benefits for road safety but such matters are outside the scope of this study.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit walkers, runners and cyclists using the road and footpath, as well as neighbours, people waiting for buses and people parking cars in the trees' shade. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

Most birds attracted to the site do so via the surrounding residential area, where they enrich the birdlife experienced by residents in their daily lives.

The shade, wind protection and visual amenity of the roadside encourage people to get exercise by walking, running or cycling.

The natural ambience of the roadside adds considerably to the amenity of the streetscape and the 'green and leafy' character of the area. It also preserves something of the area's natural landscape. It helps to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there was a loss of 0.01 ha of vegetation associated with the creation of the Palm Court intersection. Over the same period, that loss was outweighed many times over by revegetation and the growth of tree crowns over areas with no prior native vegetation cover. The net gain is difficult to quantify but appears to exceed 0.1 ha.

Change in the ecological condition of habitat

There is very little prior flora data for Site 92 but the author has observed the vegetation casually on at least a weekly basis for 17 years, as well as a cursory flora survey in 1996. His perception is that most of the site's naturally-occurring vegetation has changed little other than growth of the trees, with two exceptions:

- VicRoads appears to have taken to regular herbicide spraying of the road batters over the past few years. In places, that has had a detrimental effect on significant vegetation; and
- The nature strip of the vacant church land at 203–205 Bayswater Road. Until around 2011, the full width of that nature strip was dominated by approximately fifteen species of native grass and a few wildflowers. The management approach changed greatly at that point and most of the nature strip is now heavily dominated by two or three common, introduced grass species.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Possible future road widening;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Spraying of herbicide onto the globally endangered flat-pea, *Platylobium infecundum*, particularly near the southwest corner of 225–227 Bayswater Road;
- Continuing damage to the abovementioned flat-pea by mowing;
- Decline of plant health from past (and possible future) overplanting of trees, which causes plants to struggle to compete for sunlight, soil moisture and nutrients. (See Section 11.8.5 of Volume 1 for more information.) Deaths will occur mainly during droughts, which are predicted to become more frequent and severe with climate change;
- Increased mowing of areas that have so far not experienced frequent mowing; and
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success.

Strategic planning

The site is zoned 'Road Zone – Category 1'. Removal of native vegetation in the whole site is regulated under the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. In addition, removal of trees (native or not) is regulated under the Significant Landscape Overlay (Schedule 3 in the southern half of the site and Schedule 4 in the northern half).

The Nationally significant areas containing the flat-pea, *Platylobium infecundum*, and the State-significant area beside Cheong Park, should be covered by the new overlay schedule ESO1 described in Section 11.1.2 of Volume 1. The rest of the site probably receives adequate planning protection through clause 52.17 and the Significant Landscape Overlay.

Planning controls have rather limited effectiveness on main roads. It is recommended that Council liaise with VicRoads regarding its spraying and mowing of significant vegetation, particularly of the globally endangered flat-pea, *Platylobium infecundum*.

Information sources

The analysis above draws on the following sources of information sources:

- A total of approximately 4½ hours of ecological survey in the site for this study from October 2018 to September 2019, including: (a) compiling a list of indigenous plant species and their abundances, for each of three different parts of the site; (b) documenting the details of rare plants and large trees; and (c) mapping the vegetation, rare plants and large trees;
- Casual observations of the site by the author as a driver, pedestrian or cyclist, most days from 2002 to 2016 and weekly since then;
- An observation by Rebecca and Heath Mitchell of an Eastern Grey Kangaroo beside Bayswater Road near Morris Road on 28/5/16;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which the author did a 'windscreen' flora survey of the site was done in 1996;

- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Atlas of Living Australia or the Victorian Biodiversity Atlas.

Site 93. Canterbury Road, Bayswater North (Discontinued)

Biological Significance Level: *Not Significant*

Site 93 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised the southern roadside of Canterbury Road, Bayswater North from 200m east of Bayswater Road to immediately west of the current Bunnings store. The reasons for the site being recognised were the presence of a corridor of trees with scattered indigenous groundcover plants. The vegetation type was the endangered Swampy Woodland.

In the first decade of this century, all the native vegetation was destroyed during a project to duplicate Canterbury Road. The vegetation that was planted on the new nature strip and median strip does not meet any of the standard criteria of Amos (2004) for sites of biological significance. The site therefore falls into the category, 'Not Significant', in the scheme of Amos (2004).

Strategic planning

There is currently no planning protection for any plants along this stretch of road. This study has not detected any reason to change that situation.

Site 94. Colchester Road, Kilsyth South (Discontinued)

Biological Significance Level: *Not Significant*

Site 94 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised the remnant vegetation along the eastern side of Colchester Road in Kilsyth South between Collier Road and Dandenong Creek. The report regarded it as being of Local biological significance but not requiring specific protection under the Maroondah Planning Scheme. The citation of the site's significance was, 'A strip of native vegetation only 1.5 m wide at ground level which contains approximately 5 plants of the locally rare Pale-fruit Ballart, *Exocarpos strictus*. 15 indigenous plant species found'.

At most six wild, indigenous plant species remain of the fifteen noted in 1997 – fortunately including the Pale-fruit Ballart. Two of the six species have been planted within the site and it is unclear whether there are also wild plants. If not, there are only four surviving wild, indigenous plants. The main reasons for the loss of so many wild, indigenous plant species appear to be the Millennium Drought and regular, heavy use of herbicide.

While the wild, indigenous flora has declined greatly, this study counted seventeen plant species that have been planted by Maroondah City Council. Fifteen of those species are indigenous and the other two are *Melaleuca parvistaminea* (probably mistaken for the indigenous *M. ericifolia*) and a cultivar of *Correa*. The planting has increased the extent of native vegetation compared with 1997 but the groundcover is sparser due to herbicide use.

Biological significance rating

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

No part of Site 94 meets any of the standard criteria for sites of biological significance because:

- The site falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the roadside is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The site is not believed to be part of an existing habitat corridor (as per standard criteria 1.2.6) or have potential to become one (as per standard criterion 1.3), particularly because its northern end is something of an ecological 'dead end';
- Standard criterion 2 is not met because the roadside does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because no rare or threatened species are present and none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the roadside does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the roadside is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the roadside is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit nearby residents, users of the shared path through the site, and (in the case of wind reduction) road users. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The tree canopy probably encourages some forest birds such as Eastern Rosellas and Australian King-Parrots into the surrounding residential area and hence into the lives of nearby residents.

The site's vegetation adds a 'green and leafy' character to the area. It also preserves something of the area's natural landscape and is part of the area's natural heritage.

The location of the southern end of the site beside a major stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the part of the site within 200 m of Dandenong Creek is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Strategic planning

As for all public roads in Victoria, Colchester Road is covered by the state-wide planning controls over removal, destruction or lopping of native vegetation. Given that the site does not meet the state government's criteria for a site of biological significance, there appears to be no need to introduce additional planning protection for the site's vegetation.

Information sources

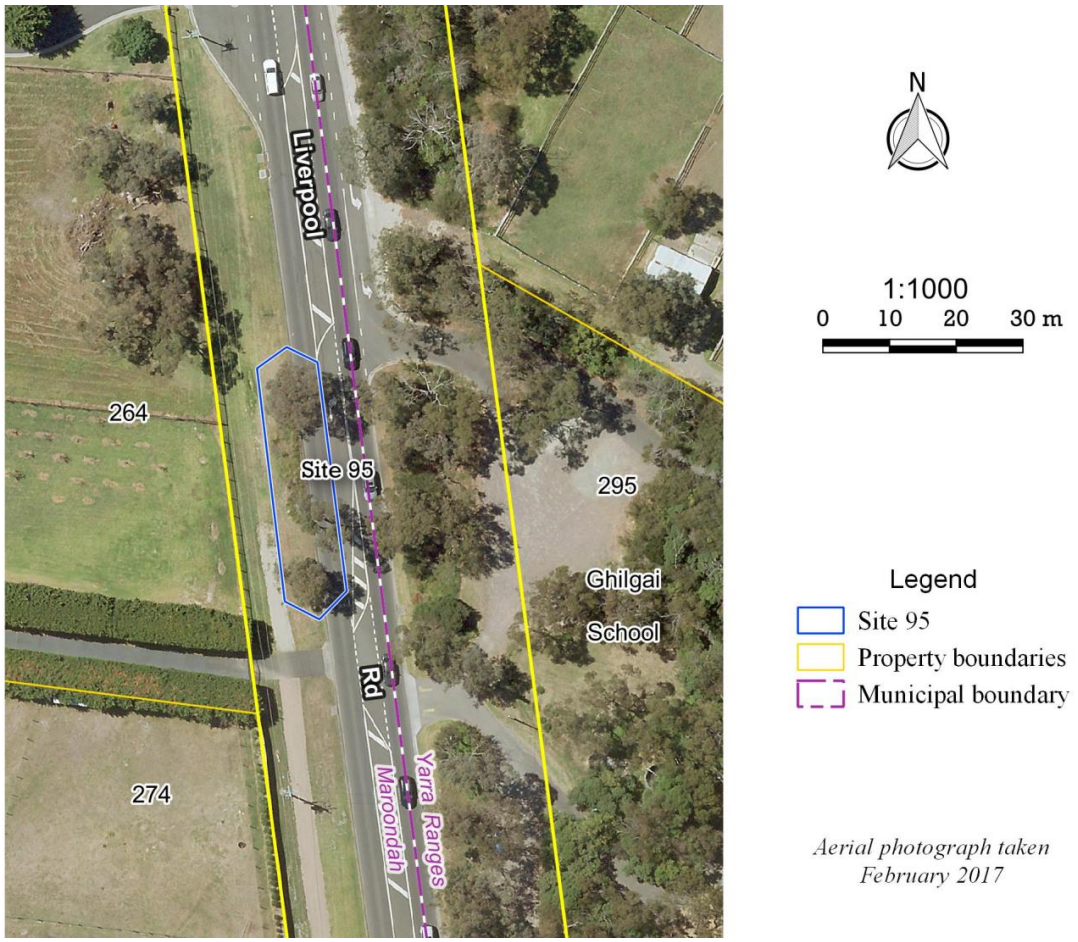
The analysis above draws on the following sources of information about the site:

- Thirty minutes of flora survey by the author on 28/10/19, including: (a) compiling a list of all wild, vascular plant species and their abundances; (b) mapping the vegetation and scarce plants; and (c) checking for any other features relevant to this report;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated field data from the present author's flora survey on 30/3/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 95. Liverpool Road, Kilsyth South

Biological Significance Level: *Local* due to the presence of locally-threatened mistletoes



The original version of Site 95 in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was not mapped but instead described as 'Roadside from 50 m south of Canterbury Road to the southern end of Eastwood Golf Course'. It only included the western side of the road, as the other side is in the Shire of Yarra Ranges. The site was recognised as being of Local biological significance for the following reasons:

- 'a near-continuous tree canopy connected with the Dandenong Ranges and Bungalook Conservation Reserves, containing sections with understorey of good biodiversity (south of Tereddan Drive).
- 'contains the highest density (and perhaps a large proportion of the total Maroondah population) of the native Drooping Mistletoe, which is rare elsewhere in the municipality'.

Potential future road-widening was identified as a threat to the persistence of these values.

Within a few years, some of the vegetation north of Glasgow Road was cleared for road widening and to provide new intersections, deceleration lanes and access to new residences.

Approximately eight plants of the abovementioned Drooping Mistletoe (*Amyema pendula*) survived the roadwork and the Millennium Drought. They grow on two Mealy Stringybarks (*Eucalyptus cephalocarpa*), 155 m and 180 m north of Tereddan Drive, within the blue outline on the aerial photograph above. There are larger numbers of Drooping Mistletoe on the opposite side of the road, in Yarra Ranges. The two host

trees and their mistletoes on the Maroondah side of the road are the only remaining items of biological significance in the original Site 95 north of Eastwood Golf Course.

While Drooping Mistletoes were regarded as rare in Maroondah in 1997, the vast majority of Maroondah's population died during the latter years of the Millennium Drought. Nearly all of Maroondah's Mistletoebirds and Imperial Jezebel Butterflies also died out because those species rely critically on mistletoes for food. The population described here (on both sides of Liverpool Road) is larger than any other population in or adjacent to Maroondah.

Further south within the original Site 95, the vegetation next to Eastwood Golf Course (Site 68) remains significant but not for the reasons mentioned in the 1997 report: It contains three patches of the globally endangered, mat-forming flat-pea called *Platylobium infecundum*. (The species was not even scientifically described until 2011.)

Taking into account the changes since 1997, this report has:

- Merged the section of the original Site 95 that lies next to Eastwood Golf Course to form an enlarged, nationally-significant Site 68 (see p. 522); and
- Retained a greatly reduced Site 95 – 353 m² in area – that contains the mistletoes and their host trees, as outlined in blue on the aerial photograph on the previous page.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Drooping Mistletoe (*Amyema pendula*) is clearly in the 'critically endangered' category of dying out in Maroondah. The cluster of approximately eight plants within the blue outline on the aerial photograph above fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a **Local** significance rating. The presence of a larger number of Drooping Mistletoes on the opposite side of the road contributes to the population's viability.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Possible future road widening;
- Possible future excavation of a trench beside the trees for installation of underground utility services (though boring is available as a safer alternative); and
- Death or debilitation of one or both host trees due to drought. Droughts are predicted to worsen with climate change. Mistletoes tend to die before their hosts show major signs of drought stress.

Strategic planning

The site is zoned 'Road Zone – Category 2'. There are no planning overlays.

Removal of native vegetation from any Victorian road reservation is regulated by the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. However, the controls often have little effect in protecting matters of Local significance, in part because of clause 52.17's exemptions.

Other possible planning controls to protect vegetation would be likely to give little if any stronger protection for the mistletoes than clause 52.17.

Therefore, rather than introducing new planning controls, it is recommended that Maroondah City Council:

- Note the existence of Site 95's mistletoes; and
- Seek to minimise the risk posed to the host trees when and if any threatening proposals for works come before Council.

Information sources

The analysis above draws on the following sources of information about the site:

- This study's inspection of the whole length of the verge of Liverpool Road within Maroondah during 2018 and 2019;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 96. Landau Drive Residential Area, Warranwood (Discontinued)

Biological Significance Level: *Not Significant*

Site description and changes

Site 96 of the 1997 report, *'Sites of Biological Significance in Maroondah'*, comprised the residential properties within the area bounded by Colman Road, Landau Drive, Daisy St and the municipal boundary. The biological significance was described thus 'This area has houses surrounded by enough indigenous trees to provide habitat for Koalas and occasionally Eastern Grey Kangaroos. Sugar Gliders have also been seen nearby'.

Since then, Koalas have become locally extinct and Eastern Grey Kangaroos have spread through much of Maroondah. Most of the area's habitat trees have grown larger and become better habitat but some have been removed without replacement. The wattles that Sugar Gliders prefer as food remain very scarce. Overall, the amount and suitability of the area's habitat has changed little.

Although the area possesses arboreal habitat, it does not appear to meet any of the standard criteria of biological significance of Amos (2004). None of the vegetation qualifies as a 'patch' of native vegetation under the standard criteria, i.e. an unbroken area of at least 0.25 ha with native understorey cover of 10% or more. None of the plant species detected in the site are rare or threatened, locally or more widely. The area is unlikely to serve as an ecological 'stepping-stone' in the sense of standard criterion 1.2.6.

The area therefore falls into the 'Not Significant' category in the scheme of Amos (2004).

However, the native vegetation and associated birdlife have value for climate moderation, amenity and natural heritage. These sorts of values are not considered by Amos (2004).

Strategic planning

The area is zoned 'General Residential Zone – Schedule 1' except for the shops in the northeast corner, which have no habitat value. Schedule 4 of the Significant Landscape Overlay requires a permit for the removal of canopy trees.

As the site does not meet any of the standard criteria for a site of biological significance, there is no need to introduce any new planning controls.

Information sources

The analysis above draws on the following sources of information about the site:

- A brief inspection from roads on 17/3/18;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and an associated field data sheet by John C. Reid on 21/4/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No relevant information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Sites 97 & 98. Little John Road, Warranwood (Discontinued)

Biological Significance Level: *Not Significant*

Site 97 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was 40 Little John Road, Warranwood. At the time, it was a vacant block covered with the regionally vulnerable vegetation type, 'Valley Grassy Forest', except for a band at the rear where rubbish had been dumped. Thirty-nine indigenous plant species were recorded in a vegetation survey on 18th April 1996. Additional species are bound to have gone undetected because of the time of year.

Site 98 of the same report comprised the whole of 44 Little John Road and around the perimeter of 46 Little John Road. The former property was a vacant block and the latter was recently developed. As with Site 97, Site 98 contained 'Valley Grassy Forest'.

Since 1997, the sites have become fully developed into typical residential blocks and practically all the native vegetation has been destroyed. The only native fauna that would find habitat there are urban-adapted species that may be found around any other suburban home.

Biological significance rating

Any site with the above characteristics fails to meet any of the Victorian Government's standard criteria for sites of biological significance (Amos 2004 – see p. 2). The required designation under those criteria is 'Not significant'.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The properties' vegetation has very limited tree cover and therefore makes negligible contribution to climate moderation or sequestration of carbon dioxide. The properties provide only the most basic opportunities for people to have contact with nature. They do not preserve any natural heritage or contribute to any significant degree to the area's natural landscape.

Strategic planning

Sites 97 and 98 are in the General Residential Zone. All trees above a threshold size are protected under Schedule 4 of the Significant Landscape Overlay. There appears to be no need to change or augment these controls.

Site 99. Tortice Drive Gully, Ringwood North

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundary

Site 99 is outlined with a dashed blue line above. The boundary corresponds to property boundaries where yellow can be seen in the gaps between the dashes. The boundary north and west of the dam follow a tall, chain mesh fence except in the northeast corner, where it follows the southern edge of a gravel path. The rest of the boundary has been drawn to circumscribe the native vegetation that supports the site's role as a habitat corridor.

The original version of Site 99 of Lorimer *et al.* (1997) excluded the retarding basin property fronting Tortice Drive. Since then, revegetation around the Tortoise Drive property has improved the habitat and facilitated colonisation by indigenous flora and fauna, including a plant of the locally-threatened Shrubby Fireweed (*Senecio minimus*).

Land use and tenure

The site is all public land but it is fenced to exclude the public. It is set aside for drainage management and as a water supply.

Most of it is within the property that formerly housed the Parkwood Secondary College and now hosts the North Ringwood Community House. However, a fence has always stopped the land being used by the school, the community house or the public. That part of the site contains a dam, two pumphouses, a small retarding basin and surrounding native vegetation. The pumphouses presumably pump water from the dam to the nearby playing fields.

A small part of the site east of the former school property is part of the same property as Quambee Reserve. It contains the treed levee of another small retarding basin, fenced to exclude the public.

The property in the site's south, fronting Tortice Drive, contains a third small retarding basin, with native vegetation on three sides. Only the native vegetation is included within the site.

General description

Site 99 occupies 2.0 ha on a north-flowing gully – an upper reach of the east arm of Andersons Creek. The source of the creek is in nearby McAlpin Reserve.

The dam seen on the aerial photograph above measures 0.43 ha. Its fringes and perhaps its base are well vegetated with indigenous wetland plants, which explains why it was being used by large numbers of waterbirds on all three occasions the site was visited for this study.

The cover of trees and shrubs on the site contains a mixture of indigenous regrowth, planted indigenous species, Monterey Pines (many of which were probably planted) and introduced species that have volunteered themselves. There is a substantial indigenous component to the groundcover, particularly around the dam and for a distance of typically 25 m to the east of the dam. Across the whole site, this study detected fifty-four naturally-occurring, indigenous plant species.

There are substantial numbers of rabbits in the site, maintaining suitable conditions for certain tiny indigenous plants (particularly mosses and liverworts). Additional soil disturbance is regularly caused by children building cubby-houses and bike tracks, despite the council's efforts to keep the fences and gates secure.

Relationship to other land

To the north, Site 99 abuts native vegetation in Quambee Reserve (Site 7). That vegetation then connects directly to a corridor of vegetation further downstream along Andersons Creek East Branch, firstly in Site 9 and then through the City of Manningham to Warrandyte.

Site 99 is the closest substantial area of habitat to Monterey Bush Park (Site 6), which lies 107 m to the south. Without the habitat in Site 99, there would be a gap of 320 m between Monterey Bush Park and Site 7. That would be expected to significantly reduce the extent of visitation of Monterey Bush Park by birds and flying insects. The resulting reduction in movement of pollen and seeds may reduce the viability of some plant populations at Monterey Bush Park.

Between Site 99 and the North Ringwood Community House, there is a moderate cover of mature, remnant eucalypts over lawn. Many of those trees are quite large. There are younger, non-indigenous eucalypts between the community house and Tortice Drive. That leaves a canopy gap of 70 m to Monterey Bush Park.

The *'Maroondah Habitat Corridors Strategy'* of 2005 assumed that fauna moving between Monterey Bush Park and Site 99 would do so via the community house. The present author suspects that the gully would be at least as attractive to flying fauna because it has a shorter gap in understorey and fauna generally move along gullies in preference to ridges.

The residential area surrounding Site 99 has quite limited tree cover. Only a very small proportion of properties have vegetation that serves the habitat needs of local wildlife.

Bioregion: Gippsland Plain. See the interpretation of the bioregional boundary on p. 53.

Habitat types

Only naturally-occurring, indigenous plant species are included here except where otherwise noted.

Valley Heathy Forest (Ecological Vegetation Class 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Bundy (*Eucalyptus goniocalyx*) and Yellow Box (*E. melliodora*), mixed with some large Monterey Pines (*Pinus radiata*) in some of the site. Mealy Stringybark (*E. cephalocarpa*) is co-dominant in part. Swamp Gum (*E. ovata*) is fairly abundant on the lower slopes, being relics of the Swampy Riparian Complex that would once have lined the creek before the dam was constructed. There are also five Red Stringybark (*E. macrorhyncha*) and a few Messmate Stringybark (*E. obliqua*)

Lower trees: Dominated variously by Black Wattle (*Acacia mearnsii*) or Blackwood (*A. melanoxylon*). Cherry Ballart (*Exocarpos cupressiformis*) is quite localised. There are a few Black Sheoak (*Allocasuarina littoralis*) and a suckering copse of Silver Wattle (*A. dealbata*) in the property fronting Tortice Drive but they have been planted.

Medium to large shrubs: Sweet Bursaria (*Bursaria spinosa*) is abundant. Sifton Bush (*C. sifton*) is fairly abundant and widespread. Yarra Burgan (*Kunzea leptospermoides*) and Hop Goodenia (*Goodenia ovata*) are scattered thinly. Prickly Moses (*Acacia verticillata*), Common Cassinia (*Cassinia aculeata*) and Tree Everlasting are each represented by a single plant.

Shrubby herbs: Annual Fireweed (*Senecio glomeratus*) is fairly abundant on the lower slopes. Shrubby Fireweed (*S. minimus*) was only represented by a single plant on the property fronting Tortice Drive at the time of this study but that species is known for its large population fluctuations.

Ferns: Austral Bracken (*Pteridium esculentum*) forms four or five dense patches of various sizes.

Climbers: Mountain Clematis (*Clematis aristata*) is fairly abundant on the slope east of the dam. A single plant of Coarse Dodder-laurel (*Cassytha melantha*) was seen in this study.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is scattered around the lower slopes. A crane's-bill (probably *Geranium* sp. 2) and the wood-sorrel, *Oxalis exilis/perennans*, are quite localised.

Grasses, rushes and sedges: Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is dense on the lower slopes and scattered further uphill, where it is joined by a few of the other subspecies of that species (*viz.* subsp. *exilis*) and some scattered Wattle Mat-rush (*L. filiformis* subsp. *filiformis*). Weeping Grass (*Microlaena stipoides*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are dense on parts of the mid-slope east of the dam. Thatch Saw-sedge (*Gahnia radula*) is fairly abundant and widespread. Pale Rush (*Juncus pallidus*) is scattered fairly liberally due to soil disturbance. Finger Rush (*Juncus subsecundus*) is represented by a few clusters. Kangaroo-grass is fairly scarce, some or all of it perhaps planted. Short-stem Sedge (*Carex breviculmis*) appears to be very scarce but may have been partly overlooked due to rabbit grazing. Silvertop (or Red-anther) Wallaby-grass (*Rytidosperma pallidum*) was recorded in the previous flora survey (1996) but not in this study.

Other groundcover: Mosses and liverworts are abundant, including the locally-uncommon *Fissidens bifrons*, *Fissidens taylorii* and *Fossombronia* ?*altilamellosa* due to rabbit grazing. Spreading Crassula (*Crassula decumbens*) is abundant within the mossy patches and is probably accompanied by Common Cotula (*Cotula australis*) in season. Other vascular species are extremely scarce. They represented by Pale Flax-lily (*Dianella longifolia*), Tasman Flax-lily (*Dianella tasmanica*) and Black-anther Flax-lily (*Dianella revoluta*) but the first two of these may be due to planting and the last was not detected during this study.

Wetland habitat in and beside the dam (Ecological Vegetation Class 74)

Trees and shrubs: A couple of Swamp Gums (*Eucalyptus ovata*) grow in the zone of fairly regular inundation. Some planted bottlebrushes (*Callistemon* ?*citrinus*) are scattered in the same zone.

Non-woody species: Cumbungi (*Typha orientalis*) dominates most of the dam margins, intermingled with dense rushes. The densest of the rushes are Green Rush (*Juncus gregiflorus*) and Pale Rush (*Juncus pallidus*). Broom Rush (*J. sarophorus*) is fairly abundant. Austral Rush (*J. australis*) and Tall Rush (*J. procerus*) are both very scarce. Beneath the rushes and on the muddy edges of the dam, Angled Lobelia (*Lobelia anceps*) is quite abundant and Swamp Crassula (*Crassula helmsii*) is fairly abundant. They are accompanied by a scattering of Swamp Club-rush (*Isolepis inundata*) and Slender Knotweed (*Persicaria decipiens*).

Significant plants

The following naturally-occurring plant species recorded at Site 80 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – five living trees and several dead trees were detected in this study. One or two others may have been missed; and
- *Senecio minimus* (Shrubby Fireweed) – one plant grows on the dam wall within the property fronting Tortice Drive. This species is known for being prone to large population fluctuations.

Fauna habitat features

- The dam supports waterbirds, frogs and aquatic invertebrates. The frogs and invertebrates are a source of prey for other fauna;
- The dam also provides a source of drinking water for fauna, which may be particularly important in times of drought or extreme heat.
- The site's forest vegetation represents suitable habitat for common forest birds, bats, possums, reptiles and invertebrates. That habitat benefits from the fertility of the gully, which favours high production of carbohydrates by plants and hence strengthens the base of the food chain;
- Tree hollows offer roost sites or nest sites for some animals, including bats; and
- The site's location on the east arm of Andersons Creek amplifies the habitat values above.

Ecological condition

As a wetland, the dam is in fair ecological condition – rating 'C' on the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997).

The interior or the retarding basin in the northeast of the site appears (from outside the fence) to have very little native vegetation.

The rest of the site's native vegetation varies from fair to poor ecological condition – ratings 'C' to 'D'.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The significance of the site hinges on whether there is a 'patch' of native vegetation, as defined by the standard criteria. The definition is an area of at 0.25 ha in which the cover of native understorey is at least 10%. With the aid of satellite navigations, this study determined that there is such an area: the forest abutting the lake's eastern shore, as outlined in green on the aerial photograph on p. 673. Its area barely meets the minimum size limit. The forest type is Valley Heathy Forest, which is listed as 'endangered' in the bioregion. As a result, the site meets standard criterion 3.2.3 for a site of **State** significance.

Ecological corridor

The section above headed 'Relationship to other land' describes how the site minimises the gap between habitat at Monterey Bush Park and habitat further downstream along the east branch of Andersons Creek. On that basis, the site fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to **Local** significance.

Rare plant species

Referring to the section above headed 'Significant plants', Site 99 is known habitat for *Eucalyptus macrorhyncha* and *Senecio minimus*. The latter is only currently present as single individual but it is likely to be part of a more wide-ranging population including Monterey Bush Park (Site 6) and the Melbourne Rudolf Steiner School site (Site 8). The *Eucalyptus* and perhaps the *Senecio* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The site's tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. The dam provides further cooling in hot weather. These effects of microclimate moderation benefit neighbours and people using the adjacent parts of Quambee Reserve.

As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

Birds attracted to the site or which use the site as part of their movement along the Andersons Creek East Branch corridor will also pass through neighbouring gardens. Some of them probably also digress toward the North Ringwood Community House. Those movements bring birds into people's daily lives, which is expected to bring a little enjoyment and perhaps improve people's wellbeing.

Changes

Change in the extent of habitat

Comparison of aerial photographs from 2001 and 2017 shows that revegetation and possibly natural recruitment of trees has brought about an increase in the extent of tree cover by an estimated 0.14 ha. The extent of loss of canopy from tree deaths has been insignificant by comparison.

Change in the ecological condition of habitat

Comparison of aerial photographs from 2001 and 2011 shows that many eucalypts died in the intervening years – i.e. during the Millennium Drought. A 2017 aerial photograph shows that far fewer eucalypts died subsequent to the Millennium Drought, but possibly still more than would be expected from the natural attrition rate. There is also some indication of a general thinning of foliage in the eucalypt crowns.

Without more detailed information from the past, it is not possible to infer more about ecological changes.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by introduced plants, particularly pines; and
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The property with the dam on it is zoned 'Public Use Zone – Education'. The Quambee Reserve property is zoned 'Public Park and Recreation Zone'. The property containing the retarding basin next to Tortice Drive is zoned 'General Residential Zone'.

Except for the Tortice Drive property, the removal, destruction and lopping of native vegetation in the site is covered by the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. Throughout the site and its surroundings, the removal of canopy trees (native or not) is further regulated under Schedule 4 of the Significant Landscape Overlay.

As noted above in the section headed 'Biological significance ratings', a patch of forest on the slope to the east of the dam is of State significance. The existing vegetation-related planning controls are inadequate for such significant vegetation. It is therefore proposed that the part of the site within the property with the dam on it be covered by the proposed schedule ESO1 of the Environmental Significance Overlay discussed in Section 11.1.2 of Volume 1. The remaining parts of the site are substantially less significant and the existing planning controls are adequate.

Information sources

The analysis above draws on the following sources of information about the reserve:

- 2–2½ hours of site assessment specifically for this study on 18/1/19, 8/3/19 and 11/5/20;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the site was based on a flora survey by the present author on 14/4/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

Site 100. Godbehear Reserve, Ringwood (Discontinued)

Biological Significance Level: *Not Significant*

Site 100 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was a tiny council reserve on Forest Court, Ringwood North. The land has since become the southwestern part of Godbehear Reserve (5 Godbehear Court, Ringwood). The reason for the site being recognised in 1997 was that although the tree canopy was (and remains) heavily dominated by pines, the understorey was predominantly made up of 22 indigenous plant species.

When inspected for this study on 18/1/19, only 11 indigenous plant species could be found. In addition, approximately two of the locally threatened Red Stringybark (*Eucalyptus macrorhyncha*) were found in the lawn immediately east of the original Site 100 (in the former Site 101). No other significant species were found. The pines have grown substantially since 1997 and hence provide considerably greater competition against the indigenous flora.

An assessment of the site and its habitat found no feature that meets the standard criteria for sites of biological significance of Amos (2004). Even after expanding the site boundary to encompass the Red Stringybarks, the total area of the site is only 0.18 ha – much too small to meet the threshold for a 'patch' of native vegetation under the standard criteria. The very small number of Red Stringybarks and their questionable viability in the medium- to long-term means they probably do not fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. The site is very unlikely to serve as a significant ecological 'stepping-stone'.

The site therefore falls into the 'Not Significant' category in the scheme of Amos (2004).

However, the presence of the Red Stringybarks and native understorey does form part of the neighbourhood's scarce natural heritage (notwithstanding the pines).

Strategic planning

Schedule 4 of the Significant Landscape Overlay (SLO4) covers Godbehear Reserve. It requires a permit for the removal of canopy trees, including the pines and several indigenous trees in the site. If a permit application under SLO4 arises, it should be considered alongside the information above. There is currently no planning protection for vegetation other than under SLO4.

As the site does not meet any of the standard criteria for a site of biological significance, the application of the Environmental Significance Overlay cannot be justified.

If Maroondah City Council wishes to provide planning protection for the site's native understorey, a schedule under the Vegetation Protection overlay would be an appropriate tool. There would be little point in doing so if the pines are allowed to continue growing and slowly displacing the indigenous flora. Removal of the pines would be likely to stimulate extensive regeneration of indigenous plants, thereby improving the site's natural heritage value.

Site 101. 'Tandarra', Ringwood (Discontinued)

Biological Significance Level: *Not Significant*

Site 101 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997) was a pine plantation at the western end of the private property, 'Tandarra', at 99 Kalinda Road, Ringwood. It abutted Site 100 (Forest Court Reserve, Ringwood) to the west. The biologically significant attributes of the site were as follows:

- A pond within the plantation contained ten indigenous wetland plant species, two of which were rare within Maroondah (*Wolffia australiana* and *Spirodela punctata*); and
- Thirty-six additional indigenous plant species grew among the pine trees.

The site was cleared for a residential subdivision by 2001. Some of the site became the eastern half of the current-day Godbehear Reserve, united with Site 100. Some indigenous plants have been planted in a strip along the southern boundary.

The site no longer meets any of the standard criteria of Amos (2004) for sites of biological significance. The site therefore falls into the category, 'Not Significant', in the scheme of Amos (2004).

Strategic planning

The few trees on the site are protected under Schedule 3 of the Significant Landscape Overlay. Because the site has lost its biological significance, there are no grounds for applying any new planning control.

Site 102. Knee Lane Reserve, Croydon North (Discontinued)

Biological Significance Level: *Not Significant*



Aerial photograph taken February 2017

Legend
Site 102
Properties
Vegetation types

N

1:1000
0 10 20 30 40 50 m

Boundary, land use and tenure

The boundaries of Site 102 correspond to property boundaries of Knee Lane Reserve except for the two short segments in the northeast, which are drawn so as to follow the edge of the tree canopy. The site is a municipal drainage reserve.

General description

Site 102 occupies 0.38 ha on a minor drainage line with a small dam of approximately 300 m² on it. To the west of the drainage line, there is a moderately steep (1:4) slope facing east-southeast. In the southeast corner (labelled 'scattered eucalypts' on the aerial photograph), there is a steep (1:3) slope facing northwest.

The dam has become well populated with at least six indigenous wetland plant species, one of which might have been planted. There is negligible native understorey among the scattered eucalypts just referred to. Much of the opposite slope has scarce native understorey because it is used as an extension of the back lawn and garden of an abutting residence. The rest of the site is forested ('Herb-rich Foothill Forest') in mediocre condition. The total number of naturally-occurring, indigenous plant species detected in this study was twenty-one.

Relationship to other land

In the vicinity of Site 102, there is a moderate level of eucalypt cover in a fragmented chain along Knee Lane, the pipe track to the reserve's south, Power Street and Yarra Road. A handful of private properties in the vicinity also have moderate eucalypt cover, including the property west of Site 102.

The location of nearby sites of biological significance can be seen on the key map on p. 1. At the eastern end of Knee Lane, 410 m from Site 102, lies Hochkins Ridge (Site 51). The Nangathan Way frontage of Hochkins Ridge Drainage Reserve (in Site 51) lies 270 m to the northeast. Power Street Reserve (Site 53) lies 150 m north-northeast of Site 102.

The *'Maroondah Habitat Corridors Strategy'* of 2005 identified a potential habitat corridor extending from the Nangathan Way frontage of Hochkins Ridge Drainage Reserve (in Site 51), through Knee Lane Reserve and along the pipe track to Candlebark Walk Reserve (Site 17). The report assessed the potential corridor as having 'very high relative corridor conservation priority'. However, there remain large gaps that would have to be filled with revegetated habitat to create a functioning corridor. Revegetation of the drainage reserve to the northeast of Site 102 appears quite feasible and would probably encourage greater traffic of birds and flying insects to and from the Hochkins Ridge Drainage Reserve. Revegetation of the pipe track would face practical and administrative difficulties.

Bioregion: Gippsland Plain (abutting the Highlands - Southern Fall to the east)

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Herb-rich Foothill Forest (EVC 23, **Vulnerable** in the bioregion) on the east-southeast-facing slope

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) followed by Swamp Gum (*E. ovata*) at the lowest elevations. Narrow-leaved Peppermint (*E. radiata*) is fairly abundant. Bundy (*E. goniocalyx*) is also present.

Lower trees: Strongly dominated by Blackwood (*Acacia melanoxylon*), with a few Black Wattle (*A. mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*).

Medium to large shrubs: Severely depleted. There are a few Sweet Bursaria (*Bursaria spinosa*) and a single Myrtle Wattle (*Acacia myrtifolia*). Tree Everlasting (*Ozothamnus ferrugineus*) was present in the previous (1995) flora survey.

Small shrubs: None seen.

Ferns: Austral Bracken (*Pteridium esculentum*) is the dominant species of the undergrowth in a substantial part of the site.

Climbers: There are 3–5 Mountain Clematis (*Clematis aristata*).

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is fairly abundant.

Grasses, rushes and sedges: Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is dense in part of the reserve. Thatch Saw-sedge (*Gahnia radula*) is widespread and fairly abundant. There is a cluster of many Green Rush (*Juncus gregiflorus*) plants. One or two other species may have gone undetected in this study due to the time of year (August).

Other groundcover: Very scarce. The only indigenous plants seen in this study were a few cudweeds (*Euchiton* ?*japonicum*) and a single Pale Flax-lily (*Dianella longifolia*).

Artificial dam (no EVC allocated)

Grasses, rushes and sedges: Much of the fringe of the dam is dominated by Green Rush (*Juncus gregiflorus*), possibly accompanied by a second rush species that could not be identified in the August flora survey. There are substantial numbers of Swamp Club-rush (*Isolepis inundatus*). Tall Sedge (*Carex appressa*) is moderately abundant but possibly only due to planting. A few Common Blown-grass (*Lachnagrostis filiformis*) were seen in the August flora survey, suggesting that it may be abundant in summer when the water level falls.

Other species: Slender Knotweed (*Persicaria decipiens*) is dominant around parts of the dam. The dead remains of cumbungi (*Typha* species) were seen in August, suggesting that it may be abundant in summer. Hairy Willow-herb (*Epilobium hirtigerum*) was recorded in 1995 and is probably present in summer.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

The reserve does not meet any of the standard criteria for sites of biological significance because:

- It falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the reserve is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- As discussed in the section above headed 'Relationship to other land', the site is not believed to be part of an existing habitat corridor (as per standard criteria 1.2.6) and there would be difficulties in creating one (as per standard criterion 1.3);
- Standard criterion 2 is not met because the reserve does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because no rare or threatened species are present and none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the reserve does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the reserve is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the reserve is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

Knee Lane Reserve's tree canopy reduces wind speed to a small degree. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate slightly warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and also immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The vegetation along the drainage line and in the dam helps to stabilise the soil and remove water pollution. However, the dam wall may be destabilised by trees growing in it.

The reserve's semi-natural vegetation and the birds it attracts provide the local community with a low-level experience of the natural world. As explained in Section 1.3 of Volume 1, contact with nature has

been shown to be beneficial to health, wellbeing, childhood development and quality of life. To a small degree, those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the reserve.

Changes

Change in the extent of habitat

Comparison of aerial photographs from 2001 and 2017 shows that the extent of tree canopy has reduced by nearly 100 m² in the mown area and an increase of roughly 400 m² in the northeast.

Changes in the species present

The flora surveys of 1995 and 2019 differ very little in the indigenous plant species recorded. The only clear changes are that Tree Everlasting (*Ozothamnus ferrugineus*) has died out (perhaps temporarily) and Black Wattle (*Acacia mearnsii*) has appeared.

Change in the ecological condition of habitat

Aerial photographs from 2001, 2011 and 2017 show that at least eight mature eucalypts appear to have died between 2001 and 2011, during the Millennium Drought. No additional eucalypt deaths can be discerned between the 2011 and 2017 aerial photographs.

There is inadequate data to determine any other changes in the ecological condition of the reserve's habitat.

Threats

The identified threats to Knee Lane Reserve's biodiversity are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Gardening and mowing in the northwest; and
- Death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change.

Although it is not important for biodiversity, there is also the abovementioned threat that trees growing on the dam wall may destabilise it.

Strategic planning

Knee Lane Reserve is zoned 'General Residential Zone – Schedule 1'. There are no overlays. Removal of native vegetation in the whole reserve is covered by the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. There is no apparent reason to add any additional planning controls over vegetation removal.

Recommended actions

It is recommended that:

- Council consider the risk of dam failure associated with the trees growing in the dam wall; and
- A fence be erected along the reserve's northern boundary.

Information sources

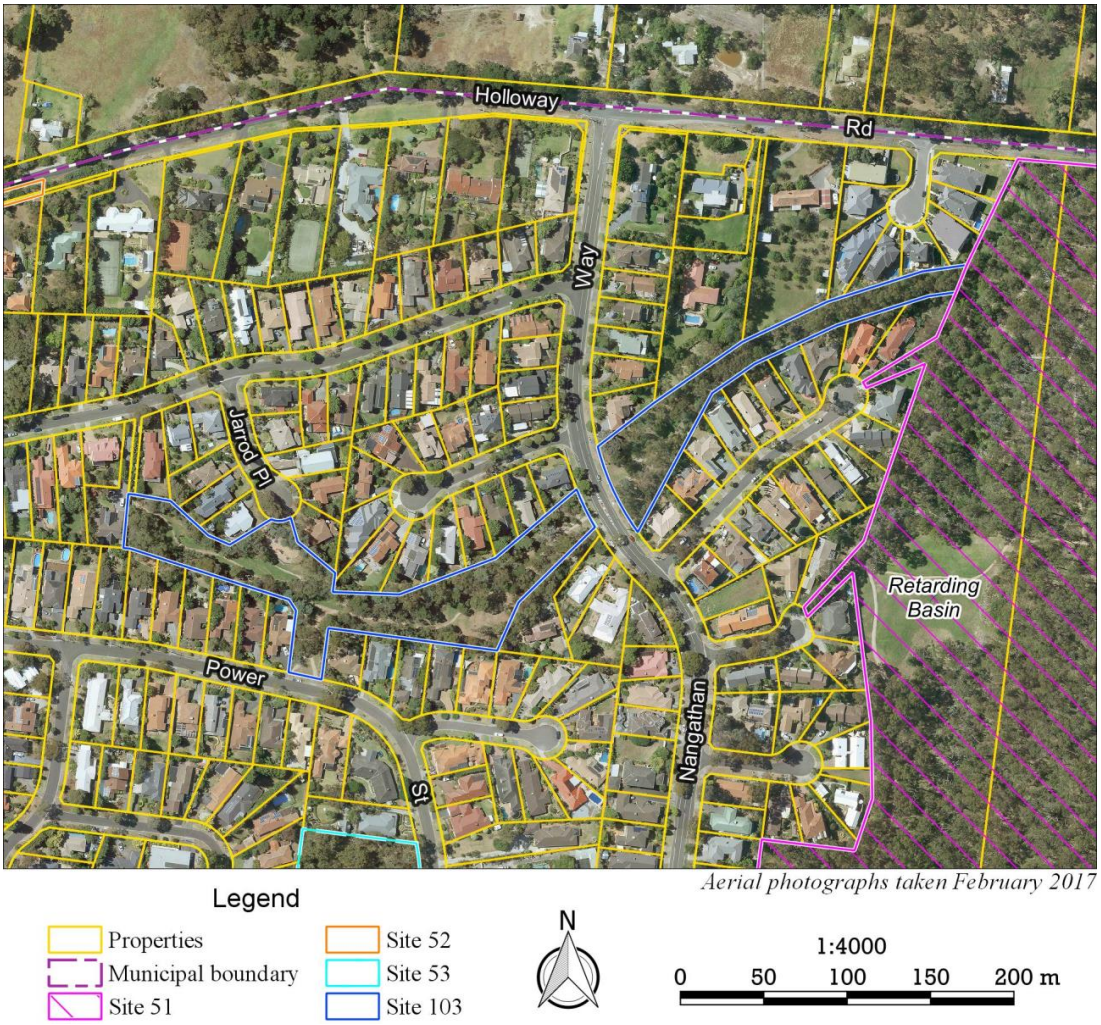
The analysis above draws on the following sources of information about the reserve:

- 25 minutes of site assessment specifically for this study in August 2019;

- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on a flora survey by Lynlee Tozer in December 1995;
- Aerial photographs from 1945, 2001, 2011 and 2017.

Site 103. Northern Waterways Reserve, Croydon North

Biological Significance Level: *Local* as part of a minor habitat corridor



Aerial photographs taken February 2017

Boundary, land use and tenure

The boundaries of Site 103 correspond to the property boundaries of the Northern Waterways Reserve except for the short segment at the eastern end, which cuts the site off from Site 51. The site is a municipal drainage reserve. It has a playground near Jarrod Place and it provides pedestrian access through the neighbourhood.

General description

The Northern Waterways Reserve occupies 1.6 ha along a former creek that has been largely replaced by an underground pipe. There is a small, artificial pond just east of Nangathan Way. As can be seen on the aerial photograph, some of the reserve is lawn, which is of no biological significance. Most of the remaining vegetation comprises indigenous species (mainly trees) planted in the early- to mid-1990s. The main exceptions are:

- Approximately 150 m² at the western extremity, where a few species are remnants of the 'vulnerable' Ecological Vegetation Class (EVC) called 'Creekline Herb-rich Woodland'. Those remnants include a large Swamp Gum (*Eucalyptus ovata*); and
- Approximately 300 m² in the southwestern corner of the segment east of Nangathan Way, where approximately seven species are remnants of the EVC called 'Grassy Dry Forest'.

Altogether, this study detected thirteen naturally-occurring, indigenous plant species, four additional planted indigenous species and six species that may or may not have been planted.

Because so much of the reserve's vegetation was planted around twenty-five years ago, quite a few plants cannot be confidently determined to be naturally-occurring, planted or descendants of planted plants.

Relationship to other land

The eastern (downstream) end of the Northern Waterways Reserve abuts one of Maroondah's premier sites of biological significance – Hochkins Ridge (Site 51). A larger (but less natural) area of habitat than Hochkins Ridge is approximately 200 m to the north of the Northern Waterways Reserve, designated BioSite 9 by Manningham City Council. The tiny Power Street Reserve (Site 53) lies 100 m south of the reserve and the even tinier Site 52 (a short stretch of roadside on Holloway Road) lies 185 m north-northwest.

The *'Maroondah Habitat Corridors Strategy'* of 2005 assessed the Northern Waterways Reserve as being in the 'high' category of 'relative corridor conservation priority'. However, because the reserve is so narrow and has so little habitat in the vicinity of its western half, it is uncertain whether it really functions as a habitat corridor. Regardless, it probably entices some common forest birds to radiate out of Hochkins Ridge in search of food, bringing those birds into the daily lives of surrounding residents.

Only a very small proportion of properties in the neighbourhood have vegetation that serves the habitat needs of local wildlife.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Grassy Dry Forest (EVC 22, 'Least concern' in the bioregion) – vestiges only; located next to Power Street and in the southwestern corner of the part of the reserve east of Nangathan Way

Canopy trees: Strongly dominated by Red Box (*Eucalyptus polyanthemos*). There are a few Bundy (*E. goniocalyx*). Red Stringybark (*E. macrorhyncha*) is scarce.

Lower trees: No sub-canopy trees are convincingly natural.

Shrubs: The only potentially natural shrub species detected in this study was Sweet Bursaria (*Bursaria spinosa*), and even they might have been planted.

Ferns: None seen.

Creepers and climbers: None seen.

Grasses, rushes and sedges: There is a small patch of Thatch Saw-sedge (*Gahnia radula*) and a tiny cluster of Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*). Several additional grass species were present in 1996 but appear to have died out, perhaps due to the extensive herbicide spraying in the reserve.

Other groundcover: The only other groundcover found in this study was a single plant of Black-anther Flax-lily (*D. revoluta*), which may well have been planted.

Creekline Herb-rich Woodland (EVC 164, **Vulnerable** in the bioregion) – vestiges and revegetation only

Canopy trees: Swamp Gum (*Eucalyptus ovata*) is probably the only naturally-occurring canopy species along the creek. That species has also been extensively planted, along with small numbers of other eucalypt species.

Lower trees: Blackwood (*Acacia melanoxylon*) is strongly dominant but most (perhaps all) are the result of planting. There are also a few Black Wattle (*Acacia mearnsii*), which might also have been planted.

Shrubs: The only potentially natural shrub species detected in this study were Yarra Burgan (*Kunzea leptospermoides*) and Sweet Bursaria (*Bursaria spinosa*), though both might be present only through planting.

Ferns: There is a tiny patch of Austral Bracken (*Pteridium esculentum*), which is convincingly natural.

Creepers and climbers: None seen.

Grasses, rushes and sedges: Patches of Thatch Saw-sedge (*Gahnia radula*) are scattered through the site. It is joined by a high density of Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) in the most natural patch of vegetation in the far west. In the wettest spots, there are a few patches of Common Reed (*Phragmites australis*) and one colony of Cumbungi (*Typha* species) at the pond. A few additional species were present in 1996 but appear to have died out, which is consistent with the extensive herbicide spraying in the reserve.

Other groundcover: There is a tiny patch of Swamp Crassula (*Crassula helmsii*) at the pond just east of Nangathan Way but it is quite likely that it was planted there. A single plant of Pale Flax-lily (*Dianella longifolia* var. *longifolia*) may also have been planted. No other natural groundcover species could be found.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Ecological corridor

The section above headed 'Relationship to other land' describes how the Northern Waterways Reserve might help to a small degree in the movement of wildlife around the local area. On that basis, the reserve fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The reserve's role as a habitat corridor could be improved by further revegetation and growth of the existing trees. With that in mind, the *'Maroondah Habitat Corridors Strategy'* (Context 2005) gives the reserve a 'high corridor conservation priority'. That situation fits the description in standard criterion 1.3.3, 'Cleared or degraded area which may with suitable habitat reconstruction or rehabilitation work form a strategically important corridor… Site (or one of a group of such sites) to form a strategic corridor of local importance and scale'. That description applies to a site of Local significance.

The reserve does not meet any of the other standard criteria for sites of biological significance because:

- It falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the reserve is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- Standard criterion 2 is not met because the reserve does not have an unusually high diversity of species or communities (quite the contrary) and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because no rare or threatened species are present and none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;

- Standard criterion 4 is not met because the reserve does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the reserve is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the reserve is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The reserve's tree canopy reduces wind speed to a small degree. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate slightly warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit users of the reserve and also immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The reserve's semi-natural vegetation and the birds it attracts provide the local community with a low-level experience of the natural world. As explained in Section 1.3 of Volume 1, contact with nature has been shown to be beneficial to health, wellbeing, childhood development and quality of life. To a small degree, those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the reserve.

The shade, wind protection and semi-natural ambience of the reserve encourage people to get exercise by walking, running or cycling through it.

Changes

Change in the extent of habitat

Comparison of aerial photographs from 2001 and 2017 shows that the reserve's eucalypts – both planted and wild – have grown. The enlarged crowns have brought about an increase in the extent of tree cover by an estimated 0.1 ha.

Changes in the species present

The previous (1996) flora survey of the reserve detected significantly more naturally-occurring grassy species and several more other groundcover species than during this study. The loss of species is consistent with the extensive use of herbicide in the reserve.

Change in the ecological condition of habitat

Apart from the abovementioned loss of plant species, there is insufficient prior information about the reserve's ecological condition to infer change over time.

Threats

The only significant threats to the reserve's flora or fauna detected in this study are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and
- The extensive use of herbicide. However, nearly all indigenous plants vulnerable to herbicide use appear to have already died out.

Strategic planning

The part of the Northern Waterways Reserve west of Nangathan Way is zoned 'Public Park and Recreation Zone'. The easternmost 90 m of the reserve is zoned 'Public Conservation and Resource Zone'. The rest of the site is zoned 'General Residential Zone – Schedule 1'. It is recommended that Council consider whether three zones are required.

The part of the reserve east of Nangathan Way is covered by the Bushfire Management Overlay.

The removal, lopping and destruction of native vegetation are regulated in the whole reserve by the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

The reserve's low level of biological significance and the low level of threat to its biodiversity mean that the state-wide native vegetation planning controls provide adequate protection for biodiversity.

Information sources

The analysis above draws on the following sources of information about the reserve:

- Thirty minutes of site assessment specifically for this study in August 2019;
- The *'Maroondah Habitat Corridors Strategy'* (Context 2005);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the reserve was based on a flora survey by Lynlee Tozer on 31/1/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

Site 104. Maroondah Hwy Verge, East of Yarra Rd

Biological Significance Level: *State* due to the presence of a threatened vegetation type and the rare Dandenong Range Cinnamon Wattle



Boundaries

Site 104's boundary is outlined in magenta above. The southeastern edge, beside Maroondah Highway and its off-ramp to Alice Street, encompasses as much as possible of the tree canopy along the road edge without extending onto the road pavement. Part of the northwestern site boundary follows the property boundaries of 1/6 to 4/6 Faull Close and 10, 10A and 12 Faull Close. The boundary also encompasses a tiny segment of a water supply reserve and part of 1 Alice Street at the site's northern extremity. As with all sites in this volume, the precise boundary is available in a shapefile for geographic information systems.

Land use and tenure

Most of the site is within the road reserve for Maroondah Highway and serves as the highway's verge, with a footpath along it. An 11 m-wide strip at the northwestern edge of the site (officially designated 195 Maroondah Highway) is a municipal reserve that serves a drainage function, as it contains a non-perennial creek. The creek flows from there into 1 Alice Street, which is a residential property with a single dwelling. Downstream (east-northeast) of the water supply reserve, a sewer and a water main have been laid along the gully.

General description

Site 104 occupies 1.06 hectares in a steep-sided gully down the eastern escarpment of the Wicklow Hill ridge. A footpath runs beside the creek along the floor of the gully. Between the footpath and Maroondah Highway is a steep (1:1 to 1:3), north- to northwest-facing slope, presumably comprising fill from the construction of Maroondah Highway. Runoff from the highway is discharged into the site by pipes at intervals along the road. The strongly pulsed flows in the creek have eroded so much soil a sewer pipe has been left suspended two metres above the current ground level.

Because the creek is now so deeply incised into the gully and the roadside batter has been made so steep, the valley is much more steep-sided than its natural state. It is therefore shadier and more sheltered than the natural state. Additional shade is provided along some of the creek by shady introduced tree species such as Sweet Pittosporum (*Pittosporum undulatum*). The pulsing of flows means that the creek is more intermittent than natural and the adjacent soil less consistently wet.

For all these reasons, the vegetation along the creek today is substantially different in composition and ecological function than prior to the excavation, pipelaying and establishment of introduced trees. It is more typical of a gully in the Dandenong ranges than Maroondah. The natural vegetation along the creek may have belonged to the Ecological Vegetation Class (EVC) called Swampy Riparian Complex but now, ferns are much more prominent than is normal for that EVC. Among the ferns are Rough Tree-ferns (*Cyathea australis*), Mother Shield-ferns (*Polystichum proliferum*) and what appears to be Maroondah's last remaining Gristle Fern (*Blechnum cartilagineum*).

The steep, northwest-facing slope between the footpath and Maroondah Highway receives more sun than along the creek for topographic reasons and because there are few shady, introduced trees and shrubs. The slope retains characteristics and plant species of the grassy forest that would have occurred there prior to European settlement.

Across the whole site, this study detected thirty-one naturally-occurring, indigenous plant species.

Relationship to other land

Of the fauna present in Site 104, all except small lizards and non-flying invertebrates would need to periodically travel elsewhere to fulfil their habitat needs. As seen on the aerial photograph on p. 338, the abutting Site 46 (Birt Hill) and nearby Site 45 (Birts Hill Reserve) provide additional habitat. Warrien Reserve (450 m northeast) provides additional, high-quality habitat.

Wildlife movements further afield are aided by Site 104's location on the eastern escarpment of the Wicklow Hill ridge, which runs north-northeast from Site 79 in Heathmont to Hochkins Ridge Nature Conservation Reserve in Croydon North. As can be seen on the key map on p. 1, Site 104 and the neighbouring Sites 45 and 46 form one of the largest areas of habitat in a sequence of sites of biological significance distributed along the ridge. It is expected (without direct observational evidence) that birds move along the ridge, using the sites as ecological stepping-stones.

The habitat between the sites of biological significance is augmented by remnant eucalypts or Australian native trees in quite a few residences and on nature strips.

Bioregion: at the interface between Gippsland Plain and Highlands - Southern Fall

Habitat types

The state government's mapping of Ecological Vegetation Classes (EVCs) and bioregional boundaries is inaccurate in this vicinity. Site 104 is shown as not having any native vegetation. The mapping of pre-European vegetation implausibly shows Grassy Dry Forest along the creek, right up the adjacent steep, shady, southeast-facing slope and up the slope between the creek and Maroondah Highway.

Because the site is at the interface between two bioregions, the vegetation community on the slope is intermediate between the Valley Heathy Forest EVC of the Gippsland Plain bioregion and the Valley Grassy Forest EVC of the Highlands - Southern Fall bioregion.

The description of vegetation below excludes introduced plant species and those indigenous species believed to be present only as a result of planting.

Indistinguishable between Valley Heathy Forest (EVC 127, **Endangered** in the Gippsland Plain) and Valley Grassy Forest (EVC 47, **Vulnerable** in the Highlands - Southern Fall)

Canopy trees: Strongly dominated by Bundy (*Eucalyptus goniocalyx*). There is also a large White Stringybark (*E. globoidea*). Red Stringybarks (*E. macrorhyncha*) were present in the 1990s but they appear to have all died.

Lower trees: Dominated by Cherry Ballart (*Exocarpos cupressiformis*). There are a few Black Wattles (*Acacia mearnsii*). The solitary Golden Wattle (*A. pycnantha*) may have been planted. Blackwood (*A. melanoxylon*) was present in 1996.

Shrubs: Shiny Cassinia (*Cassinia longifolia*) is the most abundant shrub. Snow Daisy-bush is also fairly abundant but it might be present solely as a result of planting. There are at least six Dandenong Range Cinnamon Wattle (*Acacia stictophylla*), half of which seem very likely to be natural. It is too difficult to tell how many of the Sweet Bursarias (*Bursaria spinosa*) and Common Correas (*Correa reflexa*) are natural rather than planted, but both grew naturally in the site in 1996. The following additional shrub species were present in 1996: Common Cassinia (*Cassinia aculeata*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Yarra Burgan (*Kunzea leptospermoides*), Prickly Tea-tree (*Leptospermum continentale*), Common Flat-pea (*Platylobium obtusangulum*) and Golden Bush-pea (*P. gunnii*).

Ferns: There are patches of Austral Bracken (*Pteridium esculentum*).

Climbers: Mountain Clematis (*Clematis aristata*) was the only climber detected in this study. A 1996 survey also detected Twining Glycine (*Glycine clandestina*) and Purple Coral-pea (*Hardenbergia violacea*).

Creepers: Cranberry Heath (*Astroloma humifusum*) and the wood-sorrel, *Oxalis exilis/perennans*, were recorded in 1996.

Grasses, rushes and sedges: Abundant and fairly rich in species. Dominated variously by Thatch Saw-sedge (*Gahnia radula*) or Weeping Grass (*Microlaena stipoides*). The most ecologically informative other species are Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*) and Forest Wire-grass (*Tetrarrhena juncea*).

Other groundcover: Depleted, the only species detected in this study's brief inspection being Black-anther Flax-lily (*Dianella revoluta*) and Small Poranthera (*Poranthera microphylla*), both of which are fairly abundant. The 1996 survey also detected Honeypots (*Acrotriche serrulata*) and Common Raspwort (*Gonocarpus tetragynus*).

Gully, formerly Swampy Riparian Complex? (EVC 126, **Endangered** in the bioregion)

Canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*).

Lower trees: A few Black Wattle (*A. mearnsii*).

Shrubs: The only indigenous shrub species that does not show signs of being planted is Tree Everlasting (*Ozothamnus ferrugineus*), which is scarce.

Ferns: Surprisingly abundant and rich in species, representing most of the indigenous understorey cover. Austral Bracken (*Pteridium esculentum*) is scattered, there is a patch of Common Maidenhair (*Adiantum aethiopicum*), at least eleven Mother Shield-ferns (*Polystichum proliferum*), at least nine Rough Tree-ferns (*Cyathea australis*), at least one Gristle-fern (*Blechnum cartilagineum*) and at least one Tender Brake (*Pteris tremula*).

Climbers: Wonga Vine (*Pandorea pandorana*) is scarce.

Creepers: None seen, but Bidgee-widgee (*Acaena novae-zelandiae*) is probably present, at least at times.

Grasses, rushes and sedges: Tall Sedge (*Carex appressa*) and Green Rush (*Juncus gregiflorus*) are scattered along the creek.

Other groundcover: Slender Knotweed (*Persicaria decipiens*) is scarce in the creek channel.

Significant plants

Rare (but not otherwise threatened)

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its global geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. Six individuals were observed in this study's brief inspection of the site. One of them was a seedling (and definitely not planted) and another two looked more likely to be natural than planted. The other three might have been planted but the species was recorded in the site in 1996 before any planting commenced.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 36 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Astroloma humifusum* (Cranberry Heath) – recorded in 1996 without an indication of numbers; perhaps overlooked in this study's brief site inspection;
- *Blechnum cartilagineum* (Gristle Fern) – one plant was discovered in 2019, the last known plant of its species in Maroondah;
- *Polystichum proliferum* (Mother Shield-fern) – eleven plants were discovered in 2019, the largest of the four known populations of the species in Maroondah;
- *Eucalyptus globoidea* (White Stringybark) – there is a large individual in fairly good health; and
- *Eucalyptus macrorhyncha* (Red Stringybark) – only dead individuals appear to remain.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, possums and invertebrates but the proximity to the highway may reduce the usage of the habitat;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards and birds;
- The presence of additional habitat in the abutting Site 46 and nearby amplifies the habitat values above;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1); and
- The creek and its vegetation probably provide habitat for frogs.

Ecological condition

The ecological condition of the vegetation was not assessed in detail in this study. A general impression was gained that, using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), half to one-third is in category 'C' (fair) and the remainder is in category 'D' (poor).

The health of the eucalypt canopy is quite variable, with gaps left by the deaths of trees a decade or more ago.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

Site 104 includes an area of 0.25 ha that has over 10% native understorey cover, thereby (just) meeting the definition of a 'patch' of native vegetation adopted by the standard criteria. The vegetation within the patch is intermediate between an endangered EVC and a vulnerable EVC (see above). Either way, because the 'habitat score' is clearly at least 0.3, it follows that the vegetation has a 'conservation significance' rating of 'high' or 'very high' under the Native Vegetation Framework (NRE 2002). Consequently, the site meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

The section above headed 'Significant plants' provides details of threatened plants.

The site has several Dandenong Range Cinnamon Wattles (*Acacia stictophylla*), part of a larger population extending into the neighbouring Site 45 (Birts Hill Reserve) and Site 46 (Birt Hill). That species does not occur outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

Polystichum proliferum falls into the 'critically endangered' category of risk of dying out in Maroondah. The site's eleven plants represent the largest known population in Maroondah. They therefore fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site supports Maroondah's last know survivor of *Blechnum cartilagineum*, which therefore makes it an 'important site' in the terms above and hence a site of Local significance.

Ecological corridor

The section above headed 'Relationship to other land' describes how Site 104 forms part of a large node in a sequence of sites of biological significance along the Wicklow Hill ridge. The node fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to differences in the criteria used and the state government's recognition in the interim of the conservation status of Valley Heathy Forest, Valley Grassy Forest and the Dandenong Range Cinnamon Wattle.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through

atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people walking through the site or living beside it. As part of the 'urban forest', the trees also make a small contribution to reducing the urban heat island effect and sequestering carbon dioxide from the atmosphere.

The site's aquatic flora and fauna are expected to remove some nutrients and other pollutants from the creek.

The site's natural ambience is expected to contribute to the enjoyment, health and wellbeing of visitors. It may also encourage people to use the path to walk through the neighbourhood rather than go by vehicle, thereby improving the people's health and reducing vehicle use.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, there has been no discernible change in the extent of habitat in Site 104.

Change in the ecological condition of habitat

Aerial photographs from 2001, 2011 and 2017 indicate that some eucalypts were dead in 2001, a similar number died between 2001 and 2011 (the Millennium Drought), and no additional deaths can be detected since 2011. Otherwise, there is no prior information about the condition of habitat in Site 104, so no other changes can be determined.

Threats

This study has identified the following threats to the site's biodiversity:

- Displacement of indigenous flora and their dependent fauna by rampant growth of introduced plant species, particularly Sweet Pittosporum;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Possible future subdivision of 1 Alice Street;
- Further eucalypt deaths and consequent ecological disruption to understorey and fauna. Deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Potential future widening of Maroondah Highway; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The road reservation for Maroondah Highway, which makes up most of Site 104, is zoned 'Road Zone – Category 1'. The narrow municipal reserve is zoned 'Public Park and Recreation Reserve'. Most of the municipal reserve along the creek is zoned 'Public Park and Recreation Zone'. The rest of the municipal reserve, the water supply reserve and 1 Alice Street are zoned 'Neighbourhood Residential Zone – Schedule 1'.

Tree removal is controlled throughout by Schedule 3 of the Significant Landscape Overlay. Removal of native vegetation (trees or otherwise) on 1 Alice Street and within the road reservation comes under the state-wide controls of clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the whole site.

Information sources

The analysis above draws on the following information about the site, from the author's work except where otherwise noted:

- A total of 65 minutes of site inspection for this study on 19/1/19 and 17/8/19, including: (a) compiling lists of wild, indigenous plant species in each of the two vegetation types in the site; (b) mapping and documenting the populations of rare plants; (c) mapping the area that has over 10% indigenous understorey cover; and (d) checking the site against any of the standard criteria for sites of biological significance;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose information about Site 104 was based on fieldwork in April 1996 by Helen Moss; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

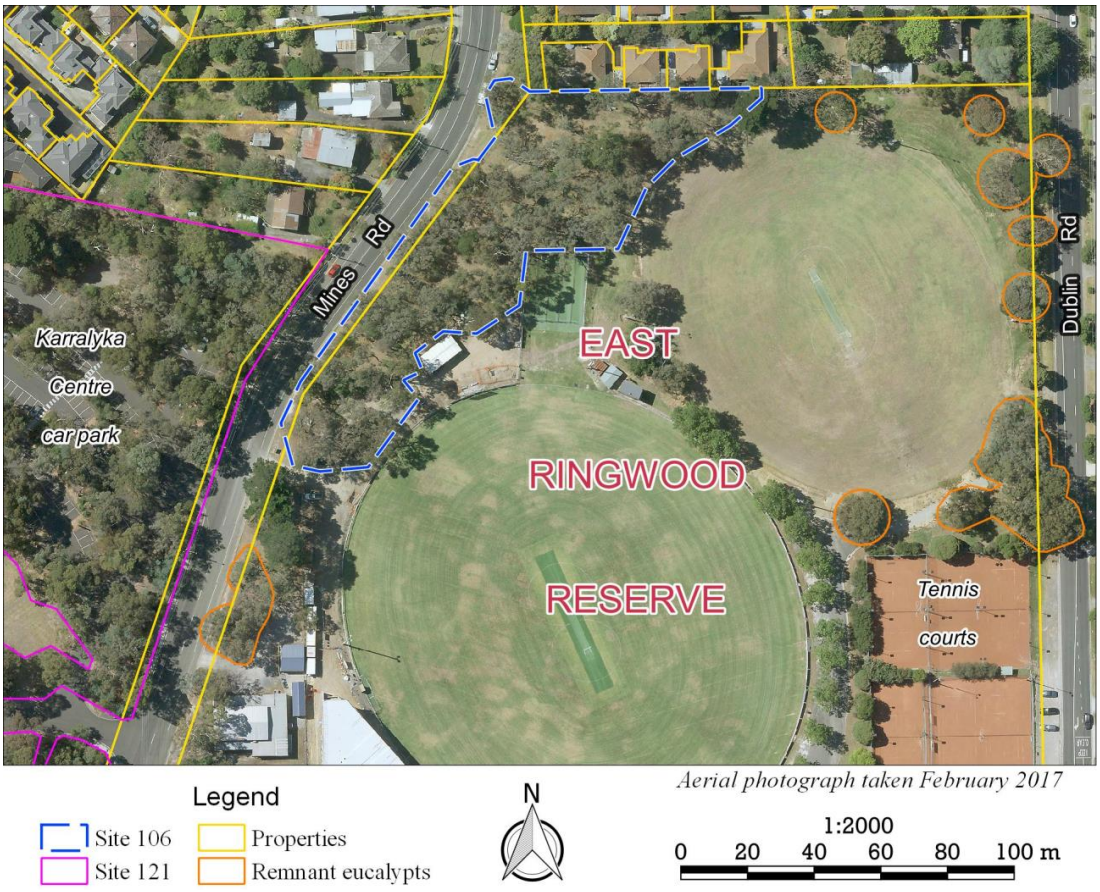
No useful information could be found in the Victorian Biodiversity Atlas, the Atlas of Living Australia or eBird.

Site 105. Corner of Maroondah Hwy and Croydon Rd, Croydon

Site 105 of Lorimer *et al.* (1997) is here merged with the Lincoln Road site, Site 85. See p. 639.

Site 106. East Ringwood Reserve

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries

Site 106 is marked with a dashed blue outline on the aerial photograph above. The boundary follows the edge of the tree canopy of an area of native vegetation with indigenous understorey, including groundcover. The tiny amount of tree canopy that overhangs the pavement of Mines Road or private land to the north is excluded from the site. As with all sites in this volume, the precise site boundary is available in a shapefile for geographic information systems.

Land use and tenure

Part of Site 106 is on the nature strip of Mines Road, which is a Council road. There is no footpath. The rest of the site is in East Ringwood Reserve, which is Crown land used as a reserve for sport, gambling and entertainment. A small part of Site 106 in the south is used for car parking. The rest of the site in the reserve receives little use. None of the site is managed for nature conservation.

General description

Site 106 covers 0.57 hectares. It has a gentle slope of typically 1:15 facing east, except for artificial slopes right next to some of the sporting facilities.

The site has an almost-complete canopy of remnant eucalypts. The understorey has been regularly mown for many decades, decimating the shrub layer and diminishing the number of groundcover species. This study detected twenty-one naturally-occurring, indigenous plant species, of which ten are groundcover species. Additional species would be detected during a summer flora survey.

Relationship to other land

Site 106 is so small that its birdlife and many of its flying insects can meet only part of their habitat needs within the site. The birds and insects therefore move between the site and other nearby habitat.

The main area of nearby habitat for birds and insects is across Mines Road around the Karralyka Centre (Site 121), where there is a patchy cover of eucalypts (mostly naturally-occurring), indigenous shrubs and indigenous groundcover. From a habitat point of view, Sites 106 and 121 form a single site, but they are separated here because of their different land uses. The orange-outlined areas on the aerial photograph on p. 699 contain remnant eucalypts, many of them with naturally-occurring Thatch Saw-sedge (*Gahnia radula*) beneath. The next-closest fauna habitat is along Mount Dandenong Road (Site 90), which provides a link to Ringwood Lake Park (Site 26). Dublin Road Reserve (Site 122) is next-closest, 260 m to the north. The spatial relationship between these sites can be seen on the key map on p. 1.

Forest birds such as rosellas can be readily seen moving between Sites 106, 121 and 90. It seems likely that those birds, and some flying insects, also commute to and from other sites in the area. The sites can therefore be viewed as a network of ecological 'stepping-stones' for fauna movements.

The movements of birds and flying insects between these sites may improve the viability of the indigenous flora in each site, through pollination and transport of seeds.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species. This study's flora survey was conducted on 18/1/19 and therefore some species are likely to have gone undetected.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: There is a near-pure stand of Mealy Stringybark (*Eucalyptus cephalocarpa*), interrupted only by a single Red Stringybark (*E. macrorhyncha*).

Lower trees: Golden Wattle (*Acacia pycnantha*) and Lightwood (*A. implexa*) are present in substantial numbers but the latter may be the result of planting. Black Wattle (*A. mearnsii*) is scarce.

Medium to large shrubs: Yarra Burgan (*Kunzea leptospermoides*) appears to be the only surviving shrub species. It is fairly abundant.

Small shrubs: None seen.

Shrubby herbs: None seen.

Ferns: None seen.

Climbers: None seen.

Creepers: None seen.

Grasses, rushes and sedges: Clustered Wallaby-grass (*Rytidosperma racemosum*) dominates the groundcover. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) is also abundant. The following species are moderately abundant: Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Kneed Wallaby-grass (*R. geniculatum*) and Purplish Wallaby-grass (*R. tenuius*). Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*) and Small Grass-tree (*Xanthorrhoea minor*) are scarce.

Other groundcover: Very depleted. This study's mid-January survey detected only Black-anther Flax-lily (*Dianella revoluta*) and Pale Flax-lily (*Dianella longifolia*), both of them scarce. Nodding

Greenhood (*Pterostylis nutans*) was recorded in 1996 and could easily have escaped detection in this study due to the time of year.

Significant plants

Critically endangered in Maroondah

- *Eucalyptus macrorhyncha* (Red Stringybark) – a single tree.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates. Some of the invertebrates become food for vertebrates such as lizards, bats and birds;
- Some eucalypts have hollows, which offer roost sites or nest sites for some animals;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.2 ha of Site 106 falls into rating 'C' (fair) and the remainder (0.3–0.4 ha) falls into rating 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

Part of the site's native vegetation meets the definition of a 'patch' adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. (The area is just large enough to qualify.) The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 106 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Such a site is recognised by the standard criteria as having Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to different criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through

atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people using the northwest part of East Ringwood Reserve and also neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site may contribute to the enjoyment of reserve users.

The vegetation in Sites 106 and 121 contributes to the 'green and leafy' character of the neighbourhood. It, and the associated birdlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

As an ecological 'stepping-stone' in a network of habitat sites, Site 106 encourages the movement of birds through the surrounding residential area. Those birds enrich the daily lives of the residents.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, it appears that perhaps as many as ten mature eucalypts have been lost from East Ringwood Reserve as a whole. About half of those eucalypts were quite separate from Site 106, as circumscribed here. The others were intermingled with pines along the reserve's northern boundary, immediately east of Site 106. The effect has been to reduce the extent of Site 106 by approximately 0.1 ha. However, that loss is partly compensated because the crowns of some eucalypts have grown over lawn.

Change in the ecological condition of habitat

The previous (1996) assessment of Site 106 rated the ecological condition of the whole site as 'D' (poor), using the same scale as in the section above headed 'Ecological condition'. In 2019, roughly 0.2 ha is rated 'C' (fair). The increase in rating is probably due mainly to reduced mowing and the consequent growth of Burgan (*Kunzea leptospermoides*).

Aerial photographs show that a substantial number of eucalypts in Site 106 died between 2001 and 2011, attributable to the Millennium Drought. A smaller number of additional eucalypts appear to have died between 2011 and 2017.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by aggressive non-indigenous plants ('environmental weeds');
- Resumption of eucalypt deaths and consequent ecological disruption to understorey and fauna. Eucalypt deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Possibly poorly-timed or over-frequent mowing; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

East Ringwood Reserve is zoned 'Public Park and Recreation Zone'. The abutting nature strip of Mines Road is zoned 'General Residential Zone – Schedule 1'. In both cases, native vegetation receives planning protection under clause 52.17 of the Victoria Planning Provisions. In addition, trees above a certain size are protected under Schedule 4 of the Significant Landscape Overlay (SLO4).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to Site 106, as outlined in blue on the aerial photograph on p. 699.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately one hour of flora survey by the author on 18/1/19, including: (a) compiling a list of indigenous plant species and their abundances; and (b) mapping the vegetation and scarce plants;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated field data from the present author's flora survey on 13/3/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 107. Jenkins Close, Ringwood North (Discontinued)

Biological Significance Level: *Not Significant*

Site description and changes

Site 107 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised seven residential properties: 5 Kubis Drive and 1–4, 8 & 9 Jenkins Close, Ringwood North. The properties range in size from 651 m² to 1,144 m². At the time, house construction had begun on 3 Jenkins Close and the other properties were vacant. The reason for the site being recognised was that 56 indigenous plant species grew on the land, including some locally rare species. Of those species, the following fall into the 'critically endangered' category of risk of dying out in Maroondah, under current-day criteria:

- *Astroloma humifusum* (Cranberry Heath);
- *Cynoglossum suaveolens* (Sweet Hound's-tongue);
- *Eucalyptus macrorhyncha* (Red Stringybark);
- *Lachnagrostis aemula* (Purplish Blown Grass); and
- *Pentapogon quadrifidus* (Five-awned Spear-grass).

When the site was inspected for this study on 12/7/18, each property had a house and garden. No indigenous vegetation remained on 5 Kubis Drive. 2, 3 and 9 Jenkins Close each had no more indigenous vegetation than a single tree. The only indigenous plants at 8 Jenkins Close were two Red Box trees. Seven indigenous plant species could be seen in an area of 100 m² at 4 Jenkins Close. The front yard of 1 Jenkins Close stood out, with 16 indigenous plant species (mostly wildflowers) visible from the footpath in a winter inspection. Of the species in the dot-points above, Red Stringybark has convincingly died out and the rest were not detected but may have escaped detection at 1 Jenkins Close. Importantly, one plant of Grey Guinea-flower (*Hibbertia obtusifolia*) was seen at 1 Jenkins Close. That species falls into the 'critically endangered' category of risk of dying out in Maroondah.

Despite the significance of the Grey Guinea-flower and the possibility that a small number of other significant plants might have escaped detection, no aspect of the site appears to meet any of the standard criteria of biological significance of Amos (2004). The largest area of indigenous vegetation measures 100 m², which is much too small to meet the threshold for a 'patch' of native vegetation under the standard criteria. The Grey Guinea-flower population appears to be too small to fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. The site is extremely unlikely to serve as an ecological 'stepping-stone' in the sense of standard criterion 1.2.6.

The site therefore falls into the 'Not Significant' category in the scheme of Amos (2004).

However, the wildflowers of 1 Jenkins Close have value for amenity, natural heritage and the benefits of contact with nature (e.g. health, wellbeing and childhood development). The indigenous plants in the rest of the site also have value for natural heritage. None of these sorts of values are considered by Amos (2004).

Threats

The main threats to biodiversity in the site are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and

- The possible future conversion of the areas of indigenous plants in the front gardens of 1 and 4 Jenkins Close into lawns, ornamental gardens or paved areas. That has been the fate of almost all similar vegetation on residential properties of similar size in Maroondah.

Strategic planning

Schedule 3 of the Significant Landscape Overlay covers the whole neighbourhood. It requires a permit for the removal of canopy trees. If a permit application under SLO3 arises, it should be considered alongside the information above. There is currently no planning protection for any understorey plants, including any locally threatened species.

As the site does not meet any of the standard criteria for a site of biological significance, the application of the Environmental Significance Overlay cannot be justified. In addition, the areas of indigenous vegetation are so small that adding planning protection for understorey plants would probably not succeed in the long-term. In case law at the Victorian Civil and Administrative Tribunal, native vegetation is generally assumed to be unviable on residential properties smaller than 0.4 ha, which applies in this case.

Site 108. Giana Court, Ringwood North
(Discontinued)

Biological Significance Level: *Not Significant*

Site description and changes

Site 108 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised seven residential properties: 2, 3 and 5–9 Giana Court, Ringwood North. The properties range in size from 674 m² to 1,045 m². The reason for the site being recognised was that the properties had a substantial cover of naturally-occurring, indigenous trees (mainly eucalypts) that provided habitat for wildlife, including koalas.

Koalas appear to have died out in the area and throughout Maroondah.

When the site was inspected for this study on 12/7/18, the tree cover had increased due to growth of the eucalypt crowns. Some of the gardens contained 'Australian native' plants that augment the wildlife habitat provided by the naturally-occurring, indigenous trees. Overall, the wildlife habitat appears to have improved on the seven properties. It has also improved at 10 Giana Court, which is now on par with the original seven properties in the site.

Although the habitat in the site has improved or at least been maintained, no aspect of the site appears to meet any of the standard criteria of biological significance of Amos (2004). The area does not contain a 'patch' of native vegetation as defined by the standard criteria, i.e. an unbroken area of at least 0.25 ha with native understorey cover of 10% or more. None of the plant species detected in the site are rare or threatened, locally or more widely. The site is unlikely to serve as a significant ecological 'stepping-stone' in the sense of standard criterion 1.2.6.

The site therefore falls into the 'Not Significant' category in the scheme of Amos (2004).

However, the vegetation and associated wildlife (mainly birds) have value for amenity, natural heritage and the benefits of contact with nature (e.g. health, wellbeing and childhood development). None of these sorts of values are considered by Amos (2004).

Strategic planning

Schedule 3 of the Significant Landscape Overlay covers the whole neighbourhood. It requires a permit for the removal of canopy trees. There is currently no planning protection for any other plants. It is unusual for so many eucalypts to be retained on properties of this size without greater planning protection. Presumably, successive residents have valued the tree cover highly enough not to remove it as many other Maroondah residents have done.

If a permit application under SLO3 arises, it should be considered alongside the information above.

As the site does not meet any of the standard criteria for a site of biological significance, the application of the Environmental Significance Overlay cannot be justified. One could take the view that, as the tree cover has persisted so well, there is no need to introduce further planning protection. On the other hand, if the residents value the tree cover and wildlife highly enough, they may favour the introduction of additional planning protection. If so, a schedule under the Vegetation Protection Overlay would be appropriate.

Site 109. Railway Line West of Wantirna Road, Ringwood (Discontinued)

Biological Significance Level: *Not Significant*

Site description and changes

Site 109 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised strips of native vegetation beside the railway tracks of the Belgrave and Lilydale lines between Heatherdale Road and Wantirna Road. It was recognised as being of Local significance for the presence of 'a corridor containing patchy representation of remnant overstorey and understorey'.

Since then, Eastlink has been constructed across a 124-metre length of the site and a new Heatherdale Railway Station has been constructed on all the land west of Eastlink. The rest of the site has been subjected to intense, frequent herbicide spraying, killing most understorey plants other than the declared noxious weed, Gorse (*Ulex europaeus*). A shared path was constructed on the southern side of the tracks in 2018, involving substantial excavation that severed roots of eucalypts (possibly fatally) and probably removed some indigenous plants.

When inspected for this study, the only surviving indigenous plants on the north side of the tracks were a few Wattle Mat-rushes (*Lomandra filiformis* subsp. *coriacea*), a tuft of Thatch Saw-sedge (*Gahnia radula*) and a solitary Sifton Bush (*Cassinia sifton*, which is arguably not indigenous). On the south side of the tracks, this study detected (along with abundant Gorse and Cotoneasters):

- Six Mealy Stringybark (*Eucalyptus cephalocarpa*), four Bundy (*E. goniocalyx*), three Messmate Stringybark (*E. obliqua*) and one Narrow-leaved Peppermint (*E. radiata*);
- Ten Golden Wattles (*Acacia pycnantha*) near the dead end of Thanet Court and a copse of suckering Silver Wattle (*A. dealbata*) near Eastlink;
- Two Sifton Bushes;
- A few Cotton Fireweeds (*Senecio quadridentatus*);
- A small amount of Austral Bracken (*Pteridium esculentum*);
- A single Black-anther Flax-lily (*Dianella revoluta*) just east of New Street; and
- About ten Wattle Mat-rushes, six Small Grass-trees (*Xanthorrhoea minor*) and a few tufts of Thatch Saw-sedge – all concentrated on the brow of the high railway cutting behind 22 & 24 Albert St, Ringwood. (The herbicide spraying is less intense at that height.)

Biological significance rating

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

Site 109 does not meet any of the standard criteria for sites of biological significance because:

- The site falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the site is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The highly urbanised landscape to the east and west means the site is not an existing habitat corridor (as per standard criteria 1.2.6) and has no potential to become one (as per standard criterion 1.3);
- Standard criterion 2 is not met because the site does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;

- Standard criterion 3 is not met because no rare or threatened species are present and none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the site does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the site is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the roadside is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

On the southern side of the tracks, there are fourteen indigenous eucalypts and a similar number of planted 'Australian native' eucalypts. They provide shade and wind protection for neighbours and users of the adjacent shared path. The indigenous eucalypts include some particularly large, old trees. They and the few surviving indigenous understorey plants are vestiges of the area's pre-European landscape and therefore preserve a tiny piece of central Ringwood's natural heritage. In particular, they demonstrate that the pre-European vegetation belonged to the now-endangered vegetation type called Valley Heathy Forest.

Threats

This study's brief site inspection identified the following threats to the site's biodiversity:

- Herbicide spraying threatens to destroy the remaining indigenous understorey and any recruitment of seedlings of indigenous trees or understorey species;
- Current trends in climate change and global greenhouse gas emissions pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and
- Eucalypts may die over the next few years from root severance during the 2018 construction of a shared patch along the southern side of the tracks. The deaths may be staved off until very dry conditions put the trees under stress.

Strategic planning

The site is zoned 'Public Use Zone 4 - Transport'. There are no overlays. Removal of native vegetation is controlled under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions but exemptions mean that the controls are not stopping the repeated destruction of native vegetation by herbicide.

Because so little native vegetation has survived and as the site does not meet any of the standard criteria for a site of biological significance, there is no need to introduce any new planning controls.

Information sources

The analysis above draws on the following sources of information about the site:

- A site inspection for this study on 24/9/19 and 1/10/19;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), whose assessment of the site relied upon a flora survey by the present author in May 1996; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 110. Loughnan Hill, Ringwood North

Biological Significance Level: *Local* due to locally threatened species of flora and fauna



Boundaries

The original version of Site 110 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was not given a mapped boundary but simply described as 'The area generally between Felix Crescent and Cielterre Avenue. Melway Ref. 49 F5'. A precise boundary is required for strategic planning purposes, so the site is outlined in mid-blue on the aerial photograph above. The boundary has been drawn to circumscribe the area containing habitat for indigenous flora and fauna.

The site's polygon to the west of Ringwood Heights Primary School comprises part of 1 Aurum Crescent as well as the abutting road verges (up to the footpaths) and a 3 m-wide strip of the abutting property to the north, where there is a line of posts. The polygon on the opposite side of Aurum Crescent comprises Hygeia Parade Reserve, the full nature strip width along Aurum Crescent and a 3 m-wide strip of the nature strip along Hygeia Parade.

As with all sites in this volume, the precise site boundaries are available in a shapefile for geographic information systems.

Different parts of the site are mapped with either blue hatching or blue crosses to indicate different habitat types and their recommended strategic planning responses – see the section below headed 'Strategic planning'.

Land use and tenure

Site 110 mostly contains residential properties and their streets but also a water reservoir property on the top of Loughnan Hill, Hygeia Parade Reserve (0.65 ha) in the southwest and a tiny park at the end of Cielterre Avenue (0.08 ha).

General description

The site covers 28.1 hectares. It is spread over the upper parts of one of Maroondah's highest hills, reaching 190 m above mean sea level. The steepest slope is quite steep (1:3) but most of the land has a slope between 1:6 and 1:11. There are no creeks or gullies within the site but there is a seep in the southern half of Hygeia Parade Reserve. Throughout, the naturally-occurring native vegetation is consistent with the endangered Ecological Vegetation Class (EVC), 'Valley Heathy Forest' (albeit mostly in greatly simplified states).

At the top of the hill, there is a substantial number of remnant eucalypts on the northern half of a property used for a covered reservoir (7–17 Pine Crescent). It also has a scattering of native understorey, suppressed by mowing. The southern half of the property is dominated by pines, many of them large.

The largest and most diverse areas of indigenous understorey that could be found in this study were in the west at Hygeia Parade Reserve and 1 Aurum Crescent (on the northwest corner with Felix Crescent). Both these properties are crossed by electricity transmission lines. The transmission lines limit the possible land uses, which has allowed the persistence of plant species that appear not to have survived elsewhere in the site.

The site's 0.18-hectare polygon at 1 Aurum Crescent contains at least 41 indigenous plant species that can be seen from the adjacent footpath, including such sensitive wildflower species as Honeypots (*Acrotriche serrulata*), Milkmaids (*Burchardia umbellata*), Pale Grass-lily (*Caesia parviflora*) and Common Rice-flower (*Pimelea humilis*). However, the eucalypt cover is greatly suppressed, presumably because of the electricity transmission lines above.

Hygeia Parade Reserve is superficially quite plain but thirty-nine indigenous plant species were found in this study's half-hour walk around it. One of the species (*Centrolepis strigosa*) falls into the 'critically endangered' category of risk of dying out in Maroondah. The reserve could become a good example of Valley Heathy Forest if mowing were to be reduced and declared noxious weeds were to be controlled.

Most of the rest of the site has patchy distributions of remnant eucalypts and mature pines. The pines and eucalypts often compete strongly with each other. 'Australian native' trees have been planted on quite a few properties, offering wildlife habitat that supplements the indigenous trees. Small patches of indigenous understorey are thinly scattered through the site.

Across the whole site, this study detected sixty-two naturally-occurring, indigenous plant species.

Relationship to other land

Site 110 abuts Ringwood Heights Primary School (Site 1). The two sites act as one, from the perspectives of fauna habitat and genetic pools of plant species.

A low-density residential area with substantial cover of remnant trees and patchy indigenous understorey lies as close as 150 m to the west, in Manningham municipality. That abuts the major habitat corridor of Mullum Mullum Creek.

To the north of Site 110 lies the habitat of B.J. Hubbard Reserve (Site 2, 150 m away) and Loughies Bushland (Site 3, 500 m away).

The proximity of these sites is favourable for native birds and occasional echidnas to visit Site 110.

Exchange of pollen and seeds between the sites by birds and insects improves the reproductive success and genetic diversity of plant populations.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the more abundant or ecologically informative indigenous plant species that could be detected in this study.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Yellow Box (*Eucalyptus melliodora*) and Bundy (*E. goniocalyx*). Messmate Stringybark (*E. obliqua*) and Red Box (*E. polyanthemos*) are also fairly abundant. Mealy Stringybark (*E. cephalocarpa*), Red Stringybark (*E. macrorhyncha*) and Narrow-leaved Peppermint (*E. radiata*) are very scarce.

Lower trees: Golden Wattle (*Acacia pycnantha*) is dense in some areas. Blackwood (*A. melanoxylon*) is moderately abundant. are scattered There are also scattered Lightwood (*A. implexa*), Black Wattle (*A. mearnsii*) and Cherry Ballart (*Exocarpos cupressiformis*).

Medium to large shrubs: Sifton Bush (*Cassinia sifton*) is fairly abundant. The following species are concentrated in the most natural areas: Hop Bitter-pea (*Daviesia latifolia*), Yarra Burgan (*Kunzea leptospermoides*), Prickly Tea-tree (*Leptospermum continentale*) and Manuka (*Leptospermum scoparium*).

Small shrubs: As is normal for Valley Heathy Forest, Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant at 1 Aurum Crescent.

Ferns: Austral Bracken (*Pteridium esculentum*) forms occasional dense patches.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is present at 1 Aurum Crescent and Coarse Dodder-laurel (*Cassytha melantha*) grows at the dead end of Cielterre Avenue. Wonga Vine (*Pandorea pandorana*) is only present as a result of the species spreading beyond its historically natural range to the east.

Creepers: The Wood-sorrel (*Oxalis exilis/perennans*) and Slender Speedwell (*Veronica gracilis*) are the only creeper species seen in this study, both being quite localised.

Grasses, rushes and sedges: Abundant and rich in species, in the more natural areas. Mostly dominated by Thatch Saw-sedge (*Gahnia radula*), Weeping Grass (*Microlaena stipoides*) or Kangaroo Grass (*Themeda triandra*). Other species that are abundant in at least one part of the site include Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Toad Rush (*Juncus bufonius*), Smooth Wallaby-grass (*Rytidosperma laeve*), Bristly Wallaby-grass (*R. setaceum*) and Common Bog-rush (*Schoenus apogon*). The following species are fairly abundant in a least one part of the site: Common Love-grass (*Eragrostis brownii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Clustered Wallaby-grass (*Rytidosperma racemosum*) and Purplish Wallaby-grass (*Rytidosperma tenuius*). Although few of the following species were seen in this study, they are good ecological indicators: Variable Sword-sedge (*Lepidosperma laterale*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Forest Wire-grass (*Tetrarrhena juncea*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: The species seen in this study include Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Milkmaids (*Burchardia umbellata*), Spreading Crassula

(*Crassula decumbens*), Creeping Cudweed (*Euchiton japonicus*), Common Raspwort (*Gonocarpus tetragynus*), Small Poranthera (*Poranthera microphylla*), Pale Grass-lily (*Caesia parviflora*), Pale Flax-lily (*Dianella longifolia*), Black-anther Flax-lily (*Dianella revoluta*), Scented Sundew (*Drosera aberrans*), Slender Onion-orchid (*Microtis parviflora*), Variable Stinkweed (*Opercularia varia*), Common Rice-flower (*Pimelea humilis*), Yellow Rush-lily (*Tricoryne elatior*) and Common Early Nancy (*Wurmbea dioica*).

Significant plants

Critically endangered in Maroondah

The following species seen in the site in this study can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Note that the survey was fairly brief and conducted entirely from the public realm, so other significant species may have gone undetected:

- *Centrolepis strigosa* (Hairy Centrolepis) – thirty individuals were counted at Hygeia Parade Reserve but many others could have gone undetected due to the minute size of the plants and the brevity of the survey; and
- *Eucalyptus macrorhyncha* (Red Stringybark) – at least one grows at the front of 8 Pine Crescent. Others could easily have gone undetected.

Significant fauna

Sugar Gliders are resident in the site and the population appears to be viable. The species is so rare in Maroondah as a whole that the site's population contributes significantly toward staving off local extinction.

An Eastern Grey Kangaroo was reported by Jaan Raadik on Felix Crescent on 15/12/11 but the animal can be regarded as a vagrant.

Echidnas have been recorded in or near Ringwood Heights Primary School in 2009 and 2013. The extent of their use of the area, including Site 110, is uncertain. Echidnas are clearly at risk of dying out in Maroondah

Fauna habitat

- The structure and composition of the native vegetation in the more natural areas represents suitable habitat for Sugar Gliders and a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Locally threatened species

Referring to the sections above headed 'Significant plants' and 'Significant fauna', the site's populations *Centrolepis strigosa*, Sugar Glider and perhaps *Eucalyptus macrorhyncha* fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened]

taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit all the site's residents as well as adjacent homes. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

Site 110's semi-natural ambience is expected to be beneficial to the health, wellbeing, childhood development and quality of life of the residents. Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals attracted to Site 110.

The site's vegetation contributes substantially to the 'green and leafy' character of Ringwood North. The indigenous vegetation also preserves something of the area's natural landscape. The native vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. However, the abundance of large pines diminishes the natural heritage values.

Changes

Change in the extent of habitat

Inspection of aerial photographs indicates that since 2001, there has been a loss of roughly 0.2 ha of eucalypt cover through tree removal. The loss has been roughly balanced by an increase through the growth of eucalypt crowns.

Change in the ecological condition of habitat

There is too little data (particularly for backyards) to be able to determine any change in the ecological condition of the site's habitat.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Displacement of indigenous plants and their dependent fauna by pines;
- Displacement of indigenous plants and their dependent fauna by other introduced plant species going wild, particularly Sweet Pittosporum and Ivy;
- Loss of vegetation for construction of outbuildings and other property improvements;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Residential subdivision;
- Eucalypt deaths and consequent ecological disruption to fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Unpermitted removal of natural understorey to create lawns and gardens; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The reservoir property at 7–17 Pine Crescent is zoned 'Public Use Zone – Service and Utility'. The removal, lopping or destruction of native vegetation on the property is subject to the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. Trees above a threshold size (native or otherwise) are further subject to the controls of Schedule 3 of the Significant Landscape Overlay (SLO3).

The reservoir property's existing planning controls are appropriate for the type and significance of the property's vegetation.

The rest of the site is zoned 'Neighbourhood Residential Zone – Schedule 2' and covered by SLO3 and Schedule 2 to the Design and Development Overlay. There is a minimum lot size for subdivision of 864 m². The only properties large enough for native vegetation to be affected by the abovementioned clause 52.17 are Hygeia Parade Reserve and 17–21 Panorama Avenue, but the latter has no native vegetation, anyway.

The site's two westernmost polygons, which mostly contain Hygeia Parade Reserve and part of 1 Aurum Crescent, are highly deserving of the overlay schedule ESO1 described in Section 11.1.2 of Volume 1.

The appropriate strategic planning response to habitat in the rest of the site is less clear-cut. ESO1 would provide protection for indigenous understorey plants, which is arguably desirable, but it would not protect habitat trees from other parts of Australia. SLO3 currently affects trees without regard to their origin but it is limited in its ability to consider habitat values. ESO2 would protect the full range of habitat trees but not the indigenous understorey. One might argue that no planning controls can provide effective, long-term protection of indigenous understorey on lots as small as those under discussion. If that argument is accepted, ESO2 would be appropriate; otherwise, ESO1 would be appropriate.

Information sources

The analysis above draws on the following sources of information about the site:

- A site inspection for this study, mainly on 12/7/18 and 8/11/19, viewing every property from the public realm;
- Verbal reports of recent and older observations of Sugar Gliders by local residents, Steve Malcolm and Ken McInnes;
- Robyn Bellamy's record in the Victorian Biodiversity Atlas of a Short-beaked Echidna at Ringwood Heights Primary School on 22/11/13. The echidna would probably have crossed the adjacent Site 110 on its way to or from the school;
- A report by Jaan Raadik (in the Victorian Biodiversity Atlas) of a Short-beaked Echidna at 1 Aurum Crescent on 19/10/09 and an Eastern Grey Kangaroo on Felix Crescent on 15/12/11;
- The Victorian Government's Mapping of Ecological Vegetation Classes present in 2005 and 1750; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in eBird or the Atlas of Living Australia.

Site 111. Proclamation Park, Ringwood

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries, land use and tenure

Site 111 occupies two areas (polygons) of native vegetation at Proclamation Park (11–33 Sylvia Grove, Ringwood), as outlined with dashed blue outlines above. As with all the sites in this volume, the precise boundaries are available in a shapefile for geographic information systems.

The park is owned by Maroondah City Council, who manages the parts within Site 111 for recreation and nature conservation. There is a playground in the northeast of Site 111.

General description

Proclamation Park occupies 8.9 hectares, of which 1.9 hectares is within Site 111. A westward-flowing creek has been filled in and ovals have been constructed over it. As part of the levelling for the ovals, the slopes on each side of the creek have been excavated and steep batters have been created. The athletics track shown on the aerial photograph above has also been levelled by cutting and filling, leaving a steep, 9 m-high embankment within the smaller of Site 111's two polygons.

The only part of the park with fairly natural terrain is east of the driveway, with a gentle slope of 1:15 to the south-southeast. The absence of excavation in that area has allowed many indigenous plant species to persist despite the land being cleared at least once (as evidenced by a 1945 aerial photograph) and regularly mown for decades until c. 2011. Since then, cessation of mowing between the driveway and the fence marked on the aerial photograph has brought about a remarkable regeneration of flora. A large number of indigenous plant species have regenerated - even sensitive, regionally rare species such as the White Fingers orchid (*Caladenia catenata*). That area is now a good example of the listed endangered vegetation type, 'Valley Heathy Forest'.

Indigenous groundcover extends some metres east of the fence, where it is still regularly mown.

The excavations that created the batters around the ovals have allowed far fewer indigenous plant species to regenerate. Nevertheless, those batters support significant flora.

The strip of embankment along the park's southern boundary supports two grass species (or subspecies, in one case) that are listed as rare throughout Victoria. There is also a modest range of other indigenous species, some of which are rare in Maroondah. They are intermingled with planted Australian native species and locally dense infestations of environmental weeds such as Gorse (*Ulex europaeus*) and Bulbil Watsonia (*Watsonia meriana* var. *bulbillifera*). That embankment is not mown.

The site's smaller polygon is regularly mown in the drier months and becomes boggy during wetter months. The bogginess restricts mowing during the critical time of year for the surviving indigenous plants. The polygon supports hundreds of the Branched Sundew (*Drosera hookeri*), which falls into the 'critically endangered' category of risk of dying out in Maroondah. There are also hundreds of sun-orchids and a range of other indigenous groundcover species.

Across the whole park, this study detected 107 naturally-occurring, indigenous plant species.

Relationship to other land

The site is so small that its birdlife and many of its flying insects can meet only part of their habitat needs within the site. They therefore move between the site and other habitat. Unfortunately, the nearest suitable habitat is over 500 m away, and then only small patches. The closest is at Jubilee Park (Site 114), which is 530 m to the east-northeast and small. The second-closest is Heatherdale Reserve, over 600 m west, which is again small and has very little understorey. Unfortunately, the land between those sites and Proclamation Park is sparsely-vegetated and very poor habitat for most indigenous fauna.

This explains why the only birds observed in this study were of species that tolerate urban environments or readily traverse substantial tracts of inhospitable territory. The apparent paucity of movement of birds and insects between Proclamation Park and other native habitat may be causing a high level of genetic isolation of the park's flora.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: The dominant species are Bundy (*Eucalyptus goniocalyx*) and Messmate Stringybark (*Eucalyptus obliqua*). Mealy Stringybark (*Eucalyptus cephalocarpa*) and Red Stringybark (*Eucalyptus macrorhyncha*) are fairly abundant and Yellow Box (*Eucalyptus melliodora*) is scarce.

Lower trees: Silver Wattle (*Acacia dealbata*) is abundant in the far north of the site, quite probably as a result of plating. The following species are fairly abundant: Black Wattle (*A. mearnsii*), Blackwood (*A. melanoxylon*), Golden Wattle (*A. pycnantha*) and Cherry Ballart (*Exocarpos cupressiformis*). Black Sheoak (*Allocasuarina littoralis*) is represented by a single seedling.

Medium to large shrubs: Sweet Bursaria (*Bursaria spinosa*) is the dominant shrub species but there are also substantial numbers of Sifton Bush (*Cassinia sifton*), Prickly Currant-bush (*Coprosma quadrifida*), Yarra Burgan (*Kunzea leptospermoides*) and Manuka (*Leptospermum scoparium*). The following species are scarce: Hedge Wattle (*Acacia paradoxa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*), Victorian Christmas-bush (*Prostanthera lasianthos*) and Golden Bush-pea (*Pultenaea gunnii*). The *Daviesia* may have been planted and the *Prostanthera* includes planted plants and their descendants.

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant and Grey Parrot-pea (*Dillwynia cinerascens*) is scarce.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*Senecio quadridentatus*) are fairly abundant.

Ferns: None seen.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is fairly abundant. Coarse Dodder-laurel (*Cassytha melantha*), Love Creeper (*Comesperma volubile*) and Purple Coral-pea (*Hardenbergia violacea*) are scarce.

Creepers: The following creeper species are fairly abundant: Creeping Bossiaea (*Bossiaea prostrata*), Kidney-weed (*Dichondra repens*), Trailing Goodenia (*Goodenia lanata*), Wood-sorrel (*Oxalis exilis/perennans*) and Ivy-leaf Violet (*Viola hederacea*). Thin-leaf Wattle (*Acacia aculeatissima*), Centella (*Centella cordifolia*) and Running Postman (*Kennedia prostrata*) are very scarce.

Grasses, rushes and sedges: Abundant and rich in species. Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Leafy Wallaby-grass (*Rytidosperma fulvum*) are dominant in different areas. The other abundant species are Tall Spear-grass (*Austrostipa pubinodis*), Common Love-grass (*Eragrostis brownii*), Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Soft Tussock-grass (*Poa morrisii*), Smooth Wallaby-grass (*Rytidosperma laeve*), Clustered Wallaby-grass (*Rytidosperma racemosum*) and Common Bog-rush (*Schoenus apogon*). The following species are fairly abundant or widespread: Veined Spear-grass (*Austrostipa rudis* subsp. *australis*), Short-stem Sedge (*Carex breviculmis*), Slender Sword-sedge (*Lepidosperma gunnii*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Common Woodrush (*Luzula meridionalis*), Weeping Grass (*Microlaena stipoides*), Common Wallaby-grass (*Rytidosperma caespitosum*), Kneed Wallaby-grass (*Rytidosperma geniculatum*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Slender Wallaby-grass (*Rytidosperma penicillatum*), Velvet Wallaby-grass (*Rytidosperma pilosum*), Bristly Wallaby-grass (*Rytidosperma setaceum*) and Kangaroo Grass (*Themeda triandra*). The following species are scarce: Finger Rush (*Juncus subsecundus*), Common Blown Grass (*Lachnagrostis filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), the wallaby-grass *Rytidosperma monticola/erianthum* and Purplish Wallaby-grass (*Rytidosperma tenuius*).

Mosses and liverworts: Abundant and moderately rich in species. Common Breutelia (*Breutelia affinis*) is dense. Other conspicuous species include Green Worms (*Chiloscyphus semiteres*), Broody Swan-neck Moss (*Campylopus clavatus*), Common Hypnum (*Hypnum cupressiforme*), Common Juniper-moss (*Polytrichum juniperinum*), Golden Weft-moss (*Thuidiopsis furfurosa*) and Moonwort (*Lunularia cruciata*).

Other groundcover: Abundant and rich in species. There are hundreds of Chocolate Lily (*Arthropodium strictum*), Branched Sundew (*Drosera hookeri*), Nodding Greenhood (*Pterostylis nutans*) and Trim Sun-orchid (*Thelymitra peniculata*). The following species are fairly abundant or widespread: Milkmaids (*Burchardia umbellata*), Pale Grass-lily (*Caesia parviflora*), Button Everlasting (*Coronidium scorpioides*), Common Cotula (*Cotula australis*), Spreading Crassula (*Crassula*

decumbens var. *decumbens*), Black-anther Flax-lily (*Dianella revoluta*), Scented Sundew (*Drosera aberrans*), Creeping Cudweed (*Euchiton japonicus*), Common Raspwort (*Gonocarpus tetragynus*), Slender Bottle-daisy (*Lagenophora sublyrata*), Broad-leaf Stinkweed (*Opercularia ovata*), Common Rice-flower (*Pimelea humilis*), Maroonhood (*Pterostylis pedunculata*), Smooth Solenogyne (*Solenogyne dominii*), Hairy Solenogyne (*Solenogyne gunnii*) and Yellow Rush-lily (*Tricoryne elatior*). The following species are scarce or very localised: Small Mosquito Orchid (*Acianthus pusillus*), Honey-pots (*Acrotriche serrulata*), White Caladenia (*Caladenia catenata*), Pale Flax-lily (*Dianella longifolia* var. *longifolia*)*, Tasman Flax-lily (*Dianella tasmanica*)*, Common Hovea (*Hovea heterophylla*), Small St John's Wort (*Hypericum gramineum*), Golden Weather-glass (*Hypoxis hygrometrica* var. *hygrometrica*), Blue (or Common) Bottle-daisy (*Lagenophora stipitata*), Brown-beaks (*Lyperanthus* suaveolens), Common Onion-orchid (*Microtis* ?unifolia), Variable Stinkweed (*Opercularia varia*), Yellow Star (*Pauridia vaginata*), Blunt Greenhood (*Pterostylis curta*), a hybrid greenhood (*Pterostylis curta* × *nutans*), Grass Trigger-plant (*Stylidium armeria*), Sprawling Bluebell (*Wahlenbergia gracilis*), Common Early Nancy (*Wurmbea dioica*) and Cut-leaf Xanthosia (*Xanthosia dissecta*).

Significant plants

Rare (but not otherwise threatened) in Victoria

An estimated sixty-one plants of a subspecies of Veined Spear-grass (namely *Austrostipa rudis* subsp. *australis)* were seen in this study. That subspecies is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. Approximately thirty were counted south of the ovals, approximately thirty immediately north of the car park and a solitary plant slightly east of the middle of the area between the driveway and the fence. A herbarium specimen was taken. Additional plants may well have escaped detection due to similarity to the more abundant subspecies *rudis*. Subspecies *australis* is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Another species listed by the Victorian Government as rare (but not otherwise threatened) in Victoria is the wallaby-grass, *Rytidosperma monticola*. The embankment south of the ovals at Proclamation Park is one of seven sites in Maroondah to support plants that are best regarded as an undocumented form of *R. monticola* with some characters tending toward the Hill Wallaby-grass (*R. erianthum*). Approximately twelve plants were discovered in this study. A herbarium specimen was taken.

Critically endangered in Maroondah

- *Acianthus pusillus* (Small Mosquito Orchid) – a cluster of five plants grows just west of the fence marked on the aerial photograph on p. 715;
- *Caladenia catenata* (White Caladenia) – a single plant grows near the playground;
- *Drosera hookeri* (Branched Sundew) – hundreds grow on the embankment immediately south of the athletics track;
- *Eucalyptus macrorhyncha* (Red Stringybark) – fairly abundant between the driveway and the fence marked on the aerial photograph on p. 715; scarce elsewhere;
- *Hypoxis hygrometrica* var. *hygrometrica* (Sheath Star) – in March 2020, at least fifteen plants were seen (with photographic evidence) east of the driveway by Sharon Mason and Daniel Flaim. Others almost certainly remain undetected as the species is very hard to see when not in flower;
- *Kennedia prostrata* (Running Postman) – two plants were seen in this study near Sylvia Grove. As a species, *Kennedia prostrata* is prone to large variations in population over the years;
- *Lagenophora stipitata* (Blue (or Common) Bottle-daisy) – scarce, east of the driveway;
- *Pauridia vaginata* (Sheath Star) – a single plant was seen east of the driveway in 2019. Others may remain undetected as the species is very hard to see when not in flower.

* Perhaps planted.

Fauna habitat

- The structure and composition of the native vegetation east of the driveway and south of the ovals represents suitable habitat for urban-adapted birds, bats, possums and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The native vegetation and its litter provide food and cover for invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The value of the habitat features above is diminished by the site's small area, highly urbanised surroundings and distance from other habitat; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the vegetation between the driveway and the fence marked on the aerial photograph on p. 715 is rated 'B' (or good), declining to 'C' (fair) within 10 m of Sylvia Grove. Rating 'D' (poor) applies to vegetation within approximately 12 m of the park's southern boundary, 20 m of the eastern boundary or 40 m of the southwest corner. The rest of Site 111 is rated 'C' (fair).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

The vegetation between the driveway and a few metres east of the fence marked on the aerial photograph on p. 715 easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The site's smaller polygon, south of the athletics track, also meets that criterion despite being much less natural. In both cases, the vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

Referring to the section above headed 'Significant plants', the Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a clearly viable population in two parts of the site. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Site 111 also has an apparently viable population of the local form of *Rytidosperma monticola*. That species' range is not confined to Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. As above, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Referring further to the section above headed 'Significant plants', the site's populations of all six species in the 'critically endangered' category of local extinction risk fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The reserve's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to different criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit those using the park or living nearby. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors. Those benefits are spread into neighbouring streets and gardens by birds, butterflies and other animals moving between the site and other areas of habitat.

The site's vegetation adds a 'green and leafy' character to an otherwise poorly vegetated neighbourhood. The vegetation and associated birdlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, the only detectable change in the extent of native vegetation during that period was the clearing of approximately 100 m² for expansion of the car park.

Change in the ecological condition of habitat

Based on his 1996 inspection of Proclamation Park for the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997), John Reid described the park as having 'A population of several species of remnant eucalypts, with no remaining understorey'. He would have gained that impression because the forested area beside the driveway was being regularly mown and sometimes used for car parking, and presumably Mr Reid saw no reason to look closely at the rest of Site 111.

In c. 2011, Council employee Peter Goegan noticed that there appeared to be a variety of indigenous plants surviving the regular mowing, east of the driveway. He suspended the mowing to see what would come up. The resulting regeneration of indigenous flora was so striking that a fence was erected (as marked on the aerial photograph on p. 715) and the area to its west has not been mown since. Management responsibility for that area was transferred to Council's specialist bushland maintenance team.

The cessation of mowing has allowed many indigenous plant species to regenerate and the vegetation structure to become much more natural. Birdlife and insect life now reflect the change in vegetation.

In summary, there has been a huge improvement in the ecological condition of the habitat between the driveway and the fence since c. 2011.

There is insufficient prior information about the rest of the site to determine what changes have occurred.

Threats

This study has identified the following threats to the site's biodiversity (in decreasing order):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;

- Environmental weeds on the embankment south of the eastern oval, particularly Gorse (*Ulex europaeus*) and Bulbil Watsonia (*Watsonia meriana* var. *bulbifera*);
- Unnaturally dense suckering of Silver Wattle (*Acacia dealbata*) near Sylvia Grove;
- Further eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Loss of indigenous flora if mowing of the embankments were to become too frequent or occur when the ground is boggy; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The park is zoned 'Public Park and Recreation Zone'. There are no overlays. The removal, destruction and lopping of native vegetation (trees to groundcover) throughout the park is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

Because of Site 111's high biological significance, and consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the site, as outlined in blue on the aerial photograph on p. 715.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of 9¾ hours of ecological survey by the author on 27/7/18, 22/9/18, 3/10/18 and 3/12/18, including (in part): (a) compilation of a list of the presence and abundances of indigenous and introduced plant species (including mosses and liverworts) in the area between the driveway and the wire fence; (b) a similar list for the rest of the site; (c) documenting the details of rare or scarce plants; (d) collection of herbarium specimens of *Wahlenbergia multicaulis, Rytidosperma caespitosum* and *R. monticola/ erianthum* (*G.S.Lorimer 2790, 2802* and *2803*, respectively); (e) mapping the vegetation and rare plants; (f) recording fauna observed incidentally; and (g) checking for habitat features;
- Observations of rare or scarce plant species during spring 2018 by Sharon Mason, who was intensively managing the vegetation east of the driveway;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 112. Evelyn Road Reserve, Ringwood North (Discontinued)

Biological Significance Level: *Not Significant*



Boundary, land use & tenure

The boundary of Site 112 is outlined in mid-blue above. It has been drawn to circumscribe an area dominated by indigenous plant species. The land is a council amenity park with a playground.

General description

Site 112 occupies 0.92 hectares of predominantly native vegetation within Evelyn Road Reserve, North Ringwood. As shown on the aerial photograph above, two creeks once flowed through the reserve to converge at the northwest corner, but both creeks have been filled in and replaced with pipes. The land between the two former creeks has a moderate gradient of typically 1:7, facing west to northwest.

Apart from the playground, the vast majority of the reserve is regularly mown. As a result, the only surviving indigenous groundcover species are grasses and Spreading Crassula (*Crassula decumbens*). Shrubs are also very scarce due to mowing. However, there are substantial numbers of remnant eucalypts and understorey trees.

Since c. 1994, revegetation has been undertaken in mulched beds along the reserve's northern edge and in the northeast.

The report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) identified Evelyn Road Reserve as an area of Local biological significance, without mapping which part of the reserve was significant. There was no recommendation for specific recognition of the site in the Maroondah Planning Scheme. The report's citation explanation of the significance was '13 indigenous plant species occurring

naturally, plus 10 species reintroduced by Council'. Twenty naturally-occurring indigenous plant species were detected in the present study.

Relationship to other land

Site 112 is so small that its birdlife and many of its flying insects can meet only a small part of their habitat needs within the site. The fauna therefore move between the site and other nearby habitat. The location of nearby habitat sites is best seen on the key map on p. 1.

The closest habitat is on the opposite side of Evelyn Road, where there is an arm of B.J. Hubbard Reserve (Site 2). Northwest of there, there is a gap of less than 100 m to Loughies Bushland (Site 3) and then a fragmented corridor to Mullum Mullum Creek and the Yarra River.

To the southwest of Evelyn Road Reserve, the patchy habitat of Loughnan Hill (Site 110) lies 120 m away.

Otherwise, the habitat within one kilometre of Evelyn Road Reserve comprises little more than occasional remnant eucalypts and Australian native trees on nature strips and in residential gardens.

Bioregion: Gippsland Plain, bordering the Highlands - Southern Fall

Habitat type

The state government's mapping of pre-European vegetation types shows the following Ecological Vegetation Class (EVC) covering what is now Evelyn Road Reserve:

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion).

However, the present author has misgivings about this and feels the current-day vegetation better matches:

Valley Grassy Forest (EVC 47, **Vulnerable** in the bioregion).

The state government's vegetation mapping fails to recognise that there is any surviving native vegetation in Evelyn Road Reserve. The mapping of the pre-European vegetation as Valley Heathy Forest is only conjectural, based on landscape-scale factors without taking into account the vegetation that remains.

The following description of the vegetation's composition relates to the wild, indigenous plant species:

Canopy trees: Dominated variously by Red Box (*Eucalyptus polyanthemos*) or Yellow Box (*E. melliodora*). Bundy (*E. goniocalyx*) is also fairly abundant. Red Stringybark (*E. macrorhyncha*), Swamp Gum (*E. ovata*) and Narrow-leaved Peppermint (*E. radiata*) are each represented by one wild tree, though Narrow-leaved Peppermint is also represented by a group of several young, planted trees.

Lower trees: Cherry Ballart (*Exocarpos cupressiformis*) is fairly abundant in the treed areas. Black Wattle (*Acacia mearnsii*) and Blackwood (*A. melanoxylon*) and more localised. Lightwood (*Acacia implexa*) is probably present only due to planting.

Shrubs: Greatly depleted by mowing, represented only by scattered Sweet Bursaria (*Bursaria spinosa*) and a seedling of Shiny Cassinia (*Cassinia longifolia*).

Ferns: None.

Climbers: Coarse Dodder-laurel (*Cassytha* ?*melantha*) is dense on a single host tree.

Creepers: None seen.

Grasses, rushes and sedges: Much of the lawn is dominated by Clustered Wallaby-grass (*Rytidosperma racemosum*). Veined Spear-grass (*Austrostipa rudis*) and Weeping Grass (*Microlaena stipoides*) are also fairly abundant. Thatch Saw-sedge (*Gahnia radula*) and Toad Rush (*Juncus bufonius*) are quite localised. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is represented by two apparently wild plants in the northwest as well as some planted plants. A single plant of *Isolepis platycarpa* was seen in this study but it is presumably more abundant in more favourable seasons.

Other groundcover: Only Spreading Crassula (*Crassula decumbens*) was seen in this study. It is seasonally abundant in the barer areas of lawn.

Significant plants

Red Stringybark (*Eucalyptus macrorhyncha*) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. There are three living trunks of the species at Evelyn Road Reserve, almost touching each other and originating as basal sprouts of a tree whose original trunk died long ago. The surviving trunks are leaning and the crowns are in fair health. Their long-term survival is doubtful and mowing assures that no seedlings can establish.

Fauna habitat

- The reserve's native vegetation represents suitable habitat for a modest range of common birds, bats, other arboreal mammals and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including microbats;
- In the (scarce) unmown areas, the forest litter provides food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The leaf litter is also important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The reserve's vegetation is in poor ecological condition, held back by mowing and the near-absence of shrubs. It falls into category 'D' (poor) on the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not Significant

Site 112 at Evelyn Road Reserve appears not to meet any of the standard criteria for sites of biological significance because:

- It falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the reserve is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The site's small size and relative isolation from other habitat mean that the site does not appear to represent an ecological 'stepping-stone' or part of a habitat corridor (as per standard criteria 1.2.6) and there seems little likelihood of that changing (in the sense of standard criterion 1.3);
- Standard criterion 2 is not met because the site does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because: (a) the only significant species observed is Red Stringybark, which is represented by only three clones in fair health and doubtful viability; and (b) none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the site does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the site is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the site is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit reserve visitors and neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The semi-natural ambience of the site is expected to contribute to the enjoyment and wellbeing of visitors to the reserve. Those benefits are spread into neighbouring streets and gardens by birds, butterflies and other animals commuting to and from the reserve.

The site's vegetation contributes to the area's 'green and leafy' character. It also preserves something of the area's natural landscape. It, and the associated wildlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, the only discernible changes in the extent of habitat are a reduction of approximately 80 m² where a eucalypt has died and an increase of approximately 300 m² of revegetation in the northeastern corner.

Change in the ecological condition of habitat

Based on aerial photographs and flora data from 1996 and 2019, any changes in ecological condition since 1996 have been minor.

Threats

The only threats to the site's biodiversity identified in this study are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and
- Death and decline of eucalypts, whose prevalence over the next few decades is likely to be low. (Red Box, Yellow Box and Bundy are hardy species.) Any deaths are most likely to occur during droughts, which are predicted to worsen with climate change.

Strategic planning

Most of Evelyn Road Reserve is zoned Public Park and Recreation Zone' but the northern fringe is zoned 'Neighbourhood Residential Zone – Schedule 2'. Removal of trees above a threshold size is regulated by Schedule 3 of the Significant Landscape Overlay (SLO3). Removal of native vegetation (trees to groundcover) is regulated by the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

Those vegetation controls appear adequate, given that the site does not meet any of the state government's standard criteria for sites of biological significance.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately one hour of flora survey by the author on 18/1/19 and 5/11/19, including: (a) compiling a list of indigenous plant species and their abundances; (b) mapping the area in which the cover of native understorey exceeds 10%; and (c) assessing the site against the standard criteria for sites of biological significance;
- State government mapping of Ecological Vegetation Classes (EVCs);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated field data from the present author's flora survey on 13/3/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 113. Eva Burrows College, Ringwood
(Discontinued)

Biological Significance Level: *Not Significant*

Site description and changes

Site 113 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was 100 Maidstone Street Ringwood, which was (at the time) Southwood Primary School. The Salvation Army's Eva Burrows College now occupies the property.

The 1997 report recognised the site as being of Local significance because it had 'a population of several species of remnant eucalypts with no remaining understorey'. No recommendation was made for any specific planning protection.

Comparison of aerial photographs between 2001 and 2018 shows that approximately 3,300 m² of eucalypt cover was removed since 2001 for buildings and a car park. That loss was offset in a small way by the growth of remaining trees, most of which have been planted.

A site inspection for this study found at most two remaining species of remnant eucalypts. Mealy Stringybark (*Eucalyptus cephalocarpa*) is represented by roughly a dozen trees concentrated in the north of the property. Two of them have trunk diameters exceeding the 'benchmark' size of 70 cm. There are also one or two Yellow Box trees (*Eucalyptus melliodora*). There are substantial numbers of Bundy (*Eucalyptus goniocalyx*) but their trunk diameters and sizes on old aerial photographs suggest that they have been planted.

While the property was a school, substantial numbers of indigenous plants were planted in the site's north, around an oval. Many of those plants are now mature or almost so.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

Site 113 does not meet any of the standard criteria for sites of biological significance because:

- The site falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the site is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The limited amount of native vegetation and substantial distance to other habitat other than the abutting Proclamation Park (Site 111) mean that the site does not appear to represent an ecological 'stepping-stone' or part of a habitat corridor (as per standard criteria 1.2.6) and there seems little likelihood of that changing (in the sense of standard criterion 1.3);
- Standard criterion 2 is not met because the site does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because: (a) no significant species were observed; and (b) none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the site does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the site is not used for scientific research or long-term ecological monitoring; and

- Standard criterion 5.2 is not met because the site is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people at the college or living nearby. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's semi-natural ambience and the birds attracted to it are expected to contribute in a small way to the enjoyment and wellbeing of people at the college.

Those benefits are spread into neighbouring streets and gardens by birds moving between the site and other areas of habitat.

The vegetated landscape adds a 'green and leafy' character to a part of Ringwood that is generally poorly vegetated.

Strategic planning

The college is zoned 'General Residential Zone – Schedule 1'. The removal, destruction and lopping of native vegetation is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. The removal, destruction and lopping of canopy trees (native or not) is further regulated under Schedule 4 of the Significant Landscape Overlay.

Taking into account the site's type of vegetation and that it does not meet any of the standard criteria for a site of biological significance, there is no need to introduce any new planning controls.

Information sources

The analysis above draws on the following sources of information about the site:

- A site inspection for this study on 15/11/19;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2018.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 114. Jubilee Park, Ringwood

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries

On the aerial photograph above, Site 114 has dashed blue outlines and blue hatching. It comprises a small (630 m²) sliver of land at Aquinas College, parts of Jubilee Park with indigenous vegetation, and tree-covered sections of Greenwood Avenue within the park. As with all sites in this volume, the precise site boundaries are available in a shapefile for geographic information systems. The area with a dashed magenta boundary on the aerial photograph, shown as a 'patch of native vegetation', has a cover of native understorey exceeding 10%. It is discussed below in the section headed 'Biological significance ratings'.

Land use and tenure

Aquinas College is a Catholic secondary school. Jubilee Park is owned by Maroondah City Council. Most of the park is managed for recreation, the exceptions being:

- A nature conservation area, which includes the area outlined with magenta dashes on the aerial photograph and its extension southward to Reilly St; and
- A retarding basin for flood mitigation at the corner of Greenwood Avenue and Reilly Street.

General description

Jubilee Park covers 21.4 hectares, of which 7.9 hectares is included here in Site 114. The natural slope has a gentle gradient of typically 1:12 to the south-southeast. There have been extensive excavations to provide a retarding basin and level ground for the many sporting facilities and car parks seen on the aerial photograph above. A natural or near-natural terrain persists in these areas:

- Beside Gardini Avenue;
- To the north and northeast of the No. 2 Oval; and
- In the area outlined on the aerial photograph with a dashed magenta line, as well as to its south as far as Reilly Street.

A creek once flowed just outside the park's southeast corner, now filled in and replaced by a pipe. That corner of the park retains vestiges of the vegetation type known as 'Swampy Riparian Complex', augmented by revegetation conducted collaboratively between Maroondah City Council and Aquinas College. The remnant vegetation elsewhere in the park belongs to the regionally endangered vegetation type called 'Valley Heathy Forest'.

Westward from the Swampy Riparian Complex to the park's southwest corner, the vegetation is mostly planted, comprising various mixtures of indigenous and 'Australian native' trees over lawn or mulched garden beds.

As one heads north along Greenwood Avenue, after passing the middle of the No. 2 Oval, the vegetation on the western side of the road is dominated by remnant eucalypts and has varying densities of indigenous understorey. Some of that understorey has dense shrubs and remnant groundcover; other parts only have mown indigenous grasses and scattered wildflowers beneath the remnant eucalypts. Among those scattered wildflowers are scores of plants of the tiny annual, Water Blinks (*Montia fontana*), which is quite uncommon in metro Melbourne.

The vegetation next to the tennis club car park and fringing the Russell Lucas oval is dominated by a mixture of remnant eucalypts (some of them large and very old) and planted 'Australian native' eucalypts, with scant indigenous understorey. There are, however, more Water Blinks.

Completing a circuit of the site, the area on the aerial photograph with a dashed magenta outline contains forest with all strata of vegetation and at least 45 indigenous plant species.

Across the whole reserve, this study detected seventy-five naturally-occurring, indigenous plant species.

Relationship to other land

The site's habitat is not very extensive, so its birdlife and many of its flying insects can meet only part of their habitat needs within the site. They therefore move between the site and other nearby habitat.

During the fieldwork for this study just north of Heathmont Railway Station (Sites 29a and 29b), many forest birds (particularly parrots) were seen moving westward toward Jubilee Park while others came from that direction. Wieland Reserve (Site 119) is on the same alignment, midway between Jubilee Park and the habitat beside the railway line. It seems likely (but unproved) that birds use these sites as ecological 'stepping-stones'. Flying insects may do likewise. The birds and insects may also benefit from revegetation along the southern edge of Aquinas College and a scattering of mature eucalypts in residential gardens. It

is also possible that the canopy of mature eucalypts at Apex Park (260 m southeast of Jubilee Park) provide further attraction for native birds and insects to move through the area.

The movements of birds and flying insects may be important as carriers of pollen or seeds to Jubilee Park, improving the viability of the indigenous flora.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation below include only naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: The dominant species are Mealy Stringybark (*Eucalyptus cephalocarpa*), Bundy (*E. goniocalyx*), Messmate Stringybark (*E. obliqua*) and Narrow-leaved Peppermint (*E. radiata*). Only a single Red Stringybark (*E. macrorhyncha*) was found in this study.

Lower trees: Blackwood (*Acacia melanoxylon*) or Golden Wattle (*A. pycnantha*) are fairly dense in some areas. Black Wattle (*A. mearnsii*) is scattered thinly. Silver Wattle (*A. dealbata*) and Cherry Ballart (*Exocarpos cupressiformis*) are scarce.

Medium to large shrubs: Patchily dense, dominated variously by Sweet Bursaria (*Bursaria spinosa*) and/or Yarra Burgan (*Kunzea leptospermoides*). Sifton Bush (*Cassinia sifton*) is widespread in the site and fairly abundant overall. The following species are scarce: Hedge Wattle (*Acacia paradoxa*), Hop Wattle (*Acacia stricta*), Common Correa (*Correa reflexa*), Narrow-leaf Bitter-pea (*Daviesia leptophylla*) and Prickly Tea-tree (*Leptospermum continentale*).

Small shrubs: Present only in the conservation area north and east of the hockey and soccer pitch. Common Flat-pea (*Platylobium obtusangulum*) is fairly abundant there, while Grey Parrot-pea (*Dillwynia cinerascens*) and Erect Guinea-flower (*Hibbertia riparia*) are scarce.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) and Cotton Fireweed (*Senecio quadridentatus*) are localised but not scarce. A single plant of Shrubby Fireweed (*Senecio minimus*) was observed north of the multipurpose pavilion in 2014.

Ferns: Austral Bracken (*Pteridium esculentum*) is scattered, north of the No. 2 Oval.

Climbers: Common Apple-berry (*Billardiera mutabilis*) is fairly abundant. Small-leafed Clematis (*Clematis decipiens*) and Purple Coral-pea (*Hardenbergia violacea*) are very scarce.

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is scattered north of the multi-purpose pavilion and Kidney-weed (*Dichondra repens*) is fairly abundant north of the No. 2 Oval. Centella (*Centella cordifolia*) and the wood-sorrel *Oxalis exilis/perennans* are scarce.

Grasses, rushes and sedges: Abundant and rich in species. Mostly dominated by Thatch Saw-sedge (*Gahnia radula*), the broad-leafed form of Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*) or Clustered Wallaby-grass (*Rytidosperma racemosum*). Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), the fine-leafed subspecies of Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*) and Small Grass-tree (*Xanthorrhoea minor*) are also abundant in the more natural areas. Other conspicuous species are Mat Grass (*Hemarthria uncinata*), Pale Rush (*Juncus pallidus*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Smooth Wallaby-grass (*R. laeve*), Red-anther (or Silvertop) Wallaby-grass (*R. pallidum*), Slender Wallaby-grass (*R. penicillatum*), Bristly Wallaby-grass (*R. setaceum*) and Purplish Wallaby-grass (*R. tenuius*). Of the scarcer species, the following are ecologically informative: Slender Sword-sedge (*Lepidosperma gunnii*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Common Woodrush (*Luzula meridionalis* var. *flaccida*), Common Wallaby-grass (*Rytidosperma caespitosum*), Velvet Wallaby-grass (*R. pilosum*) and Kangaroo Grass (*Themeda triandra*).

Other groundcover: Common Cotula (*Cotula australis*), Spreading Crassula (*Crassula decumbens*) and Water Blinks (*Montia fontana* subsp. *chondrosperma*) are abundant north of the No. 2 Oval, with substantial numbers of Smooth Solenogyne (*Solenogyne dominii*) and Hairy Solenogyne (*Solenogyne gunnii*). Scented Sundew (*Drosera aberrans*) and Common Rice-flower (*Pimelea*

humilis) are also present there, but very scarce. East and north of the hockey and soccer pitch, Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*) and Black-anther Flax-lily (*Dianella revoluta*) are moderately abundant, while Tasman Flax-lily (*Dianella tasmanica*), Common Raspwort (*Gonocarpus tetragynus*) and Nodding Greenhood (*Pterostylis nutans*) are scarce.

Swampy Riparian Complex (EVC 126, **Endangered** in the Gippsland Plain bioregion)

Dominant canopy trees: Strongly dominated by Swamp Gum (*Eucalyptus ovata*). There is a single Narrow-leaved Peppermint (*E. radiata*) but it may well have been planted.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*). There are one or two Black Wattles (*Acacia mearnsii*) but they may have been planted.

Medium to large shrubs: The small number of shrubs present may all have been planted. The species are Hop Goodenia (*Goodenia ovata*), Yarra Burgan (*Kunzea leptospermoides*) and Manuka (*Leptospermum scoparium*).

Small shrub: None recorded.

Ferns: There is a dense patch of Austral Bracken (*Pteridium esculentum*).

Climbers: None seen.

Creepers: None seen.

Grasses, rushes and sedges: A small population of Green Rush (*Juncus gregiflorus*) and a single plant of Broom Rush (*Juncus sarophorus*) appear to be naturally-occurring. A scattering of Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) might have been planted. Planted species include Tall Sedge (*Carex appressa*), which is fairly abundant, and Common Tussock-grass (*Poa labillardierei*), which is scarce.

Other groundcover: None seen.

Significant plants

Critically endangered in Maroondah

- *Correa reflexa* var. *reflexa* (Common Correa) – two plants grow northeast of the multipurpose pavilion;
- *Eucalyptus macrorhyncha* (Red Stringybark) – a single tree grows north of the multipurpose pavilion;
- *Senecio minimus* (Shrubby Fireweed) – a single plant was recorded north of the multipurpose pavilion in 2014, possibly overlooked in this study's unexhaustive flora survey.

Regionally uncommon

- *Montia fontana* subsp. *chondrosperma* (Water Blinks) – abundant in rough lawn between the tennis court car park and the No. 2 Oval.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates, particularly where there is understorey. Some of the invertebrates become food for vertebrates such as lizards, bats and birds;
- Some eucalypts have hollows, which offer roost sites or nest sites for some animals;
- A few trees have nest boxes, which offer additional roost sites or nest sites;
- The value of the habitat features above is diminished by the site's relatively small area; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), approximately 0.15 ha of the vegetation north and east of the hockey and soccer pitch falls into rating 'B' (good). Another 0.62 ha in that area, and south to Reilly St, falls into

rating 'C' (fair). A further 0.2 ha (approximately) in rating 'C' lies north of the No. 2 Oval. The rest of the site's vegetation falls into rating 'D' (poor).

The condition of the site's living eucalypts is generally fair to good but there are many dead eucalypts.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The 0.5-hectare area outlined with a dashed magenta line on the aerial photograph on p. 729 has a native understorey cover of over 10%. It meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Jubilee Park fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Such a site is recognised by the standard criteria as having Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to different criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit park users and neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the park is expected to contribute to the enjoyment, wellbeing and childhood development of park users. The natural ambience also encourages people to get exercise in the park.

The site's vegetation contributes significantly to the 'green and leafy' character of the neighbourhood. It, and the associated birdlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Birds attracted to the site get there via the surrounding residential area, thereby enriching the birdlife experienced by residents in their daily lives.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017 reveals that during that period, approximately 0.045 hectares of tree and shrub cover has been created in the site's southeastern corner through revegetation. Along the southern edge of the park and east of the No. 2 Oval, there has been an increase of 0.30 hectares of eucalypt cover (principally indigenous species) where the 2001 aerial photograph shows only sparse, young saplings. The park also contains numerous eucalypts (indigenous and non-indigenous) that were semi-mature or mature in 2001 and have significantly grown to cover land that previously only had lawn or pavement. That growth represents a substantial increase in the extent of tree cover but it is impracticable to measure the increase of each tree and add them up to determine an aggregate figure.

Change in the ecological condition of habitat

Aerial photographs show that a substantial number of eucalypts at Jubilee Park died between 2001 and 2011, attributable to the Millennium Drought. A smaller number of additional eucalypts appear to have died between 2011 and 2017. The canopy health is now generally good to fair.

There appears to be no other data about the condition of Jubilee Park's habitat prior to this study. However, during the course of this study, the author noticed a significant change in the ground flora north of the No. 2 Oval during 2017–2018. Remnant indigenous wildflowers and grasses around the bases of some eucalypts were killed with herbicide and native grass and wildflowers became mown more frequently. These changes apparently resulted from a policy decision to make the area 'tidier'.

Threats

This study has identified the following threats to the site's biodiversity:

- Herbicide spraying of indigenous plants, particularly around the bases of trees;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Resumption of eucalypt deaths and consequent ecological disruption to understorey and fauna. Eucalypt deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Jubilee Park and the section of Greenwood Avenue running through it are zoned 'Public Park and Recreation Zone'. Aquinas College is zoned 'General Residential Zone – Schedule 1'.

Tree removal in the whole neighbourhood is regulated under Schedule 4 to the Significant Landscape Overlay (SLO4). In addition, removal of all native vegetation (trees to groundcover) in the park and Aquinas College is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. A Special Building Overlay applies to the retarding basin.

The part of Site 114 within Aquinas College is small and narrow. Its native vegetation seems unlikely to be under pressure for its removal because of its location next to the fence, elevated above the adjacent sports fields. The existing planning controls of SLO4 and clause 52.17 seem adequate.

By contrast, the part of Jubilee Park within Site 114 is much more extensive and has shown itself in recent years to attract development proposals. Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the part of Site 114 that lies within Jubilee Park.

Information sources

The analysis above draws on the following sources of information about the site:

- A total of 3 hours and 25 minutes of flora survey by the author on 13/6/18, 27/7/18, 28/7/18, 30/11/18 and 1/10/19, including (in part): (a) compiling four lists of indigenous and introduced plant species and their abundances, each covering a different part of the park; (b) documenting the details of rare or scarce plants; and (c) mapping the vegetation, rare plants and physical features;
- A flora survey and report titled *'Environmental Impacts of Proposed Vegetation Removal at Jubilee Park, Ringwood'* dated 10/2/14, dealing with vegetation immediately north of the soccer pavilion;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997);
- 'Fungimap' records of *Bolbitius titubans* in May 1991 and *Coprinus cornatus* in May 1989; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 115. Apex Park, Heathmont (Discontinued)

Biological Significance Level: *Not Significant*

Site description and changes

Apex Park occupies 4,411 m² on Great Ryrie Street in Heathmont. The 1997 report, *'Sites of Biological Significance in Maroondah'*, recognised the park as a site of (low) biological significance due to the almost complete cover of naturally-occurring, indigenous eucalypts. Beneath the trees was mown lawn. No indigenous understorey was noted.

When the park was inspected for this study on 18/1/19, the tree cover had increased slightly due to growth of the eucalypt crowns. Some of the lawn was dominated by the common indigenous grass species, Clustered Wallaby-grass (*Rytidosperma racemosum*). There were also clusters of the indigenous species, Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), as well as a few individuals of Bristly Wallaby-grass (*Rytidosperma setaceum*).

Although the park has a good cover of naturally-occurring, indigenous trees, no aspect of the site appears to meet any of the standard criteria of biological significance of Amos (2004). None of the vegetation qualifies as a 'patch' of native vegetation under the standard criteria, i.e. an unbroken area of at least 0.25 ha with native understorey cover of 10% or more. None of the plant species detected in the site are rare or threatened, locally or more widely. The park appears to be too small and modified from a natural state to serve as a significant ecological 'stepping-stone' in the sense of standard criterion 1.2.6.

The site therefore falls into the 'Not Significant' category in the scheme of Amos (2004).

However, the vegetation has value for amenity, natural heritage and the benefits of contact with nature (e.g. health, wellbeing and childhood development). None of these sorts of values are considered by Amos (2004).

Strategic planning

The removal, lopping and destruction of all indigenous plants in Apex Park is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. Trees are further protected by Schedule 3 of the Significant Landscape Overlay. These controls appear to provide adequate protection for the park's biodiversity; There appears to have been no deterioration since 1997 and there are no apparent threats that planning can avert.

If a permit application to remove vegetation arises, it should be considered alongside the information above.

Site 116. Mahon Reserve, Ringwood North (Discontinued)

Biological Significance Level: *Not Significant*



Aerial photograph taken February 2017

Boundaries

Site 116 occupies the small part of Mahon Reserve marked with a dashed blue outline on the aerial photograph above. The boundary follows the edge of the tree canopy of an area of native vegetation with indigenous understorey, including groundcover. The tiny amount of tree canopy that overhangs the pavement of Mines Road or private land to the north is excluded from the site. As with all sites in this volume, the precise site boundary is available in a shapefile for geographic information systems.

Land use and tenure

Part of Site 106 is on the nature strip of Mines Road, which is a Council road. There is no footpath. The rest of the site is in East Ringwood Reserve, which is Crown land used as a reserve for sport, gambling and entertainment. A small part of Site 106 in the south is used for car parking. The rest of the site in the reserve receives little use. None of the site is managed for nature conservation.

General description

Site 116 was originally described in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) under the reserve's former name, Hans Reserve. It was regarded as a site of Local biological significance with no need for specific recognition in the Maroondah Planning Scheme. The citation for its biological significance was:

- 'Remnant wetland and forest (Habitat Types 1 & 9 [= wetland and Valley Heathy Forest]);
- '37 indigenous plant species found, including *Acacia pycnantha* (Golden Wattle), *Lobelia alata* (Angled Lobelia) and *Triglochin striatum* (Streaked Arrow-grass).'

The parts of the reserve occupied by the abovementioned forest and wetland were not mapped in 1997. Aerial photographs from 2001 and 2018 show no discernible change in the extent of forest or wetland except for a minor expansion of the tree canopy due to growth of tree crowns over what was formerly just lawn. The boundary shown on the aerial photograph above therefore accords with the area of the original Site 116 in 1997. It encompasses an area of 1.0 hectares.

The site is part of a drainage reserve. The whole of Mahon Reserve once had a creek flowing northward through it but the creek has been replaced by a pipe and covered with soil. An artificial channel flows through the part of the reserve that forms Site 116 but it does not flow all year. An old dam wall is located near the northern end of Site 116.

Many Monterey Pines (*Pinus radiata*) were planted in and around Site 116 many decades ago. Many pines remain, intermingled with indigenous plants, but they have been removed from an area of approximately 750 m² over the past decade or so in the site's northwest. Many indigenous plants have regenerated where the pines have been removed, suggesting the potential for similar regeneration if more pines were to be removed. While the pines remain and grow, they are slowly outcompeting the indigenous plants. Some of the site has been revegetated with indigenous species.

Altogether, this study detected forty-four naturally-occurring, indigenous plant species plus four others that may or may not have been planted.

Relationship to other land

Site 116 is so small that its birdlife and many of its flying insects can meet only part of their habitat needs within the site. The birds and insects therefore need to move between the site and other nearby habitat.

The site is part of the headwaters of Anderson Creek. Starting 350 m northwest of the site, the creek banks have a variable cover of remnant vegetation through to Warrandyte. It is possible that some birds or insects flying along the vegetated corridor continue to Site 116.

The next-closest habitat is 400 m to the northeast at Monterey Bush Park (Site 6). The intervening landscape has very low habitat value.

Because of this rather low level of connectivity to other habitat, Site 116 is likely to be visited only by common, urban-adapted fauna except perhaps for rare occasions.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only naturally-occurring, indigenous plant species. Monterey Pines dominate much of the vegetation. This study's flora survey was conducted on 18/1/19 and therefore some species are likely to have gone undetected.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Yellow Box (*Eucalyptus melliodora*). Mealy Stringybark (*E. cephalocarpa*) and Bundy (*E. goniocalyx*) are also fairly abundant. There is a single Red Stringybark (*E. macrorhyncha*) and a few Narrow-leaved Peppermint (*E. radiata*).

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*). Black Wattle (*A. mearnsii*) is also fairly abundant. Golden Wattle (*A. pycnantha*) and Cherry Ballart (*Exocarpos cupressiformis*) are scarce. Silver Wattle (*A. dealbata*) is also scarce and appears to be present only through planting.

Medium to large shrubs: Hop Goodenia (*Goodenia ovata*) is moderately abundant. Other species are scarce, including Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*), Yarra Burgan (*Kunzea leptospermoides*) and Tree Everlasting (*Ozothamnus ferrugineus*). Hedge Wattle (*Acacia paradoxa*) is present but perhaps only through planting.

Small shrubs: None seen.

Shrubby herbs: Rough Fireweed (*Senecio hispidulus*) is very scarce.

Ferns: Austral Bracken (*Pteridium esculentum*) dominates the undergrowth in part of the site.

Climbers: Limited to a single Coarse Dodder-laurel (*Cassytha melantha*).

Creepers: Bidgee-widgee (*Acaena novae-zelandiae*) is scarce.

Grasses, rushes and sedges: Rich in species. In different areas, the groundcover is dominated by Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) or Clustered Wallaby-grass (*Rytidosperma racemosum*). The following species are fairly abundant or widespread through the site: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Pale Rush (*Juncus pallidus*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Weeping Grass (*Microlaena stipoides*). Green Rush (*Juncus gregiflorus*), Soft Tussock-grass (*Poa* ?*morrisii*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*) and Purplish Wallaby-grass (*Rytidosperma tenuius*) are scarce.

Other groundcover: Very depleted. This study's mid-January survey detected only Black-anther Flax-lily (*Dianella revoluta*), which is fairly abundant.

Swampy Riparian Complex (EVC 126, Endangered in the bioregion)

Canopy trees: A single Swamp Gum (*Eucalyptus ovata*).

Lower trees: Swamp Paperbark (*Melaleuca ericifolia*) dominates the vegetation along a drain.

Shrubs: None.

Ferns: None.

Scramblers: Angled Lobelia (*Lobelia anceps*) is fairly abundant along the artificial creek channel.

Grasses, rushes and sedges: At the time of the January 2018 flora survey, the club-rush *Isolepis platycarpa* formed a dense turf over many square metres. Tall Sedge (*Carex appressa*), Hollow Rush (*Juncus amabilis*) and the cumbungi *Typha orientalis*) were less abundant but not scarce. Joint-leaf Rush (*Juncus holoschoenus*) and Broom Rush (*Juncus sarophorus*) are scarce. The rush, *Juncus usitatus*, is present but presumably only due to planting, as the habitat does not suit this riverine species.

Other groundcover: Moonwort (*Lunularia cruciata*) is abundant. Water Plantain (*Alisma plantago-aquatica*), Lesser Joyweed (*Alternanthera denticulata*) and Robust Willow-herb (*Epilobium billardiereanum* subsp. *intermedium*) are fairly abundant. Hairy Willow-herb (*Epilobium hirtigerum*) was scarce at the time of the January 2018 flora survey but may be more abundant at other times.

Significant plants

Critically endangered in Maroondah

- *Eucalyptus macrorhyncha* (Red Stringybark) – a single tree in poor health;
- *Juncus holoschoenus* (Joint-leaf Rush) – a single plant.

Fauna habitat

- The structure and composition of the native vegetation represent mediocre habitat for common forest birds, bats, possums and invertebrates. The habitat value is heavily diminished by the abundance of pines except that Yellow-tailed Black-Cockatoos eat pine nuts; and
- Pacific Black Ducks and perhaps Australian Wood Ducks forage along the artificial creek.

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.2 ha of Site 116 falls into rating 'C' (fair) and the remainder (0.8 ha) falls into rating 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

Site 116 appears not to meet any of the standard criteria for sites of biological significance because:

- The site falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the site is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The site's small size and relative isolation from other habitat mean that the site does not appear to represent an ecological 'stepping-stone' or part of a habitat corridor (as per standard criteria 1.2.6) and there seems little likelihood of that changing (in the sense of standard criterion 1.3);
- Standard criterion 2 is not met because the site does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because: (a) the only significant species observed are two solitary plants of doubtful viability; and (b) none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the site does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the site is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the site is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation

benefit people visiting the site or living nearby. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The treed environment may contribute to the enjoyment of visitors to Mahon Reserve. It also adds a 'green and leafy' character to the otherwise sparsely-treed neighbourhood to the north, east and south of the site.

The site's location on a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Strategic planning

0.14 ha at the southern end of Site 116 is zoned 'Public Park and Recreation Reserve'. The rest of the site is zoned 'Public Use Zone – Service and Utility'. Throughout, native vegetation receives planning protection under clause 52.17 of the Victoria Planning Provisions. In addition, trees above a certain size are protected under Schedule 4 of the Significant Landscape Overlay (SLO4).

Because the site does not qualify as a site of biological significance under the state government's standard criteria, the existing planning protection for the site's vegetation appears adequate.

Information sources

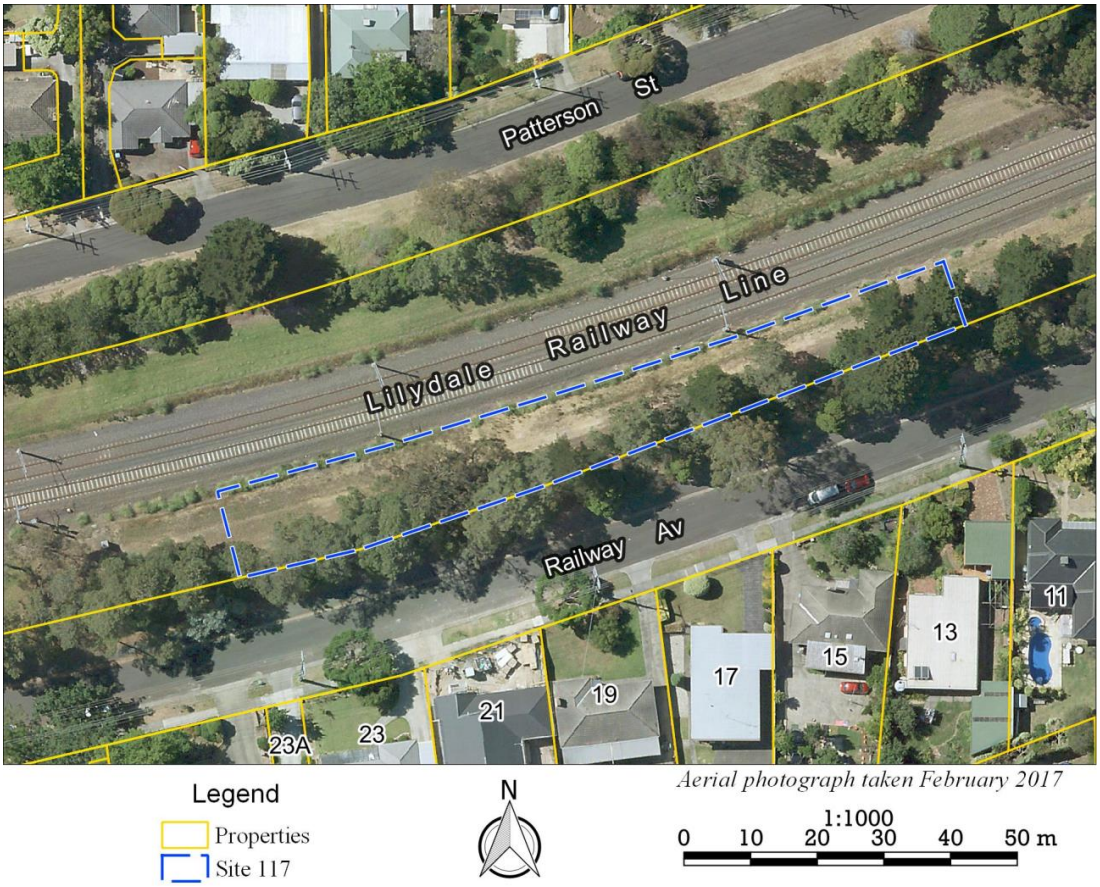
The analysis above draws on the following sources of information about the site:

- Approximately one hour of flora survey by the author, mainly on 18/1/19, including: (a) compiling two lists of indigenous plant species and their abundances – one for the forest and the other for the aquatic and semi-aquatic species in and beside the creek; (b) mapping the vegetation and scarce plants; and (c) checking for any other features relevant to this report;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated field data from the present author's flora survey in December 1995; and
- Aerial photographs from 1945, 2001, 2011, 2017 and 2018.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 117. Railway Verge opposite 13–23A Railway Avenue, Ringwood East

Biological Significance Level: *Local* due to a locally threatened bluebell species



Boundaries

Site 117 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) comprised native vegetation lining the Lilydale Railway Line beside Ringwood Secondary College and as far east as Dublin Road. The site was recognised as being of Local significance for the presence of 'a corridor containing patchy representation of remnant overstorey and understorey, best near the school'.

Since 1997, some native vegetation near the school has been lost and the state government has published more onerous criteria for sites of biological significance (Amos 2004). As a result, only a small part of the original Site 117 can still be regarded as biologically significant. That area – the new version of Site 117 – is outlined in dashed blue lines on the aerial photograph above. It extends from the invert of the gutter beside the tracks to the southern property boundary of the rail reservation. The western end is opposite the driveway of 23A Railway Avenue, Ringwood East and the eastern end is opposite the fence between 11 & 13 Railway Avenue.

Land use and tenure

The site is rail reserve, managed for the benefit of the train network and its users.

General description

The new version of Site 117 is 115 m long × 10–14 m wide, occupying 0.14 hectares.

Along the axis of the site is a strip of land typically 4 m wide that provides vehicular access for maintaining railway infrastructure. It has been built up above the natural terrain and has a gentle slope to the west. Much of it has exposed clay, as seen on the aerial photograph on the previous page. Most of the vegetation cover is from indigenous grasses, which are mown regularly. The grass's growth is reduced by soil compaction.

Between that strip and the northern site boundary is a cutting 1– 3 m wide and 1–3 m high. The cutting and its brow contain most of the indigenous plants that give the site its biological significance. There are hardly any non-indigenous plants on most the cutting. The wildflowers (including species uncommon in Maroondah) put on quite a display in spring until they are slashed. The main exception is the lowest half-metre or so of the cutting, which is periodically sprayed with herbicide.

The many indigenous plant species on the cutting are demonstrably tolerant of the slashing regime and they appear to benefit from the near-absence of introduced plants. This is in stark contrast to the railway cuttings between Eastlink and Ringwood Street (Site 109). There, herbicide spraying has been intense and frequent, leaving dense Gorse (*Ulex europaeus*) and very few indigenous plants.

Between the strip used for vehicular access and the site's southern edge, a slope descends to (or slightly below) the level of Railway Avenue. It supports five Mealy Stringybarks (*Eucalyptus cephalocarpa*) and small colonies of indigenous ground flora species such as Trim Sun-orchids (*Thelymitra peniculata*), Sheep's-burr (*Acaena echinata*) and Black-anther Flax-lily (*Dianella revoluta*). Planted pines and non-indigenous trees overhang the slope. The abutting roadside vegetation just outside the site contains a number of weedy species that extend onto the slope.

Within the site as a whole, this study detected forty-three naturally-occurring, indigenous plant species.

An aerial photograph from 1945 shows that the site abutted bushland at the time, whereas the (now very weedy) strip immediately to the east abutted an orchard.

Relationship to other land

The area outside the version of Site 117 adopted here but inside the original (much larger) version, there are populations of a few of the more common indigenous plant species in the current version, mainly Mealy Stringybark, Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and wallaby-grasses (*Rytidosperma* species). Interbreeding within those species is likely.

For most of the other indigenous plant species in the new version of Site 117, the closest other members of their species are 250–650 m to the west at Ringwood Lake Park (Site 26) and/or Bedford Park (Site 27). Distances as large as that raise concerns about genetic isolation, particularly when the site itself is so small. Evidently, the surviving species are able to persist well despite the site's relative isolation.

Site 117 provides quite limited habitat for indigenous fauna other than insects. Faunal movements between Site 117 and elsewhere therefore appear likely to be quite limited.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only the more abundant or ecologically informative indigenous plant species. It is hoped that the full set of flora data will be made available online.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion).

Canopy trees: Reduced to a few Mealy Stringybark (*Eucalyptus cephalocarpa*). Nearby along the railway line are Bundy (*E. goniocalyx*), Messmate Stringybark (*E. obliqua*) and Narrow-leaved Peppermint (*E. radiata*).

Lower trees: None within the site, but a Black She-oak grows 30 m west-southwest of the site and Black Wattle (*Acacia mearnsii*) and Golden Wattle (*Acacia pycnantha*) grow on the other side of the tracks.

Medium to large shrubs: Severely depleted, reduced to four Myrtle Wattle (*Acacia myrtifolia*) and a few Sifton Bush (*Cassinia sifton*). Yarra Burgan (*Kunzea leptospermoides*) grows nearby along the railway line.

Small shrubs: Reduced to one species – Common Flat-pea (*Platylobium obtusangulum*), which is abundant.

Shrubby herbs**:** Cotton Fireweed (*Senecio quadridentatus*) is fairly abundant. Stony Fireweed (*Senecio phelleus*) and an unidentified fireweed are both scarce.

Ferns: None seen.

Climbers: None seen.

Creepers: the wood-sorrel, *Oxalis exilis/perennans*, is fairly abundant. Creeping Bossiaea (*Bossiaea prostrata*) is scarce.

Grasses, rushes and sedges: Abundant and moderately rich in species. The cutting is dominated by the broad-leafed form of Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Kangaroo Grass (*Themeda triandra*). Kangaroo Grass is also one of the dominant species on the strip used for vehicle access, along with Clustered Wallaby-grass (*Rytidosperma racemosum*). Purplish Wallaby-grass (*Rytidosperma tenuius*) is abundant in both those areas. Thatch Saw-sedge (*Gahnia radula*), Bristly Wallaby-grass (*Rytidosperma setaceum*) and the narrow-leafed form of Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*) are fairly abundant. Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*) and Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) are scarce.

Other groundcover: Common Rice-flower (*Pimelea humilis*) and Tadgell's Bluebell (*Wahlenbergia multicaulis*) are abundant. The Sheep's-burr *Acaena echinata*, Common Raspwort (*Gonocarpus tetragynus*) and Trim Sun-orchid (*Thelymitra* ?*peniculata*) are fairly abundant. Button Everlasting (*Coronidium scorpioides*), Spreading Crassula (*Crassula decumbens*), Black-anther Flax-lily (*Dianella revoluta*) and Grass Trigger-plant (*Stylidium graminifolium*) are scarce.

Significant plants

Critically endangered in Maroondah

Wahlenbergia multicaulis (Tadgell's Bluebell) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Site 117 contained 100 or so of them when inspected in this study. That is by far the largest known population in Maroondah. Interestingly, the only two other populations recorded in Maroondah in twenty years are also beside railway lines – seven plants near Churchill Road, Croydon and four plants near The Greenway, Heathmont. The plants in Site 117 include all age groups from seedlings to large plants.

Fauna habitat

The site provides little habitat for indigenous fauna but the wildflowers provide nectar and pollen for native bees and other pollinating insects.

Ecological condition

On the A–D scale of ecological condition used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), Site 117's cutting fits category 'C' (fair) and the rest fits category 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Threatened plant species

Referring to the section above headed 'Significant plants', Site 117's population of 100 or so *Wahlenbergia multicaulis* fits the description in standard criterion 3.1.5, 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. This gives the site a Local significance rating.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The site's vegetation, and particularly its wildflowers, preserve something of the area's natural landscape. They help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Comparing aerial photographs between 2001 and 2017, there is no visible change over that period in the vegetation within the new version of Site 117. Within the much larger, original version of Site 117, approximately 0.12 hectares of native vegetation was cleared to extend the playing fields at Ringwood Secondary College.

This study found no prior records of what species were present in the current version of Site 117 previously and only a brief, one-sentence description of the nature of the vegetation within the whole of the original version of Site 117. It is therefore not possible to draw further conclusions about what changes have occurred.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- A possible future increase in the used of herbicide spraying, as has happened in some other parts of the railway system (e.g. Site 109);
- Displacement of indigenous flora by introduced plants ('environmental weeds'). The most serious threat is from Bulbil Watsonia (*Watsonia meriana* subsp. *bulbillifera*), of which there is a large, dense infestation immediately to the east (with a few outliers within the site). Pampas Grass (*Cortaderia selloana*) and Montpellier Broom (*Genista monspessulana*) also appear to represent a threat; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The reserve is zoned 'Public Use Zone 4 - Transport'. Removal of trees above a certain size is regulated under Schedule 4 of the Significant Landscape Overlay and removal of all native vegetation is controlled under the state-wide controls of clause 52.17 of the Victoria Planning Provisions. However, exemptions to those planning controls mean that they have little practical effect in a railway reservation.

Because of the high significance of the site for the survival of Tadgell's Bluebell in Maroondah, it is recommended to apply the proposed schedule ESO1 of the Environmental Significance Overlay to the site

(see Section 11.1.2 of Volume 1). Although the overlay would be subject to exemptions that limit its legal implications, it would at least highlight the site's importance.

Information sources

The analysis above draws on the following sources of information about the site:

- Site inspections for this study on 24/9/19 and 1/10/19;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 118. Former Eastern Secondary College, Heathmont (Discontinued)

Biological Significance Level: *Not Significant*

Site 118 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was a treed part of the Eastern Secondary College, which has since been cleared and developed for housing. Local significance was attributed to the presence of 'A population of several species of remnant eucalypts, with a few understorey species'. None of those attributes remain and this study found no attributes meeting the standard criteria for sites of biological significance (Amos 2004). The biological significance level is therefore 'Not significant'.

Strategic planning

There are no strategic planning implications.

Site 119. Wieland Reserve, Heathmont

Biological Significance Level: *Local* due to a locally threatened eucalypt species and because the reserve acts as an ecological 'stepping-stone'



Boundaries, land use and tenure

Site 119 comprises the areas of native vegetation at Wieland Reserve (15 Dresden Avenue), Heathmont, as outlined with dashed blue outlines above. The reserve is owned by Maroondah City Council, who manages it for flood mitigation, recreation and nature conservation. There is a playground.

General description

Wieland Reserve occupies 8,716 m², of which, 6,260 m² is within Site 119. As marked on the aerial photograph above, a creek once ran from the southeast corner to the northwest. The creek has been replaced by a pipe and a dam has been erected across it to create a retarding basin. The path in the western third of the reserve follows the crest of the dam. There is an 8 m difference in elevation between the reserve's highest point (the northeast corner) and the lowest point (near the northwest corner).

Despite the reserve's history of clearing, excavation and mowing, native vegetation has regenerated. This study detected thirty-six naturally-occurring, indigenous plant species. The vegetation is representative of the listed endangered vegetation type, 'Valley Heathy Forest', albeit rather modified from a natural state. In recent years, some areas have been relieved of slashing. There has also been extensive planting of indigenous species and removal of introduced species.

Relationship to other land

The reserve is so small that its birdlife and many of its flying insects can meet only part of their habitat needs within the reserve. They therefore move between the reserve and other nearby habitat.

Without protracted observations, one can only presume that the main faunal movements to and from Wieland Reserve are *en route* between habitat along the Belgrave Railway Line (Sites 29a, 29b and 29d, 180 m to the east) and at Jubilee Park (Site 114, 460 m west). There is basic habitat between Wieland Reserve and Jubilee Park in the form of revegetation along the southern boundary of Aquinas College and some mature eucalypts in residential gardens. It is also possible that the canopy of mature eucalypts at Apex Park (240 m southwest of Wieland Reserve) provide further attraction for native birds and insects to move through the area.

The movements of birds and flying insects are likely to be important as carriers of pollen or seeds to Wieland Reserve, improving the viability of the indigenous flora.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: The dominant species are Mealy Stringybark (*Eucalyptus cephalocarpa*), Bundy (*E. goniocalyx*) and Narrow-leaved Peppermint (*E. radiata*). Red Stringybark (*E. macrorhyncha*) and Messmate Stringybark (*E. obliqua*) are slightly less abundant.

Lower trees: Blackwood (*Acacia melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are fairly abundant. Silver Wattle (*A. dealbata*) is dense in the east but apparently only due to planting.

Medium to large shrubs: There are substantial numbers of Sweet Bursaria (*Bursaria spinosa*), Yarra Burgan (*Kunzea leptospermoides*) and Golden Bush-pea (*Pultenaea gunnii*). There are also two Large Kangaroo Apples (*Solanum laciniatum*).

Small shrubs: Extremely depleted, represented only by a solitary Common Flat-pea (*Platylobium obtusangulum*).

Ferns: Austral Bracken (*Pteridium esculentum*) is a dominant species of the undergrowth in parts of the reserve.

Climbers: Coarse Dodder-laurel (*Cassytha melantha*) is moderately abundant. Wonga Vine (*Pandorea pandorana*) is scarce and is better regarded as present due to the species' rapid expansion in range rather than an indigenous species.

Creepers: None seen.

Grasses, rushes and sedges: Abundant and moderately rich in species. Mostly dominated by Thatch Saw-sedge (*Gahnia radula*). Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Weeping Grass (*Microlaena stipoides*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are also abundant. The following species are also abundant: Short-stem Sedge (*Carex breviculmis*), Mat Grass (*Hemarthria uncinata*), Pale Rush (*Juncus pallidus*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Slender Wallaby-grass (*Rytidosperma penicillatum*). There are small numbers of Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), the fine-leafed subspecies of Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*), Red-anther (or Silvertop) Wallaby-grass (*R. pallidum*), Common Bog-rush (*Schoenus apogon*) and Small Grass-tree (*Xanthorrhoea minor*).

Other groundcover: Very depleted. The only representative detected in this study were small numbers of Black-anther Flax-lily (*Dianella revoluta*), Small St John's Wort (*Hypericum gramineum*) and Grass Trigger-plant (*Stylidium armeria*).

Significant plants

Red Stringybark (*Eucalyptus macrorhyncha*) falls into the 'critically endangered' category of risk of dying out in Maroondah. Nine of them (plus one dead one) occur in Wieland Reserve, varying in health between good and poor. (Their leaves are mostly heavily browsed by possums.) Red Stringybark is a dominant species nearby at F.J.C. Rogers Reserve (Site 29a) and the Heathmont Railway Station Sanctuary (Site 29b). Interbreeding between all three sites is likely.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The native vegetation and its litter provide food and cover for invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The value of the habitat features above is diminished by the site's small area; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the site's vegetation is divided roughly equally into categories 'C' (fair) and 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Locally threatened plant species

Referring to the section above headed 'Significant plants', the population of Red Stringybark in Site 119 fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 119 at Wieland Reserve fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Such a site is recognised by the standard criteria as having Local significance.

Regionally threatened Ecological Vegetation Classes

Although the reserve's vegetation belongs to a regionally endangered type, it occupies too small an area to meet the standard criteria for significance in that respect. However, the area is only slightly too small. The site would achieve State significance if a single, contiguous area of the native vegetation were to meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more.

The 'Local' significance rating is the same as was given in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997).

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit reserve visitors and neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation contributes to the 'green and leafy' character of the neighbourhood. It, and the associated birdlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Birds attracted to the site get there via the surrounding residential area, thereby enriching the birdlife experienced by residents in their daily lives.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017 reveals that the reserve lost approximately 0.1 hectares of tree cover during that period. A substantial part of that loss appears to have been Sweet Pittosporums (*Pittosporum undulatum*), which are environmental weeds. Some of the remainder was due to deaths of eucalypts during the Millennium Drought.

Change in the ecological condition of habitat

The *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) did not record any indigenous species of groundcover. That was because Sweet Pittosporums and Ivy (*Hedera helix*) were smothering some of the groundcover and mowing was suppressing the rest. The removal of many of the Sweet Pittosporums and the reduction of mowing have significantly improved the ecological condition of the vegetation and the wildlife habitat it forms.

Threats

This study has identified the following threats to the site's biodiversity (in decreasing order):

- Rampant growth of environmental weeds, particularly Sweet Pittosporum (*Pittosporum undulatum*), Ivy (*Hedera helix*) and suckering Silver Wattle (*Acacia dealbata*);
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Eucalypt deaths and consequent ecological disruption to understorey and fauna. There are clear signs of excessive browsing by possums. Eucalypt deaths will occur mainly during droughts, which are predicted to worsen with climate change. Removal of the environmental weeds just mentioned would reduce the possum problem and the competition for soil moisture during droughts;
- Mowing of certain areas with indigenous groundcover plants (but noting that mowing is important in other areas); and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The reserve is zoned 'Public Park and Recreation Zone'. Its surroundings are zoned 'Neighbourhood Residential Zone – Schedule 3'.

Tree removal in the whole neighbourhood is regulated under Schedule 3 to the Significant Landscape Overlay. In addition, removal of all native vegetation (trees to groundcover) in the reserve is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

The reserve's biological significance is at the lower end of the scale and the abovementioned threats to its biodiversity are unable to be controlled through the planning scheme. The present author sees no strong argument one way or the other regarding the application of an overlay to the reserve. One objective of doing so could be to raise recognition of the reserve's significance. If Council wishes to apply an overlay, it would be appropriate to apply the proposed schedule ESO1 discussed in Section 11.1.2 of Volume 1.

Information sources

The analysis above draws on the following sources of information about the site:

- A flora survey by the author on 17/2/18, 26/5/18 and 24/9/19, including (in part) compilation of a list of indigenous and introduced plant species and the abundance of each species;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 120. Skyline Place, Heathmont

Biological Significance Level: *Local* due to the presence of locally threatened eucalypts



Boundaries, land use and tenure

Site 120 comprises the area outlined with a dashed blue line above. It is part of Lot CM1 PS823883, which is also known as Skyline Place, Heathmont. It is common property under a body corporate, who is responsible for managing the vegetation within Site 120 as a 'native vegetation offset' (see below).

General description

Site 120 measures 1,943 hectares at the corner of Frances Street and Erica Crescent in Heathmont. The original version of the site in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was much larger, comprising the treed parts of the grounds of what was, at the time, Heathmont Primary School. It was regarded as locally significant for its 'population of four species of remnant eucalypts, with no remaining understorey'.

An aerial photograph from 2001 shows that most of the school buildings had been demolished by then but the trees remained. Most of the indigenous eucalypts remain today despite residential development. The

former school has been subdivided into 23A Erica Crescent, the 'Skyline Place' residential estate and properties to the east of Skyline Place. Site 120 is the part of Skyline Place that has been set aside as an 'offset' for loss of native vegetation elsewhere on the land. The offset area is required to be managed for nature conservation for a period of ten years.

Although the site inspection in 1996 did not detect any native understorey in the schoolgrounds, the 2019 inspection for this study found twenty indigenous understorey species in the smaller area retained here as Site 120. Those species ranged from Golden Wattle (*Acacia pycnantha*) to wildflowers such as the Trim Sun-orchid (*Thelymitra peniculata*) and Small St John's Wort (*Hypericum gramineum*). One or two indigenous species may have been planted.

Altogether, this study detected twenty-three naturally-occurring, indigenous plant species – overstorey and understorey.

Interestingly, in January 2019, the nature strip of Erica Crescent contained at least five indigenous species of Wallaby-grass (*Rytidosperma*) and a few other hardy indigenous species. By September, the nature strip had been laid bare and become dominated by introduced grasses and weeds.

Relationship to other land

The site is so small that its birdlife and many of its flying insects can meet only a small part of their habitat needs within the site. The fauna therefore move between the site and other nearby habitat.

Some additional eucalypt habitat remains from the former primary school, both within the Skyline Place subdivision and to its west (23A Erica Crescent) and east. Those trees can be seen on the aerial photograph on the previous page. They include a mixture of remnant trees and planted, non-indigenous eucalypts. There is no associated native understorey. Some of the eucalypts on 23A Erica Crescent may well be removed shortly for construction of a house.

The nearest habitat with native understorey is approximately 300 m away at Heathmont Reserve (Site 31), Apex Park (Site 115) and Wieland Reserve (Site 119). The next-closest habitat is just over 400 m away beside the Belgrave Railway Line near Heathmont Station (Sites 29a, 29b and 29d).

Between these patches of habitat, there is very little habitat other than for fauna adapted to urban environments.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: The dominant species are Bundy (*Eucalyptus goniocalyx*), Red Stringybark (*E. macrorhyncha*) and Messmate Stringybark (*E. obliqua*), in similar proportions to each other.

Lower trees: The only understorey trees are five Golden Wattles (*Acacia pycnantha*).

Medium to large shrubs: There are a number of Yarra Burgan (*Kunzea leptospermoides*). Sifton Bush (*Cassinia sifton*) is scarce and there is a single Narrow-leaf Bitter-pea (*Daviesia leptophylla*).

Small shrubs: None seen.

Shrubby herb: Cotton Fireweed (*Senecio quadridentatus*) is scarce.

Ferns: None seen.

Climbers: None seen.

Creepers: None seen.

Grasses, rushes and sedges: Weeping Grass (*Microlaena stipoides*) is abundant. The following species are in substantial numbers: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Clustered Wallaby-grass (*Rytidosperma racemosum*) and

Bristly Wallaby-grass (*R. setaceum*). Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Spiny-headed Mat-rush (*L. longifolia* subsp. *longifolia*), Soft Tussock-grass (*Poa morrisii*) and Smooth Wallaby-grass (*Rytidosperma laeve*) are scarce.

Other groundcover: Very depleted. All species are scarce: Chocolate Lily (*Arthropodium strictum*), Spreading Crassula (*Crassula decumbens*), Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (*Gonocarpus tetragynus*), Small St John's Wort (*Hypericum gramineum*) and Trim Sun-orchid (*Thelymitra* ?*peniculata*).

Significant plants

Red Stringybark (*Eucalyptus macrorhyncha*) falls into the 'critically endangered' category of risk of dying out in Maroondah. Fourteen of them were counted in Site 120, as well as two on the property to the west (23A Erica Crescent). They vary in health between good and poor, some of them heavily browsed by possums.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates;
- The native vegetation and its litter provide food and cover for invertebrates, some of which are likely to become food for vertebrates such as lizards, bats and birds;
- The value of the habitat features above is diminished by the site's small area; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the site's vegetation falls into category 'C' (fair).

Biological significance rating

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Locally threatened plant species

Referring to the section above headed 'Significant plants', the fourteen Red Stringybark trees in Site 120 fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit local residents. As part of the 'urban forest', the trees also make a small contribution toward reducing the urban heat island effect and sequestering carbon dioxide from the atmosphere.

The tree canopy probably encourages some forest birds such as Eastern Rosellas and Australian King-Parrots into the area and hence into the lives of nearby residents.

The site's vegetation gives the neighbourhood a 'green and leafy' character. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Threats

This study has identified the following threats to the site's biodiversity (in decreasing order):

- Displacement of indigenous plants by environmental weeds, particularly Sweet Pittosporum and Montpellier Broom;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Eucalypt deaths and consequent ecological disruption to understorey and fauna. There are clear signs of excessive browsing by possums. Also, the trees are unnaturally close together, creating strong competition among all the eucalypts and other indigenous plant species. Eucalypt deaths will occur mainly during droughts, which are predicted to worsen with climate change. Removal of the Sweet Pittosporums just mentioned would reduce the possum problem and the competition for soil moisture during droughts; and
- Loss of plant species with low populations (e.g. the solitary *Daviesia leptophylla*) due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The site is zoned 'Neighbourhood Residential – Schedule 3'. The removal, lopping or destruction of trees above a threshold size (including the remnant eucalypts) is regulated under Schedule 4 of the Significant Landscape Overlay. As an 'offset' site, the native vegetation is required to be managed for nature conservation for a period of ten years and allowed to remain indefinitely.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the site, as outlined with a dashed blue line on the aerial photograph on p. 753.

Information sources

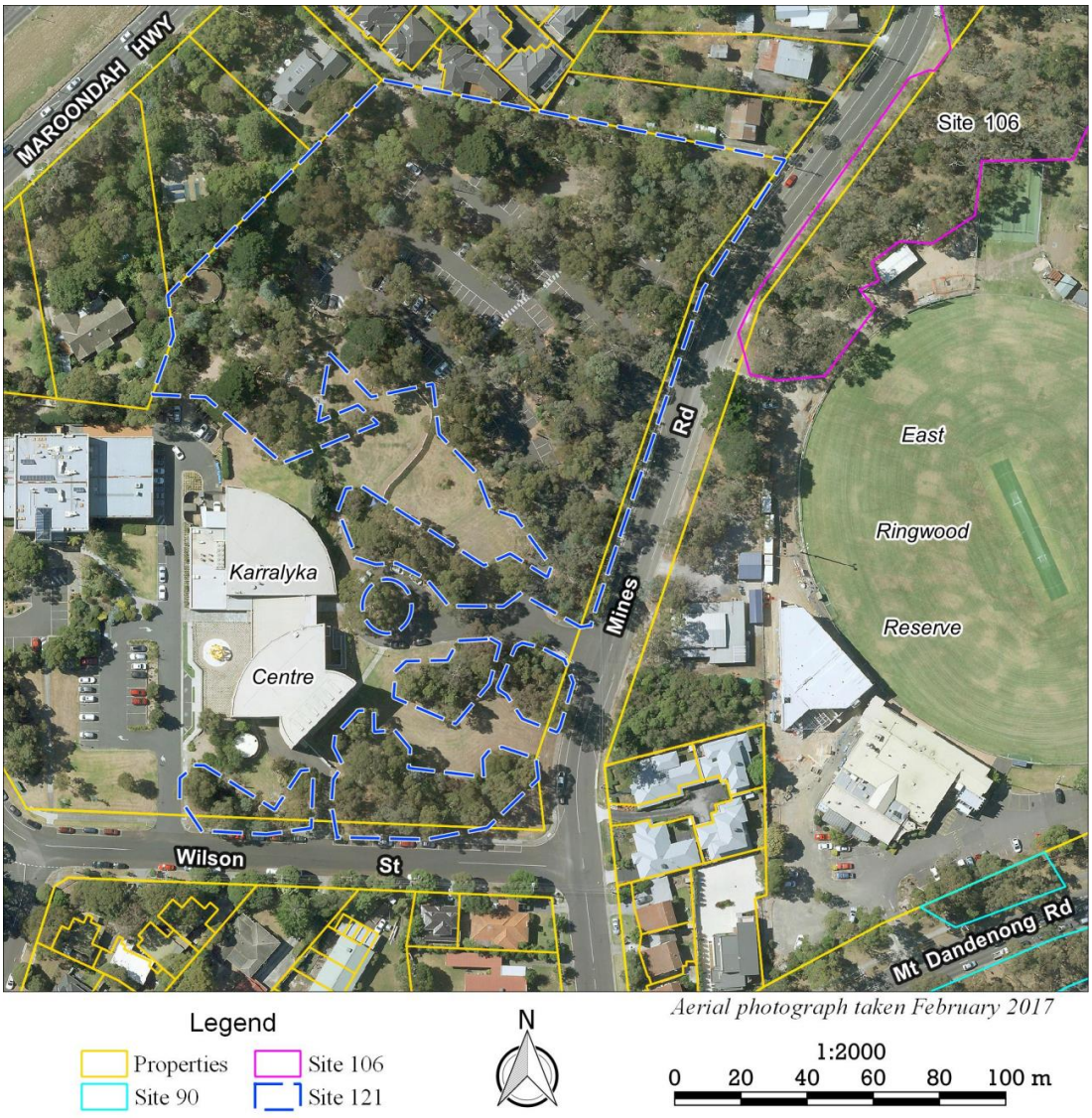
The analysis above draws on the following sources of information about the site:

- A flora survey by the author on 18/1/19 and 24/9/19, including (in part) compilation of a list of indigenous and introduced plant species and the abundance of each species;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 121. Karralyka Centre Grounds, Ringwood East

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundaries

The six polygons that make up Site 121 are marked with dashed blue outlines on the aerial photograph above. Where yellow can be seen in the gaps between the dashes, the boundary coincides with a property boundary. Elsewhere, the boundary has been drawn to follow the edge of the canopy of habitat trees. As with all sites in this volume, the precise site boundary is available in a shapefile for geographic information systems.

Land use and tenure

Part of Site 121 is on the nature strips of Mines Road and Wilson Street, which are Council roads. The rest of the site is Crown land, used by Maroondah City Council for the grounds and car park of the Karralyka Centre (a community entertainment facility).

General description

Site 121 covers a total of 2.0 hectares. Nearly all the site has a gentle slope of typically 1:11 facing east. The exceptions are that the land is almost flat in the far northwest and there is a steep batter next to part of the Mines Road footpath.

A 1945 aerial photograph shows that the site had immature regrowth of native vegetation. The current site of the Karralyka Centre buildings was bare as a legacy of a former antimony mine, which is depicted on geological survey maps. Some of the eucalypts in the 1945 aerial photograph are now large trees and some of the native understorey persists around the current-day car park, particularly in the northeast. There are also wild, indigenous plants scattered thinly across the lawns around the Karralyka Centre but they may have immigrated from elsewhere. In total, this study detected thirty-one naturally-occurring, indigenous plant species.

The site's remnant vegetation has been complemented by extensive planting of shrubs and groundcovers, most of which are of indigenous species. The southern half of the site has been planted with a mixture of indigenous and Australian native trees and shrubs, providing complementary fauna habitat to the remnant vegetation in the north and across Mines Road.

Relationship to other land

Site 121 is so small that its birdlife and many of its flying insects can meet only part of their habitat needs within the site. The birds and insects therefore move between the site and other nearby habitat.

The main area of nearby habitat for birds and insects is across Mines Road in East Ringwood Reserve (Site 106), where there are indigenous eucalypts, shrubs and groundcover. From a habitat point of view, Sites 106 and 121 form a single site, but they are separated here because of their different land uses. The next-closest fauna habitat is along Mount Dandenong Road (Site 90), which provides a link to Ringwood Lake Park (Site 26). After that, the next-closest sites are the habitat corridor along Mullum Mullum Creek (Site 24, 310 m to the north) and Dublin Road Reserve (Site 122, 330 m to the north). The spatial relationship between these sites can be seen on the key map on p. 1.

Forest birds such as rosellas can be readily seen moving between Sites 90, 106 and 121. It seems likely that those birds, and some flying insects, also commute to and from other sites in the area. The sites can therefore be viewed as a network of ecological 'stepping-stones' for fauna movements.

The movements of birds and flying insects between these sites may improve the viability of the indigenous flora in each site, through pollination and transport of seeds.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only naturally-occurring, indigenous plant species. This study's flora survey was conducted on 18/1/19 and therefore some species are likely to have gone undetected.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Bundy (*Eucalyptus goniocalyx*). Mealy Stringybark (*E. cephalocarpa*) and Narrow-leaved Peppermint (*E. radiata*) are also conspicuous.

Lower trees: Dominated by Silver Wattle (*Acacia dealbata*), which may have been planted, as it was not seen in a 1996 flora survey. Black Wattle (*A. mearnsii*) and Blackwood (*A. melanoxylon*) are fairly abundant.

Medium to large shrubs: Sifton Bush (*Cassinia sifton*), Hop Goodenia (*Goodenia ovata*), Yarra Burgan (*Kunzea leptospermoides*) and Manuka (*Leptospermum scoparium*) are fairly abundant. Sweet Bursaria (*Bursaria spinosa*) and Narrow-leaf Bitter-pea (*Daviesia leptophylla*) are scarce. In 1996,

there was also Myrtle Wattle (*Acacia myrtifolia*), Common Heath (*Epacris impressa*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: Common Flat-pea (*Platylobium obtusangulum*) is the only wild, small shrub species and it is very scarce.

Shrubby herbs: Shrubby Fireweed (*Senecio minimus*) and Rough Fireweed (*Senecio hispidulus*) were both very scarce during the January 2019 flora survey but they may well be more abundant in other seasons or years.

Ferns: Austral Bracken (*Pteridium esculentum*) dominates the understorey in part of the site.

Climbers: Represented only by a single Purple Coral-pea (*Hardenbergia violacea*).

Creepers: None seen in 2019 but Shining Pennywort (*Hydrocotyle sibthorpioides*) and Swamp Isotome (*Isotoma fluviatilis*) grew in the lawn in 1996 and the latter still grows in lawn on the western side of the Karralyka Centre.

Grasses, rushes and sedges: Some of the lawn is dominated by Clustered Wallaby-grass (*Rytidosperma racemosum*). Elsewhere, the following species are fairly abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Weeping Grass (*Microlaena stipoides*) and Purplish Wallaby-grass (*Rytidosperma tenuius*). Pale Rush (*Juncus pallidus*), Variable Sword-sedge (*Lepidosperma laterale*) and Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) are scarce and there is a patch of a rare hybrid wallaby-grass (*Rytidosperma*). (There are also abundant planted Spiny-headed Mat-rushes.) Six other species were detected in 1996 and may have gone undetected in the 2019 flora survey for seasonal reasons.

Other groundcover: Very depleted. This study's mid-January 2019 survey detected only Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*) and Yellow Rush-lily (*Tricoryne elatior*), all of them scarce. Three other species were detected in 1996, two of which could easily have gone undetected in the 2019 survey for seasonal reason.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 121 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Chiloglottis jeanesii* (Mountain Bird-orchid) – From 1996 until the 2000s, a patch grew in a garden next to the yellow sculpture at the western entrance to the Karralyka centre (just outside Site 121). It was presumably introduced in 'mountain soil'. It was the only known occurrence in Maroondah's history. It was killed with herbicide as part of gardening;
- *Isotoma fluviatilis* (Swamp Isotome) – Patches grew in the lawn just northeast of the Karralyka Centre building in the 1990s and early 2000s but they died out during the Millennium Drought. A tiny patch now grows in lawn on the opposite side of the building, just outside Site 121; and
- *Senecio minimus* (Shrubby Fireweed) – A single plant was found during the January 2019 flora survey but the species may well be more abundant in other seasons or years.

Significant hybrid

On the brow of a batter next to Mines Road, there is a patch of a wallaby-grass (*Rytidosperma*) with long rhizomes covering roughly 1 m². It appears to produce no pollen. The author collected a specimen (*G.S.Lorimer 1195*) from the same patch in 1996. The specimen is in the collection at the National Herbarium of Victoria. The only wallaby-grass that botanical literature recognises to produce long rhizomes is *Rytidosperma lepidopodum*, which the present author regards as a mixture of hybrids that collectively involve three or more species. The plant in Site 121 appears to be slightly outside the broad range of characters encompassed by herbarium specimens placed within *R. lepidopodum*. No other specimens are quite the same. The plant in Site 121 therefore provides important evidence to resolve the origins, interrelationships and taxonomy of this group of hybrids. In the past decade, the plant has been damaged by herbicide, gardening and earthworks. Possible repetition of such events poses a serious threat to the plant(s).

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates. Some of the invertebrates become food for vertebrates such as lizards, bats and birds;
- Some eucalypts have hollows, which offer roost sites or nest sites for some animals;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.4 ha of Site 121 falls into rating 'C' (fair) and the remainder (1.6 ha) falls into rating 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

Native vegetation in the site's north meets the definition of a 'patch' adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. (The area is just large enough to qualify.) The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Threatened hybrid

Referring to the section above headed 'Significant plants', the unique, long-rhizomatous wallaby-grass is seriously threatened and is distinct from all other known wallaby-grass. It is not listed as threatened under any legislation, so the standard criteria for sites of biological significance do not accord it significance at the national or state level. Instead, the hybrid fits the description in standard criterion 3.1.4, 'Site is known habitat for a taxon that is considered to be threatened in the bioregion and is … an important site for a population of the taxon'. Such a site is recognised by the standard criteria as having Regional significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 121 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Such a site is recognised by the standard criteria as having Local significance.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to different criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit visitors to the Karralyka Centre and others who live or work close by or use the car park. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the vegetation and associated birdlife adds greatly to the amenity of the site and the Karralyka Centre.

As an ecological 'stepping-stone' in a network of habitat sites, Site 121 encourages the movement of birds through the surrounding residential area. Those birds enrich the daily lives of the residents.

The vegetation in Sites 121 and 106 over the road contributes to the 'green and leafy' character of the neighbourhood. It, and the associated birdlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, the only discernible changes in the extent of habitat are due to: (a) the planting of two or three eucalypts; (b) the removal of two or three eucalypts; and (c) the growth of eucalypt crowns to cover ground that previously only had lawn of introduced grass species. The author also recalls that paving of part of the car park and creation of a place to leave a 'dumpmaster' destroyed a small amount of native vegetation. Unfortunately, that destruction included part of the unique hybrid wallaby-grass discussed above.

Change in the ecological condition of habitat

There is no prior information other than undocumented memories to allow a reliable inference of changes to the ecological condition of the site's habitat. The observed loss of several plant species may be due to either a decline in ecological condition or the impacts of the Millennium Drought.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Inadvertent destruction of the unique hybrid wallaby-grass discussed above in the section headed 'Significant plants'. It grows next to where a 'dumpmaster' bin is stored and it has already been damaged by herbicide and gardening;
- Eucalypt deaths and consequent ecological disruption to understorey and fauna. Eucalypt deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Nearly all of Site 121 is zoned 'Public Use Zone 6 – Local Government'. The exception is the nature strips of Mines Road and Wilson Street, which are zoned 'General Residential Zone – Schedule 1'. Throughout, clause 52.17 of the Victoria Planning Provisions provides protection for wild native vegetation but possibly not for the planted plants. In addition, trees above a certain size (planted or not) are protected under Schedule 4 of the Significant Landscape Overlay (SLO4).

Because of the significance of the Valley Heathy Forest in the site's north, that area is recommended to be covered by the overlay schedule ESO1 proposed in Section 11.1.2 of Volume 1. The lower significance of the rest of the site means there is less justification for applying ESO1, though that is still an option for Council. Simplification of the boundary shape may be appropriate for planning purposes.

Information sources

The analysis above draws on the following sources of information about the site:

- Approximately thirty minutes of flora survey by the author on 18/1/19, including: (a) compiling a list of indigenous plant species (including mosses and liverworts) and their abundances; and (b) mapping the vegetation and the location of the unique hybrid wallaby-grass;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated field data from the present author's flora survey in 1996 (mainly on 13/3/96);
- A specimen of the abovementioned wallaby-grass at the National Herbarium of Victoria (*G.S.Lorimer 1195* of 13/3/96; MEL 2200701A), which the author and botanist Neville Walsh have compared with specimens of *Rytidosperma lepidopodum*; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 122. Dublin Road Reserve, Ringwood

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries

The site occupies most of the council reserve at 348A Maroondah Highway, Ringwood, along with some of the abutting nature strip. The southeastern boundary follows the property boundary. The boundary along Dublin Road follows the back of the kerb. The boundary along Maroondah Highway largely follows the southeastern edge of the footpath. The western boundary has been drawn to follow the rather diffuse edge of native vegetation. As with all sites in this volume, the precise site boundary is available as a shapefile for geographic information systems.

Land use and tenure

The reserve is a council property with a playground and a drain but the drain is outside Site 122. The part of the reserve within Site 122 is managed for recreation and nature conservation. Dublin Road is a council road. Maroondah Highway is a declared arterial road managed by VicRoads.

General description

Site 122 occupies 0.75 hectares and has a gentle slope of between 1:16 and 1:12 facing west-southwest.

A 1945 aerial photograph shows the site having young regrowth of native vegetation. The largest tree crowns were approximately 6 m in diameter; today they are 15 m diameter. Between the trees, the 1945 aerial photograph looks rather bare, suggesting mowing. The reserve was certainly regularly mown in the 1980s to 2005, heavily suppressing the indigenous understorey plants.

Mowing was greatly curtailed in 2005 because Council's bushland management team noticed a range of indigenous groundcovers, barely surviving the mowing. That brought about an amazing regeneration of indigenous shrubs, grasses and wildflowers. A substantial number of orchid species have progressively appeared, some of them rare in metropolitan Melbourne. This study detected a total of sixty-nine naturally-occurring, indigenous plant species.

The site is now a good example of the endangered vegetation type called 'Valley Heathy Forest'. By contrast, the 1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), described the reserve thus: 'Intact tree canopy and some ground layer plants at tree bases'. (The mowers could not mow right up to the tree trunks.)

Relationship to other land

Site 122 is so small that its birdlife and many of its flying insects can meet only part of their habitat needs within the site. The birds and insects therefore move between the site and other nearby habitat.

The key map on p. 1 shows the spatial arrangement of nearby sites of biological significance, which provide additional habitat. The closest and most important area of nearby habitat for birds and insects is across Maroondah Highway in Site 24, which follows the floodplain and valley of Mullum Mullum Creek. The next-closest habitat is 270 m to the south in the almost-abutting Sites 106 and 121 (East Ringwood Reserve and the Karralyka Centre, respectively). The rest of the landscape within 500 m of Site 122 is quite unsuitable for indigenous fauna other than species well-adapted to urban life.

The visitation of birds and flying insects to Site 122 may improve the viability of the indigenous flora there through pollination and transport of seeds.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only naturally-occurring, indigenous plant species except where otherwise stated.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Co-dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Messmate Stringybark (*E. obliqua*). Narrow-leaved Peppermint (*E. radiata*) is also conspicuous.

Lower trees: Dominated by Silver Wattle (*Acacia dealbata*) and Blackwood (*A. melanoxylon*). Golden Wattle (*Acacia pycnantha*) is fairly abundant. Cherry Ballart (*Exocarpos cupressiformis*) is scarce.

Medium to large shrubs: Shiny Cassinia (*Cassinia longifolia*) and Sifton Bush (*Cassinia sifton*) are fairly abundant, both having colonised the site by wind since mowing ceased. Hedge Wattle (*Acacia paradoxa*) and Sweet Bursaria (*Bursaria spinosa*) are each represented by a single plant. Narrow-leaf Bitter-pea (*Daviesia leptophylla*), the hybrid *Daviesia latifolia* × *leptophylla* and the Golden

Bush-pea (*Pultenaea gunnii*) have been planted to compensate for the elimination of shrubs by past mowing.

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*) and Common Flat-pea (*Platylobium obtusangulum*) are fairly abundant. Erect Guinea-flower (*Hibbertia riparia*) is scarce.

Shrubby herbs: Cotton Fireweed (*Senecio quadridentatus*) was scarce during this study's investigation but it and other fireweed species tend to be abundant some years and scarce or absent in others.

Ferns: None seen.

Climbers: Common Apple-berry (*Billardiera mutabilis*) and the small-leafed clematis (*Clematis decipiens*) are present but scarce.

Creepers: Creeping Bossiaea (*Bossiaea prostrata*), Trailing Goodenia (*Goodenia lanata*) and the wood-sorrel *Oxalis exilis/perennans* are all present in substantial numbers.

Grasses, rushes and sedges: Abundant and rich in species. In parts of the site, the groundcover is dominated by Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) or Weeping Grass (*Microlaena stipoides*). Soft Tussock-grass (*Poa morrisii*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are also abundant. The following species are fairly abundant or widespread though the site: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Short-stem Sedge (*Carex breviculmis*), Thatch Saw-sedge (*Gahnia radula*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Common Woodrush (*Luzula meridionalis* var. *flaccida*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*), Bristly Wallaby-grass (*Rytidosperma setaceum*), Purplish Wallaby-grass (*Rytidosperma tenuius*) and Kangaroo Grass (*Themeda triandra*). Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*), Grey Tussock-grass (*Poa sieberiana* var. *sieberiana*) and Common Bog-rush (*Schoenus apogon*) are scarce. Other grass species were probably overlooked due to the times of year of this study's flora survey of the site.

Mosses and liverworts: Abundant and rich in species. In some parts of the site, the groundcover is dominated by the moss, Common Hypnum (*Hypnum cupressiforme*). Common Thread-moss (*Rosulabryum billarderi*) is also abundant. Other species include *Barbula crinita*, Common Breutelia (*Breutelia affinis*), Broody Swan-neck Moss (*Campylopus clavatus*), Green Worms (*Chiloscyphus semiteres*), *Fissidens megalotis*, a *Fossombronia* species and Golden Weft-moss (*Thuidiopsis furfurosa*).

Other groundcover: Abundant and rich in species. The most abundant species is Black-anther Flax-lily (*Dianella revoluta*), followed by Nodding Greenhood (*Pterostylis nutans*). The following species are fairly common or widespread in the site: Pale Grass-lily (*Caesia parviflora*), Common Cotula (*Cotula australis*), Spreading Crassula (Crassula decumbens), Pale Flax-lily (*Dianella longifolia* var. *longifolia*), an unidentified flax-lily (*Dianella* sp.), Scented Sundew (*Drosera aberrans*), Creeping Cudweed (*Euchiton* ?*japonicus*), Common Raspwort (*Gonocarpus tetragynus*), Variable Stinkweed (*Opercularia varia*), Common Rice-flower (*Pimelea humilis*), Small Poranthera (*Poranthera microphylla*), Maroonhood (*Pterostylis pedunculata*), Smooth Solenogyne (*Solenogyne dominii*), Hairy Solenogyne (*Solenogyne gunnii*), Trim Sun-orchid (*Thelymitra* ?*peniculata*) and Yellow Rush-lily (*Tricoryne elatior*). The following species are scarce: Honey-pots (*Acrotriche serrulata*), Chocolate Lily (*Arthropodium strictum*), Sharp Midge-orchid (*Corunastylis despectans*), Common Hovea (*Hovea heterophylla*), Broad-leaf Stinkweed (*Opercularia ovata*) and Blunt Greenhood (*Pterostylis curta*). There is also a single plant of Common Everlasting (*Chrysocephalum apiculatum*) next to the Maroondah Highway footpath but it is likely to be a vagrant because the species has not been recorded before in Maroondah's history.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 122 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Corunastylis despectans* (Sharp Midge-orchid) – Twelve plants were discovered by Maroondah City Council bushland management staff in May 2018. That is a much larger number than either of the other

two sites in Maroondah where the species has been seen this century. The species is rare throughout metropolitan Melbourne.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates. Some of the invertebrates become food for vertebrates such as lizards, bats and birds;
- Some eucalypts have hollows, which offer roost sites or nest sites for some animals;
- There are some large, old eucalypts, which are of high value as habitat trees;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.17 ha of Site 122 falls into rating 'B' (good), 0.25 ha falls into rating 'C' (fair) and the remaining 0.33 ha falls into rating 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

Most of the site's native vegetation meets the definition of a 'patch' adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

Threatened plant species

Referring to the section above headed 'Significant plants', the twelve known plants of *Corunastylis despectans* easily fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to different criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit visitors to the reserve as well as people living in close proximity. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The reserve's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors and those who pass through.

Those benefits are spread into neighbouring streets and gardens by birds, butterflies and other animals moving between the reserve and other areas of habitat.

The site's vegetation adds a 'green and leafy' aspect to the neighbourhood. It also preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, it is apparent that several trees have been removed next to the drain in the reserve's southwest. That has reduced the area of habitat by roughly 150 m².

Change in the ecological condition of habitat

The ecological condition of the reserve's vegetation has improved amazingly since the curtailing of mowing 5–10 years ago. See the section above headed 'General description' for more information.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Eucalypt deaths and consequent ecological disruption to understorey. Eucalypt deaths will occur mainly during droughts, which are predicted to worsen with climate change;
- Flower pickers, who kill orchids and prevent seed production needed to maintain viable plant populations; and
- Potentially, displacement of indigenous plants by the introduced Sweet Vernal-grass (*Anthoxanthum odoratum*), but that risk is currently being suppressed by the council bushland management team; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Dublin Road Reserve is zoned 'Public Park and Recreation Zone'. The abutting nature strip of Maroondah Highway is zoned 'Road Zone – Category 1'. The abutting nature strip of Dublin Road is zoned 'Road Zone – Category 2'. Throughout, native vegetation receives planning protection under clause 52.17 of the Victoria Planning Provisions. In addition, trees above a certain size are protected under Schedule 4 of the Significant Landscape Overlay (SLO4).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to Site 122, as outlined in blue on the aerial photograph on p. 763.

Information sources

The analysis above draws on the following sources of information about the site:

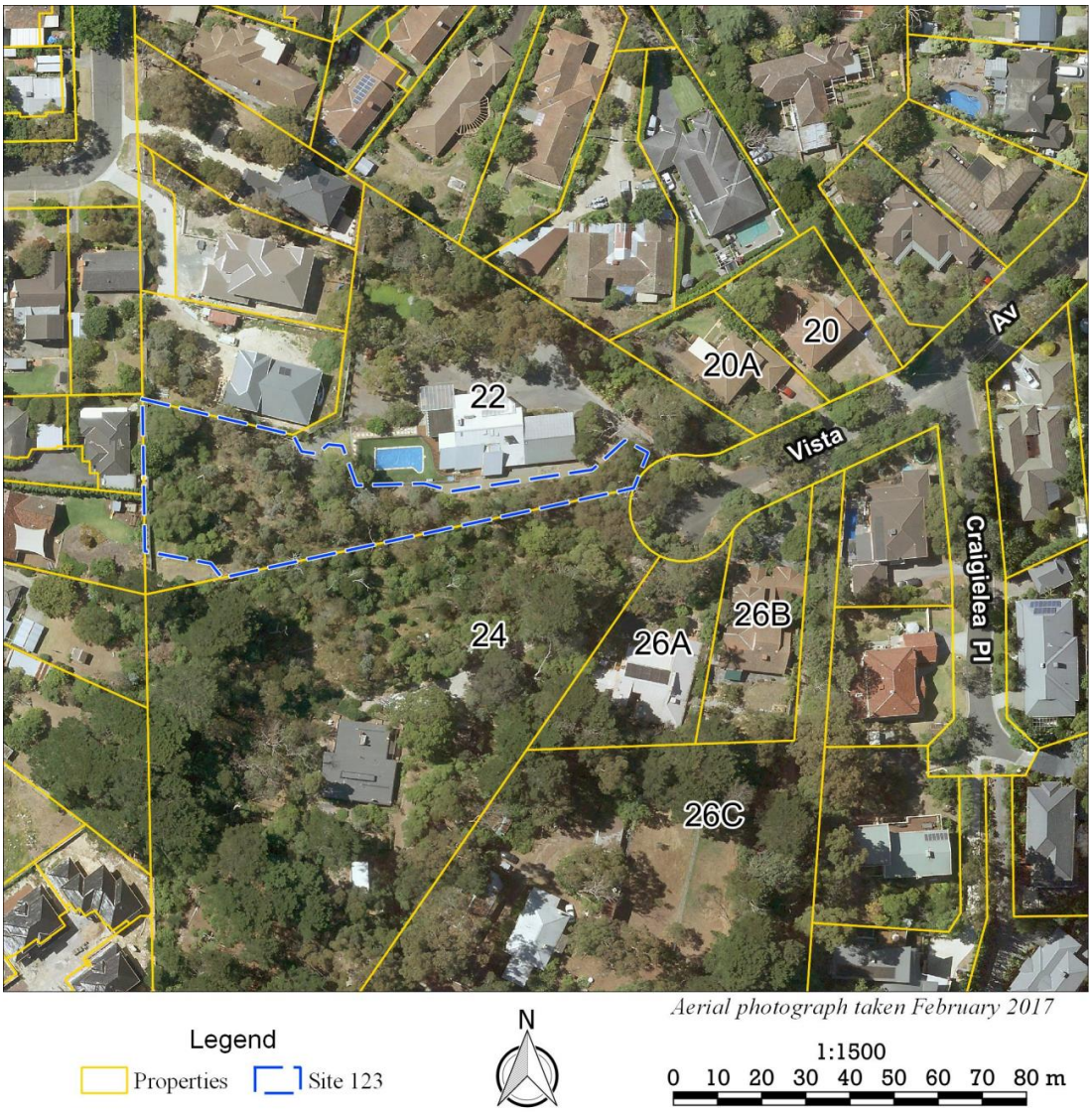
- A total of slightly over four hours of flora survey by the author on 28/8/17, 27/9/17, 18/10/17 and 31/5/18, including: (a) compiling a list of indigenous plant species (including mosses and liverworts) and their abundances; and (b) mapping the vegetation and the locations of significant plants;

- Maroondah City Council's spreadsheets of species planted into bushland reserves (including Dublin Road Reserve);
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and associated field data from the present author's flora survey in 1996 (mainly on 13/3/96);
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 123. 22 Vista Avenue, Ringwood East

Biological Significance Level: *Local* due to the presence of locally threatened wattles



Boundaries, land use and tenure

Site 123 comprises a 0.20-hectare part of 22 Vista Avenue, Ringwood East, which is a residential property with a single dwelling. The site is outlined with a dashed blue line above. The boundary has been drawn to circumscribe an area of native vegetation. As with all sites in this volume, the precise site boundary is available as a shapefile for geographic information systems.

As discussed below, the extent of the site recognised here is much smaller than the original version of Site 123 in 1997.

General description

Site 123 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) was identified as an area of Local biological significance. There was no recommendation for specific recognition of the site in the Maroondah Planning Scheme. Rather than giving it a mapped boundary, the report simply described the site as 'Treed residential neighbourhood at the southern end of the street'. The report also mentioned that 'The area of highest significance is the Blakes' property at 22 Vista Avenue and just over their southern boundary. This area contains at least fifty-five indigenous plant species, including the locally rare *Acacia ulicifolia* (Juniper Wattle) and *Sigesbeckia orientalis* (Indian Weed)'.

Aerial photographs from 2001 and 2019 show that the southern end of Vista Avenue has undergone extensive residential development and removal of native vegetation during that period. The most significant vegetation mentioned in 1997, on 22 Vista Avenue, was largely cleared in 2013–2014.

As a result, Site 123 has been reduced here to the 0.21 hectares outlined in blue on the aerial photograph above. The area approximately coincides with a 'native vegetation offset' area covered by an on-title agreement under Section 173 of the *Planning and Environment Act 1987*, as required by a tribunal hearing in 2013. The Tribunal directed that successive owners of the land must carry out maintenance and management to ensure the offset area remains in good condition in perpetuity. The overstorey comprises planted trees whereas the understorey plants are predominantly remnants of the endangered vegetation type, 'Valley Heathy Forest'. When flora surveys were conducted shortly prior to the agreement, the site contained 38 wild, indigenous plant species, including two that are locally rare.

Relationship to other land

The site is so small that its birdlife and many of its flying insects can meet only a small part of their habitat needs within the site. The fauna therefore move between the site and other nearby habitat.

The closest habitat is the cover of indigenous and Australian native trees on the rest of 22 Vista Avenue and scattered through the neighbourhood to the south, east and southeast. Seven hectares of fairly high-quality habitat lies 130 m to the southeast in Wombolano Park (Site 33). The next-closest habitat areas are at Herman Pump Reserve (290 m to the southwest), Tintern Grammar School (Site 34, 710 m northeast) and F.J.C. Rogers Reserve (780 m southwest). The spatial relationship between these sites can be seen on the key map on p. 1.

The visitation of birds and flying insects to Site 123 may improve the viability of the indigenous flora there through pollination and transport of seeds.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species, as recorded in a 2013 flora survey.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Planted 'Australian natives'.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*), Golden Wattle (*A. pycnantha*) and Cherry Ballart (*Exocarpos cupressiformis*). Black Wattle (*A. mearnsii*) is scarce.

Medium to large shrubs: Juniper Wattle (*Acacia ulicifolia*), Common Cassinia (*Cassinia aculeata*) and Yarra Burgan (*Kunzea leptospermoides*) and fairly abundant. Myrtle Wattle (*Acacia myrtifolia*), Hedge Wattle (*Acacia paradoxa*) and Sifton Bush (*Cassinia sifton*) are scarce.

Small shrubs: Grey Parrot-pea (*Dillwynia cinerascens*), Erect Guinea-flower (*Hibbertia riparia*) and Common Flat-pea (*Platylobium obtusangulum*) are present.

Ferns: None seen.

Climbers: The only climber species seen is *Pandorea pandorana*, which is not indigenous to the site.

Creepers: Kidney-weed (*Dichondra repens*) is fairly abundant. Creeping Bossiaea (*Bossiaea prostrata*), Running Postman (*Kennedia prostrata*) and Ivy-leaf Violet (*Viola hederacea*) are scarce.

Grasses, rushes and sedges: Dominated by Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), and Weeping Grass (*Microlaena stipoides*). Thatch Saw-sedge (*Gahnia radula*) and Clustered Wallaby-grass (*Rytidosperma racemosum*) are also abundant. The following species are fairly abundant: Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Reed Bent-grass (*Deyeuxia quadriseta*), Green Rush (*Juncus gregiflorus*), Slender Sword-sedge (*Lepidosperma gunnii*), Leafy Wallaby-grass (*Rytidosperma* ?*fulvum*) and Purplish Wallaby-grass (*Rytidosperma tenuius*). The following species are scarce: Pale Rush (*Juncus pallidus*), Broom Rush (*Juncus sarophorus*), Finger Rush (*Juncus subsecundus*), Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Soft Tussock-grass (*Poa morrisii*) and Red-anther (or Silvertop) Wallaby-grass (*Rytidosperma pallidum*).

Other groundcover: Chocolate Lily (*Arthropodium strictum*), Black-anther Flax-lily (*Dianella revoluta*), Common Raspwort (*Gonocarpus tetragynus*) and Nodding Greenhood (*Pterostylis nutans*) are fairly abundant. Tasman Flax-lily (*Dianella tasmanica*) is scarce.

Significant plants

In the last known flora survey (in 2013), the area outlined in blue on p. 769 contained 33 wild plants of *Acacia ulicifolia* (Juniper Wattle). The species has only been recorded as growing wild at eight other sites in Maroondah this century. The only site to rival the number of individuals in Site 123 is Hochkins Ridge Nature Conservation Reserve (in Site 51), where no count has been taken. Counts at other sites have only been up to 16 individuals.

The 2013 flora survey also detected a single plant of *Kennedia prostrata* (Running Postman), which can be confidently classified as being in the 'critically endangered' category of risk of dying out in Maroondah.

Fauna habitat

- The native vegetation and its litter provide food and cover for invertebrates, some of which are likely to become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1); and
- The site's habitat value is diminished by the small area.

Ecological condition

On the basis of the 2013 flora survey, the ecological condition of the site's vegetation is intermediate between categories 'B' (good) and 'C' (fair) on the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997).

Biological significance rating

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Locally threatened plant species

Referring to the section above headed 'Significant plants', the sixteen *Acacia ulicifolia* plants in Site 123 fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and
- In principle, the site's ecological values are under little threat from development or land use because of the protection of the Section 173 agreement discussed above in the section headed 'General description'. However, there is still a risk of loss of plant species with low populations (e.g. the solitary *Kennedia prostrata*) due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The site and its neighbourhood are zoned 'Neighbourhood Residential – Schedule 2'. The removal, lopping or destruction of trees above a threshold size is regulated under Schedule 3 of the Significant Landscape Overlay. The 'offset area' that makes up almost all of the site is subject to an on-title agreement under Section 173 of the *Planning and Environment Act 1987*. The agreement requires successive owners of the land to carry out maintenance and management of the site's vegetation to ensure it remains in good condition in perpetuity.

This level of planning control appears adequate, given the site's size and level of biological significance. No additional control is recommended.

Information sources

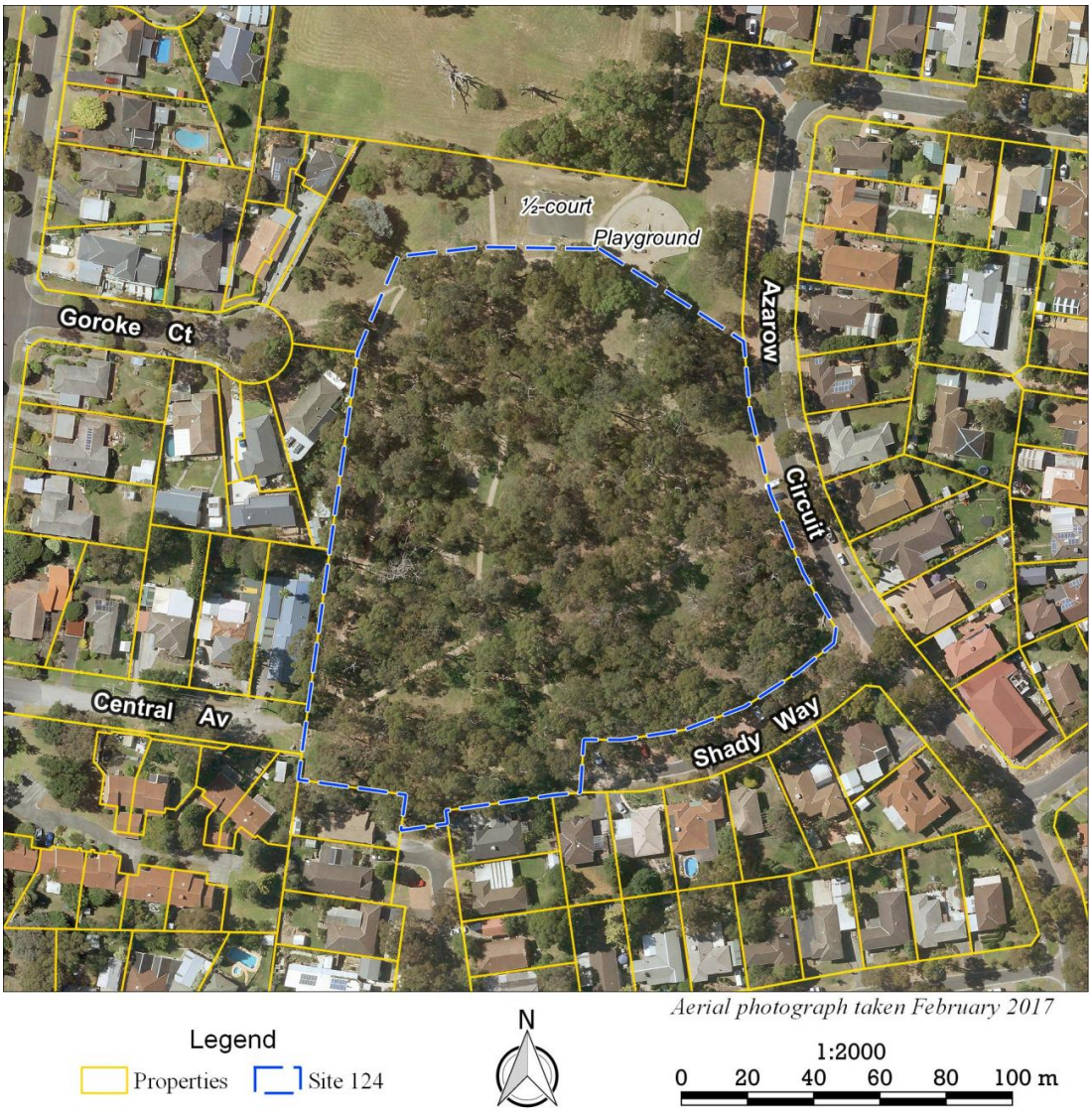
The analysis above draws on the following sources of information about the site:

- A brief site inspection of the neighbourhood by the author on 18/1/19;
- The decision and evidence of an appeal at the Victoria Civil and Administrative Tribunal regarding proposed subdivision of 22 Vista Avenue and removal of native vegetation without a permit: *Tuxedo Holdings (Australia) Pty Ltd v Maroondah CC & Ors [2013] VCAT 1337* (29 July 2013). The present author was an expert witness to the appeal, for which he conducted a flora survey on 21/6/13;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which the present author conducted a flora survey on 7/12/95; and
- Aerial photographs from 1945, 2001, 2011 and each year between 2013 and 2019.

No additional information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 124. Woodland Park, Croydon South

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Aerial photograph taken February 2017

Boundaries, land use and tenure

As shown with a dashed blue outline above, Site 124 occupies Woodland Park except for its sparsely-vegetated north. Woodland Park is a council amenity park, partly managed for nature conservation. The park also provides pedestrian thoroughfare through the neighbourhood.

General description

Site 124 occupies 2.0 hectares. It has a fairly uniform slope of 1:12 falling to the southeast. When it became a park in the late 1970s or the 1980s, Woodland Park had a substantial number of mature, naturally-occurring eucalypts but apparently very little understorey. Some of those eucalypts remain today, including a substantial number of very old trees (as evidenced by their large trunk diameters).

After becoming a park (and probably before), the weedy undergrowth was kept in check by mowing. In the early 1990s, Maroondah City Council started revegetating some of the park with indigenous species in mulched beds. Revegetation in mulched beds has been periodically expanded up to 2019 and now takes up most of Site 124. Strips of weedy lawn separate the mulched beds. Quite a few of the planted species are reproducing well.

Some naturally-occurring, indigenous groundcover species have benefited from the revegetation management and are now much more conspicuous than when the park's flora was assessed in 1995. One of those species – a grass – is listed as rare throughout Victoria.

This study detected a total of forty-three naturally-occurring, indigenous plant species in the park.

Relationship to other land

Woodland Park is too small for its birds and many of its flying insects to meet their full habitat needs. The birds and insects therefore move between the park and other habitat.

The surrounding neighbourhood has a very modest density of planted and remnant eucalypts and other trees that serve as habitat for birds and insects. Few shrubs provide suitable habitat.

The nearest area of habitat with understorey is at the Croydon Special Development School (Site 63, 280 m to the north) but it measures only 0.4 ha. There is a larger area of eucalypt cover on the Healesville Freeway Corridor (Site 64, 300 m to the south) but the condition of the habitat there is poor. The closest substantial area of habitat in good condition is at Eastfield Park (Site 61, 0.9 km north), covering roughly 5 ha.

Because of the scarcity of quality habitat within 1 km, Woodland Park's birdlife is limited to species adapted to landscapes with fragmented habitat.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below ignores most of the many plant species that are only present as a result of planting. The brevity of this study's flora survey may well have caused some wild species to be overlooked or mistaken for having been planted.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: The dominant species is Mealy Stringybark (*Eucalyptus cephalocarpa*). The other canopy species are all fairly abundant and comprise Bundy (*E. goniocalyx*), Messmate Stringybark (*E. obliqua*), Swamp Gum (*E. ovata*) and Narrow-leaved Peppermint (*E. radiata*).

Lower trees: The only convincingly naturally-occurring sub-canopy tree is a single Cherry Ballart (*Exocarpos cupressiformis*). Black Wattle (*Acacia mearnsii*) might be naturally-occurring but it is scarce. Various indigenous sub-canopy species have been planted, along with Hazel Pomaderris, which is not indigenous to Valley Heathy Forest.

Medium to large shrubs: The only shrubs that have a strong appearance of being present completely independently of planting are one or two of the Kangaroo Apple, *Solanum aviculare*, and scattered plants of Sweet Bursaria (*Bursaria spinosa*). There are also scattered plants that have germinated naturally from planted Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*) and Victorian Christmas-bush (*Prostanthera lasianthos*). A few other species, such as Large Kangaroo Apple (*Solanum laciniatum*), have germinated from seed of parents that may or may not have been planted. A range of other indigenous shrub species have been planted and some of them may well have produced offspring.

Small shrubs: No small shrubs were observed.

Shrubby herbs: Cotton Fireweed (*Senecio quadridentatus*) is fairly abundant and Rough Fireweed (*Senecio hispidulus*) is scarce.

Ferns: Austral Bracken (*Pteridium esculentum*) is dense over substantial areas in the park's south.

Climbers: Small-leafed Clematis (*Clematis decipiens*) is scarce and there is a chance that it may have been planted. Wonga Vine (*Pandorea pandorana*) is scarce and is only present as a result of the species spreading beyond its historically natural range to the east.

Creepers: Centella (*Centella cordifolia*) and Kidney-weed (*Dichondra repens*) are scarce. Bidgee-widgee (*Acaena novae-zelandiae*) may well be present only due to planting.

Grasses, rushes and sedges: Thatch Saw-sedge (*Gahnia radula*) dominates small patches of the park. Clusters of Veined Spear-grass (*Austrostipa rudis* subsp. *australis*) are scattered through the southern half of the park, including the lawns and revegetated areas. Toad Rush is fairly abundant in bare, damp spots. Weeping Grass (*Microlaena stipoides*) is scattered throughout the site. Mat Grass (*Hemarthria uncinata*), Smooth Wallaby-grass (*Rytidosperma laeve*), Clustered Wallaby-grass (*R. racemosum*) and Bristly Wallaby-grass (*R. setaceum*) are mainly present (but not abundant) in lawn. Offspring of planted Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) are fairly abundant. Wild plants of Short-stem Sedge (*Carex breviculmis*), Knob Sedge (*C. inversa*), Pale Rush (*Juncus pallidus*), Finger Rush (*J. subsecundus*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*) and Kangaroo Grass (*Themeda triandra*) are scarce.

Mosses and liverworts: Fairly abundant, the main species being Green Worms (*Chiloscyphus semiteres*), Broody Swan-neck Moss (*Campylopus clavatus*), Heath Star Moss (*Campylopus introflexus*), Common Hypnum (*Hypnum cupressiforme*), Common Juniper-moss (*Polytrichum juniperinum*) and Golden Weft-moss (*Thuidiopsis furfurosa*).

Other groundcover: Other types of groundcover are mainly planted. The naturally-occurring ones are Common Cotula (*Cotula australis*), Spreading Crassula (*Crassula decumbens*), Hairy Willow-herb (*Epilobium hirtigerum*), Creeping Cudweed (*Euchiton japonicus*) and Yellow Rush-lily (*Tricoryne elatior*). The last two of these are scarce.

Significant plants

Rare (but not otherwise threatened) in Victoria

Clusters of Veined Spear-grass (*Austrostipa rudis* subsp. *australis*) are scattered through the southern half of the park, including the lawns and revegetated areas. Seventy-seven individuals were counted in this study. Other plants in the lawn appeared to be the same subspecies but could not be confidently identified because they had been mown. The subspecies is listed by the Victorian Government as rare (but not otherwise threatened) in Victoria. It is scattered across southern Victoria, coastal NSW and eastern Tasmania.

Critically endangered in Maroondah

A single individual of the Kangaroo Apple *Solanum aviculare* was detected in this study, as well as a plant that was not identifiable at the time and could be the same species or *S. laciniatum* (which is also present). *Solanum aviculare* can be confidently presumed to be in the 'critically endangered' category of risk of dying out in Maroondah. The only other populations of the species detected in this study were at Warrien Reserve (where more than a dozen grow) and Ringwood Lake Park (where three dying plants were seen). Therefore, even a single plant is important in the context of Maroondah.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for a range of forest birds, bats, possums and invertebrates;
- Many tree hollows offer roost sites or nest sites for some animals, including bats;
- There are large, old eucalypts (living and dead), which are of high value as habitat trees;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

On the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), rating 'C' (fair) applies to the revegetated parts of the site. That amounts to approximately 1.1 ha. Rating 'D' (poor) applies to areas with tree cover over lawn, amounting to approximately 0.8 ha. Lawn without tree cover accounts for the remaining 0.1 ha of the site.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Classes

At least 0.44 ha of the site's vegetation meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

This site is unique in this study in that its State significance would not have been achieved without revegetation. The revegetation is only accepted as being part of a patch of Valley Heathy Forest in this case because:

- The composition of the vegetation is a reasonable facsimile of Valley Heathy Forest;
- There is a natural overstorey (including large eucalypts) and patches of remnant understorey; and
- At least some of the planted species are reproducing well.

Threatened plant species

Referring to the section above headed 'Significant plants', the Veined Spear-grass *Austrostipa rudis* subsp. *australis* has a clearly viable population in the site. The subspecies occurs interstate as well as Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of Regional significance.

Referring further to the section above headed 'Significant plants', it could be argued that the site's solitary confirmed plant of *Solanum aviculare* fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The reserve's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to different criteria and the state government's recognition in the interim of the conservation status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit those using the park or living nearby. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors. Those benefits are spread into neighbouring streets and gardens by birds, butterflies and other fauna moving to and from the park.

The site's vegetation contributes to the neighbourhood's 'green and leafy' character. The vegetation and associated birdlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

From inspection of aerial photographs from 2001 and 2017, it is clear that a significant area that was open lawn in 2001 now has tree cover and, to a large degree, has planted understorey as well. Calculating the total growth of the tree crowns' area is impracticable but it appears to be roughly 0.2 hectares. There is no discernible area where native vegetation has been lost.

Change in the ecological condition of habitat

The notes John C. Reid took during fieldwork in 1995 for the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) described Woodland Park as 'Indigenous trees (*E. goniocalyx* upslope, *E. obliqua* and *E. cephalocarpa* lower) over 100% weedy understorey with walking paths and dense plantings of various indigenous (?) species'. Some naturally-occurring, indigenous understorey species must have been there (e.g. *Pteridium esculentum, Tricoryne elatior, Austrostipa rudis* subsp. *australis, Lomandra filiformis* subsp. *filiformis*) but they were presumably so suppressed by mowing and mulching that Reid did not see them.

Today, those naturally-occurring species are readily seen and the revegetation has grown up to form a structure much closer to the natural state of Valley Heathy Forest. Introduced plants are sparse in most parts of the site other than the lawn.

There has therefore been a substation improvement in the ecological condition of the site's vegetation.

Threats

This study has identified the following threats to the site's biodiversity (in decreasing order):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Further eucalypt deaths and consequent ecological disruption to understorey and fauna. The risk of this outcome is heightened in some of the site by unnaturally dense planted trees, which create excessive competition. Tree deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Site 124 is zoned 'Public Park and Recreation Zone'. Trees above a certain size receive planning protection under Schedule 4 of the Significant Landscape Overlay. The removal, destruction and lopping of native vegetation (trees to groundcover) is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

Because of Site 124's high biological significance, and consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the site, as outlined in blue on the

aerial photograph on p. 773. An option would be to extend the overlay to the whole park, particularly if Council plans to increase the revegetation in the additional area.

Information sources

The analysis above draws on the following sources of information about the site:

- 1¼ hours of ecological survey by the author on 6/11/19, including (in part): (a) compilation of a list of the presence and abundances of indigenous plant species (including mosses and liverworts); (b) mapping and documenting the details of rare or scarce plants; (c) mapping the edges of vegetation that has at least 10% native understorey cover; and (d) checking for habitat features;
- The author's regular walks through the park as a local resident between 2002 and 2016;
- A bird survey by the author during February 2005;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which John C. Reid did a brief survey of flora, birds and butterflies on 8/12/95; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 125. 54 Sherman Drive, Bayswater North (Discontinued)

Biological Significance Level: *Not Significant*

At the time 54 Sherman Drive, Bayswater North was designated as Site 125 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), it was a vacant block. Its 774 m² contained native vegetation with around thirty indigenous plant species. As predicted at the time, the habitat was soon lost to residential development, apart from a few eucalypts that remain today. As a result, the property no longer meets any criteria for a site of biological significance. The biological significance level is therefore 'Not significant' in the scheme of Amos (2004).

Strategic planning

54 Sherman Drive is covered by Schedule 4 of the Significant Landscape Overlay, which provides adequate planning protection for the remaining eucalypts. No strategic planning matters arise.

Site 126. Jennings Road Reserve, Bayswater North

Biological Significance Level: *National* for the presence of a globally endangered species; otherwise *State* due to an endangered vegetation type



Boundaries, land use and tenure

Site 126 coincides precisely with the reserve at 12–14 Jennings Road, Bayswater North. The reserve is owned by Maroondah City Council, who manages it for amenity and pedestrian thoroughfare via unpaved footpaths.

General description

Jennings Road Reserve occupies 4,827 m². It has a shallow gradient of 1:11 facing south. The surrounding properties mostly measure 800–900 m² and have one house each.

The size of the tree trunks in the reserve indicates a maximum tree age of roughly fifty years, far less than a natural forest. A 1945 aerial photograph shows forest with unnaturally low tree cover. It therefore appears that the reserve has been cleared or partly cleared at least twice.

Until this study, the reserve has not been actively managed for nature conservation. The natural understorey (including the species that gives the site national significance) has been progressively reduced to lawn by mowing. However, as a result of this study's findings, some logs have been placed around some patches of indigenous groundcover.

This study detected twenty-five naturally-occurring, indigenous plant species in the reserve.

Relationship to other land

The reserve is so small that its birdlife and many of its flying insects can meet only part of their habitat needs within the reserve. They therefore move between the reserve and other nearby habitat. The main areas of nearby habitat are Canterbury Gardens Reserve (Site 71, 375 m to the west) and Bungalook Conservation Reserves (Site 66, 520 m east). In addition, there is a narrow corridor of native vegetation 300 m to the south-southeast along Colchester Road (Site 94), providing a link to the more substantial wildlife corridor of Dandenong Creek (Site 69, 630 m south).

The neighbourhood has a scattering of mature remnant eucalypts and Australian native trees, all of which are likely to help birds and flying insects traverse the landscape between the more substantial areas of habitat.

The movements of birds and flying insects are likely to be important as carriers of pollen or seeds to Jennings Road Reserve, improving the viability of the indigenous flora.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species.

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion), approaching Herb-rich Foothill Forest (Ecological Vegetation Class no. 23)

Canopy trees: Dominated by Messmate Stringybark (*Eucalyptus obliqua*) followed by Narrow-leaved Peppermint (*E. radiata*). There is also an outlier Swamp Gum (*E. ovata*).

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*). Silver Wattle (*A. dealbata*) is scarce.

Medium to large shrubs: Greatly depleted by mowing. Sweet Bursaria (*Bursaria spinosa*) was the only shrub species found in this study but in 1996, there was also Prickly Moses (*Acacia verticillata*), Hop Goodenia (*Goodenia ovata*), Prickly Tea-tree (*Leptospermum continentale*) and Golden Bush-pea (*Pultenaea gunnii*).

Small shrubs: None seen.

Ferns: Austral Bracken (*Pteridium esculentum*) was recorded in 1996 but not in this study.

Climbers: Common Apple-berry (*Billardiera mutabilis*) and Mountain Clematis (*Clematis aristata*) are both scarce.

Creepers: Kidney-weed (*Dichondra repens*) is abundant and there is at least one plant of the globally endangered flat-pea, *Platylobium infecundum*. In 1996, there was also Bidgee-widgee (*Acaena novae-zelandiae*), Trailing Goodenia (*Goodenia lanata*) and the wood-sorrel, *Oxalis exilis/ perennans*.

Grasses, rushes and sedges: Mown; fairly rich in species. Dominated by Clustered Wallaby-grass (*Rytidosperma racemosum*). Other species with substantial populations include Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis* and subsp. *filiformis*), Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Weeping Grass (*Microlaena stipoides*). There are also small numbers of Short-stem Sedge (*Carex breviculmis*), Variable Sword-sedge (*Lepidosperma laterale*) and Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*). This study's detection of other grass species was confounded by mowing, but the following additional species were recorded in 1996: Tall Spear-grass (*Austrostipa pubinodis*), Reed Bent-grass (*Deyeuxia quadriseta*), Thatch Saw-sedge (*Gahnia radula*), Red-fruit Saw-sedge (*Gahnia sieberiana*), Slender Wallaby-grass (*Rytidosperma penicillatum*) and Kangaroo Grass (*Themeda triandra*).

Other groundcover: Strongly suppressed by mowing and perhaps herbicide. There are substantial numbers of Chocolate Lily (*Arthropodium strictum*), Pale Flax-lily (*Dianella longifolia*) and

Tasman Flax-lily (*D. tasmanica*). Variable Stinkweed (*Opercularia varia*) and Yellow Rush-lily (*Tricoryne elatior*) are scarce. Rosy Hyacinth Orchid (*Dipodium roseum*) and Common Raspwort (*Gonocarpus tetragynus*) were also seen in 1996.

Significant plants

Globally endangered

The flat-pea *Platylobium infecundum* is listed by the Victorian Government as 'Endangered' in Victoria. It does not occur anywhere on Earth outside Maroondah and abutting municipalities. Jennings Road Reserve has a healthy, dense patch covering approximately 1½ m² containing an indeterminate number of plants. The author's recollection is that more plants were present in 1996.

Fauna habitat

The canopy of eucalypts, Blackwood and Cherry Ballart represents suitable habitat for common forest birds but the value of that habitat is diminished by the small area and lack of shrubs.

Otherwise, the reserve's habitat value is severely constrained by mowing.

Ecological condition

The reserve's vegetation is in poor to fair ecological condition, held back by mowing and the near-absence of shrubs.

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the vegetation falls into category 'D' (poor) with small patches in 'C' (fair).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: National in regard to at least one plant of a globally endangered species; otherwise State due to an endangered vegetation type

Threatened plant species

Jennings Road Reserve has a thriving patch of the flat-pea *Platylobium infecundum*. The species is listed as 'Endangered' in the state government's 'Advisory List of Rare or Threatened Plants in Victoria – 2014'. Its global distribution is confined to Victoria. It follows that the site meets standard criterion 3.1.2 for a site of **National** significance. However, the degree of significance is clearly less than if there were larger numbers of the species, as was once the case and might be again in the future.

Regionally threatened Ecological Vegetation Classes

The reserve's vegetation meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more, but only if one includes the mown groundcover. The inclusion of the mown groundcover is probably justified on the basis that the vegetation would more clearly qualify as a patch if the mowing were to cease. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of State significance (which does not override the National significance above).

The reserve's overall 'National' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the state government's recognition in the interim of the conservation status of *Platylobium infecundum*, which had not even been described as a

species in 1997. Even without the *Platylobium*, the significance would be 'State', which exceeds the 1997 rating due to changes in the criteria and the state government's recognition in the interim of the endangered status of Valley Heathy Forest.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit reserve visitors and immediate neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation contributes to the 'green and leafy' character of the neighbourhood. It also preserves something of the area's natural landscape. It, and the associated birdlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Birds that travel to and from the site do so via the surrounding residential area, thereby enriching the birdlife experienced by residents in their daily lives.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017 reveals that the reserve has lost approximately 250 m² of tree cover during that period. A 2011 aerial photograph indicates that most or all of the loss occurred during 2001-2011, during the Millennium Drought.

Change in the plant species present

Seventeen indigenous plant species that were recorded in the 1996 flora survey were not detected in this study. Some of those might have been detected in this study if not for mowing. However, that explanation does not apply to Red-fruit Saw-sedge (*Gahnia sieberiana*), Trailing Goodenia (*Goodenia lanata*) and four indigenous species of shrub. It is clear that there has been a substantial decline in the number of indigenous plant species in the reserve since 1996. The combination of the Millennium Drought and urbanisation of the catchment probably played roles in the loss of some of the species but mowing is likely to be the main cause.

Change in the ecological condition of habitat

The only clear indications of changes in the ecological condition of the reserve's habitat are:

- The loss of indigenous plant species mentioned above; and
- The death or removal of roughly ten eucalypts between 2001 and 2011, as evidenced by aerial photographs from those years.

Threats

This study has identified the following threats to the site's biodiversity (in decreasing order):

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Mowing, which is having a serious impact and threatens the reserve's National significance;
- Possible herbicide spraying around the bases of trees;

- Rampant growth of Jasmine, smothering trees;
- Continuing loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species; and
- Further eucalypt deaths. The deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The reserve is zoned 'Public Park and Recreation Zone'. Its surroundings are zoned 'General Residential Zone – Schedule 1'.

Tree removal in the whole neighbourhood is regulated under Schedule 4 to the Significant Landscape Overlay. In addition, removal of all native vegetation (trees to groundcover) in the reserve is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the whole reserve.

Management recommendation

The amount of mowing in the reserve is causing more ecological damage than can be justified for a site of National biological significance. It is recommended to reduce the extent and frequency of mowing and consider assisting ecological recovery.

Information sources

The analysis above draws on the following sources of information about the site:

- A botanical survey by the author on 23/8/17, 15/11/18 and 14/9/19, including: (a) compilation of a list of indigenous plant species and the abundance of each species; (b) assessment of the distribution, population size and health of the *Platylobium infecundum* and (c) a list of incidental bird observations;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which the present author did a flora survey of the reserve on 31/3/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 127. Sunset Drive Reserve, Kilsyth South

Biological Significance Level: *Local* due to the presence of a locally rare plant species



Aerial photo Feb 2017

Boundaries, land use and tenure

Site 127 contains the majority of one lot and a sliver of another. The narrow strip along the western edge is part of 19 Southfork Drive, Kilsyth South. The rest is part of 51 Sunset Drive, Kilsyth South, which also includes a narrow walkway/floodway connected to the street. The two lots are both owned by Melbourne Water and managed as a unit, principally for drainage.

The original version of this site described in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) included not just the site described here but also the east-west part of 19 Southfork Drive and a nearby strip beside Canterbury Road. Those additional areas no longer retain any significant vegetation or habitat.

General description

This site measures 0.3 hectares. The floodway that runs along it is poorly drained and retains surface water for roughly six months in a typical year. The resulting wetland habitat supports frogs, aquatic invertebrates and the locally rare plant species that gives the site its significance. During rainfall events, water flows south to the retarding basin at Bungalook Conservation Reserves (Site 66).

The banks of the floodway contain few indigenous plants due to regular spraying of herbicide.

Across the site, this study detected twenty-five naturally-occurring, indigenous plant species.

The reserve is not actively managed for nature conservation.

Relationship to other land

The floodway extending south of Site 127 provides a route for aquatic fauna such as frogs and invertebrates to move to and from Bungalook Conservation Reserves (Site 66). Waterbirds are quite capable of transferring pollen and plant propagules between Site 127 and many other wetlands.

The locally rare Floating Club-rush (*Isolepis fluitans*) and Soft Bog-rush (*Schoenus tesquorum*) that give this site its significance are pollinated by wind. It is possible that pollen of these species is exchanged between the sites.

The substantial cover of native vegetation on properties along Cloverlea Drive to the south of Site 127 provide a route for forest birds to access Site 127.

Bioregion: Gippsland Plain

Habitat types

The descriptions of vegetation composition below include only naturally-occurring, indigenous plant species except where stated otherwise. 'EVC' means 'Ecological Vegetation Class'.

Seasonal wetland (part of EVC 74, but the state government does not apply that EVC's 'Endangered' status to artificially created wetlands like this)

Indigenous species: *Schoenus tesquorum* (Soft Bog-rush) dominates two substantial parts of the site. *Isolepis platycarpa* (a club-rush), *Juncus bufonius* (Toad Rush) and the moss, *Calliergonella cuspidata*, are also abundant. The following additional species have apparently viable populations: *Alisma plantago-aquatica* (Water Plantain), *Eragrostis brownii* (Common Love-grass), *Isolepis fluitans* (Floating Club-rush), *Juncus fockei* (Slender Joint-leaf Rush), *Juncus planifolius* (Broad-leafed Rush), *Juncus* ?*sarophorus* (Broom Rush), *Lythrum* ?*hyssopifolia* (Lesser Loosestrife), *Schoenus apogon* (Common Bog-rush) and *Thelymitra peniculata* (Trim Sun-orchid).

Swampy Woodland (EVC 937, **Endangered** in the bioregion), on the banks of the floodway.

Canopy trees: There are several *Eucalyptus ovata* (Swamp Gum) that pre-date planting at the site (as seen on a 2001 aerial photograph). Various non-indigenous eucalypts have been planted.

Lower trees: There are several *Acacia dealbata* (Silver Wattle) and *Acacia melanoxylon* (Blackwood) that pre-date planting at the site (as seen on a 2001 aerial photograph). *Melaleuca ericifolia* (Swamp Paperbark) forms a dense thicket immediately upstream of the site. There are also various planted wattles (e.g. *Acacia howittii*) and volunteers of introduced *Pittosporum undulatum* (Sweet Pittosporum).

Shrubs: There are no indigenous species but some non-indigenous wattles and bottlebrushes have been planted as well as volunteers of the declared noxious weeds, *Genista monspessulana* (Montpellier Broom), *Rubus anglocandicans* (Blackberry) and *Ulex europaeus* (Gorse).

Ferns: None.

Climbers and creepers: None seen but *Centella cordifolia* could have escaped detection.

Grasses, rushes and sedges: Indigenous species include *Rytidosperma laeve* (Smooth Wallaby-grass), *Rytidosperma semiannulare* (Tasmanian Wallaby-grass), *Rytidosperma setaceum* (Bristly Wallaby-grass) and *Schoenus apogon* (Common Bog-rush).

Other groundcover: Indigenous species include *Crassula decumbens* (Spreading Crassula), Jersey Cudweed (*Laphangium luteoalbum*) and *Thelymitra peniculata* (Trim Sun-orchid).

Significant plants

Critically endangered in Maroondah

- *Isolepis fluitans* (Floating Club-rush) – seventeen plants were planted, but the full population size could not be determined due to mowing and inundation. The only other place where this species was detected during this study is in Site 72, which is destined to be developed;

- *Juncus holoschoenus* (Joint-leaf Rush) – approximately 25 plants were seen and others may have escaped detection due to mowing;
- *Schoenus tesquorum* (Soft Bog-rush) – a dominant species over two substantial parts of the site, with numbers estimated as 150–300 plus scattered individuals. The true total may be substantially greater owing to mowing, inundation and difficulty distinguishing young plants from *Schoenus apogon*, which is also present. The only other site in Maroondah where this species has been recorded since 2000 is nearby Bungalook Conservation Reserves, with a similar population size.

Ecological condition

The site's vegetation is in poor ecological condition due to over-frequent mowing.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Locally threatened plant species

The section above headed 'Significant plants' discusses three species in the 'critically endangered' category of risk of dying out in Maroondah. The occurrence of each of them at Site 127 fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The vegetation in the floodway helps to stabilise the soil and remove a small amount of water pollution.

Changes

Change in the extent of habitat

The original (1997) version of Site 127 included the east-west part of the floodway in 19 Southfork Drive. The indigenous flora in that area has become replaced by introduced plant species.

The original version of Site 127 also included nearby private land beside Canterbury Road. That area has become covered by factories and roads.

The extent of habitat was not documented in 1997 so the change cannot be quantified. It probably amounts to roughly 0.1 ha.

Change in the plant species present

Although the seasonal conditions at the time of this study's site inspection prevented a thorough documentation of the site's surviving plant species, it is clear that five species seen in 1997 are not present now.

There is a slight hope that the regionally rare Glandular Brooklime (*Gratiola pubescens*) remains but the condition of the habitat is now so poor that it seems unlikely.

Change in the ecological condition of habitat

In 1997, the author recorded no details about the site's ecological condition. The presence of such a sensitive species as the Glandular Brooklime in 1997 suggests that the ecological condition was better at that time or not long prior. (It can take some years for a species to die out after the conditions become too poor for long-term survival.)

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and
- Slashing during boggy conditions, which is a major threat to this site's significant seasonal wetlands. The action of wheels spinning in mud kills plants and aquatic fauna and leads to the establishment of weeds.

Strategic planning

The whole site is zoned 'General Residential Zone – Schedule 1'. There are no planning overlays. Removal of native vegetation is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

The presence of the Floating Club-rush in the site is probably not significant enough to warrant the addition of a planning overlay on the site. Protection of the site's ecological significance relies upon the slashing regime adopted by Melbourne Water, which is unlikely to be influenced by an additional planning control.

Management recommendation

It is recommended that Melbourne Water note the significance of the floodway and take care not to slash it when the ground is boggy.

Information sources

The analysis above draws on the following sources of information about the site:

- Site inspections totalling approximately 90 minutes by the author on 10/11/18, 15/10/19 and 9/11/19;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), for which the present author did a flora survey of the site on 1/2/97; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia. Note that all data in the Victorian Biodiversity Atlas for locations mapped within 250 m of this site actually originate from close to Tereddan Drive, further south.

Site 128. Ringwood Public Golf Course

Biological Significance Level: *State* due to the presence of two rare Yarra Gums



Boundary, land use & tenure

Site 128 is shown with a dashed, mid-blue outline on the aerial photograph above. Most of the western and eastern boundaries follow property boundaries. In the north, the strip occupied by 'The Rings' and the adjacent car park are excluded. The southern site boundary is the municipal boundary, along Dandenong Creek.

The site is owned and managed by Maroondah City Council as a public golf course. Melbourne Water has authority and responsibility for management of the bed and banks of Dandenong Creek.

General description

Site 128 occupies 41 hectares. Dandenong Creek's floodplain extends approximately 100 m into the site, increasing to 250 m in the southeast corner. North of the floodplain, the course is gently undulating with a slope rising to 1:12 near Canterbury Road.

The course retains a small number of naturally-occurring indigenous trees in clusters or as individuals among planted trees. The locations are outlined with green and white dashed lines on the aerial photograph above. The outlines have been inferred from reports about the course's vegetation in 2006 and 2014, updated with the aid of a 2017 aerial photograph. There is hardly any indigenous understorey, according to a 2006 report.

A few Manna Gums (*Eucalyptus viminalis*) in the southeastern corner are thought to be remnants of the Ecological Vegetation Class (EVC) called Riparian Forest that once lined the creek. There are also two rare Yarra Gums near the creek, mapped on the aerial photograph.

The indigenous eucalypts in the northern quarter of the course comprise Mealy Stringybark (*Eucalyptus cephalocarpa*), Bundy (*E. goniocalyx*) and a single Messmate Stringybark (*E. obliqua*). They are remnants of the endangered EVC, Valley Heathy Forest.

The small number of naturally-occurring eucalypts elsewhere on the course are Mealy Stringybarks and Swamp Gums (*E. ovata*).

Small numbers of Black Wattle (*Acacia mearnsii*) and Blackwood (*A. melanoxylon*) are the only naturally-occurring, indigenous, subcanopy trees.

The course has a large dam, three vegetated artificial wetlands and some shallow depressions near Dandenong Creek. Indigenous aquatic plants such as rushes and Lesser Joyweed (*Alternanthera denticulata*) volunteer themselves in such habitats during favourable conditions.

Relationship to other land

An important aspect of the golf course's importance for wildlife is that it is situated on the Dandenong Creek habitat corridor (Site 69) and in close proximity to other, more biologically significant sites. On the Maroondah side of the creek, Scott Street Reserve (Site 80) lies on the opposite side of Wantirna Road and the Heatherdale Creek Wetlands (Site 82) are on the opposite side of Eastlink (see the aerial photograph above). Immediately south of Dandenong Creek lies Yarrabing Reserve (Knox Site 50) and the new Mint Street Wetlands. Winton Wetlands (Knox Site 51) is 200 m to the southwest of the golf course.

Turning away from Dandenong Creek, Proclamation Park (Site 111) lies 200 m north of the golf course. Without the trees on the course, Proclamation Park would be substantially more isolated from other areas of habitat and it would therefore receive less visitation by birds and flying insects. That could have adverse consequences for the viability of Proclamation Park's native vegetation.

Significant plants

Eucalyptus yarraensis (Yarra Gum) is listed by the Victorian Government as 'Rare but not otherwise threatened'. Two individuals were discovered in 2006 by Nicki Schnittler and Nicola Barnes at the locations mapped on the aerial photograph on p. 789. The present author confirmed that they were both still present and healthy on 1/4/20.

Significant fauna

- Hoary-headed Grebe – observed by Daniel Gilmour in winter 2006 and likely to remain a visitor to the golf course's waterbodies from time to time; and
- Buff-banded Rail – observed by Daniel Gilmour in winter 2006 and may continue to be an occasional visitor. (Also seen by the present author only 130 m downstream of the golf course beside Dandenong Creek in 2020.)

Fauna habitat

- The large dam and the wetlands represent habitat for many species of waterbirds and aquatic invertebrates as well as several species of frog. That is of particular importance during drought

conditions because the dam is expected to retain water even when many natural wetlands dry up. The dam and wetlands also provide opportunities for arboreal bird species to drink and bathe;

- The arrangement and spacing of trees on the course suit bird species of open woodlands. Those species include Willie Wagtail and White-plumed Honeyeater, which have become rare in Maroondah generally; and
- The diversity of eucalypt species provides a source of food for various flying insects and other invertebrates, which in turn represent a food source for native birds.

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the vegetation falls into category 'D' (poor) due to the small number of indigenous plant species present and the lack of understorey.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Threatened plant species

The golf course's two Yarra Gums are part of a larger population scattered along Dandenong Creek, including in Sites 74 and 75. The species does not occur naturally outside Victoria. It is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. Together, these attributes meet standard criterion 3.1.2 for a site of **State** significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', the golf course provides an ecological link between Proclamation Park (200 m north) and the Dandenong Creek habitat corridor. The course therefore fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Such a site is recognised by the standard criteria as having Local significance.

The golf course's overall 'State' significance rating differs from the 'Local' rating in the *'Sites of Biological Significance in Maroondah'* report (Lorimer *et al.* 1997) due to the discovery of two Yarra Gums in 2006.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the golfers as well as neighbours and people using the Dandenong Creek Trail on the opposite side of the creek. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The course's treed landscape is expected to contribute to the enjoyment, wellbeing and quality of life of golfers. It also encourages golfers to participate in their sport, with benefits to their physical health.

The part of the course close to Dandenong Creek has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity

of aquatic and riparian habitats. Consequently, land within 200 m of Dandenong Creek is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Aerial photographs from 2001, 2011 and 2017 indicate that the average spread of the tree crowns has increased by more than 50% during that period. The associated increase in the extent of tree canopy far outweighs the loss from removal of trees over the same period. There is inadequate information to determine other ecological changes over recent decades.

Threats

This study has identified the following threats to the course's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Decline in the number of indigenous trees (including the Yarra Gums) as old ones die and seedlings succumb to mowing and other course management activities;
- Potential redesigning of the course in ways that require removal of trees; and
- Increased rates of eucalypt deaths due to climate change. The deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The course's zoning is 'Public Park and Recreation Zone'. The only planning controls over vegetation removal are the state-wide native vegetation controls of clause 52.17 of the Victoria Planning Provisions, which affect plants of species native to Victoria (whether planted or not).

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO2 to the site, as outlined in blue on the aerial photograph on p. 789. Subject to exemptions, that control would:

- Expand the range of plants requiring a permit for removal, lopping or destruction to include non-Victorian species of *Allocasuarina*, *Angophora*, *Banksia*, *Callistemon*, *Corymbia*, *Eucalyptus*, *Leptospermum*, *Lophostemon*, *Melaleuca* and *Acacia* (other than *Acacia elata*), as long as the plants exceed 2 m tall; and
- Introduce a requirement to obtain a planning permit for building, works or subdivision, subject to exemptions.

If the requirement to obtain a planning permit for tree lopping is deemed too onerous, an exemption for golf courses could be included in ESO2.

An important aspect of ESO2 is that it provides planning control over works affecting the dam and wetlands (but not for normal maintenance of the wetlands). Such works have the potential to affect waterbird habitat and water pollution entering Dandenong Creek.

Information sources

The analysis above draws on information from the following sources:

- An inspection of the part of the site within approximately 50 m of Dandenong Creek by the present author on 1/4/20;
- Observations of the welfare of two Yarra Gums on the golf course by Richard Phillips (Maroondah City Council Tree Management Officer) on 12/9/18 and the present author on 1/4/20;
- The 2014 report, *'Ringwood Golf Course Tree Management Plan 2014'* by Tree Logic Pty Ltd for Maroondah City Council;

- The 2006 report, *'Flora, Terrestrial Fauna and Net Gain Assessment of Ringwood Golf Course, Victoria'* by N. Schnittler, D. Gilmour and N. Barnes of Biosis Research Pty Ltd for Maroondah City Council;
- The 1997 report, *'Sites of Biological Significance in Maroondah'*, for which John C. Reid did an ecological survey of the golf course on 4/3/96 and the present author did a passive search for vertebrate fauna in the western half of the course on 6/2/96;
- Bird lists by Richard Retallick during 8/5/08 to 15/7/08, stored in the Victorian Biodiversity Atlas;
- A bird list by Steve Rowe on 19/4/88, stored in the Victorian Biodiversity Atlas; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 129. Waterloo Reserve, Heathmont (Discontinued)

Biological Significance Level: *Not Significant*

Site description and changes

The reserve at 25A Waterloo Street, Heathmont, was Site 129 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). It was recognised as being of Local significance because it had 'a canopy of remnant eucalypts (Silver-leafed Stringybark, Narrow-leaved Peppermint and Bundy)'. It was not recommended for any specific planning protection.

This study's inspection of the reserve and aerial photographs of it from 2001, 2011 and 2017 determined that most of the eucalypts are still present while several have died and been removed. The site inspection also detected:

- One wild plant of Black-anther Flax-lily (*Dianella revoluta*);
- Substantial numbers of the common native grass species, Clustered Wallaby-grass (*Rytidosperma racemosum*) and Weeping Grass (*Microlaena stipoides*); and
- Scattered planted eucalypts and dense revegetation in two mulched beds.

There is a row of mature pines along the reserve's western edge and a playground in the middle.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Not significant

Site 129 does not meet any of the standard criteria for sites of biological significance because:

- The reserve falls far short of qualifying under standard criterion 1.1 – 'High degree of naturalness';
- Under standard criterion 1.2, the reserve is extremely unlikely to be important for migratory fauna or as an important refuge site for non-migratory fauna;
- The reserve's small size means it does not appear to represent an ecological 'stepping-stone' or part of a habitat corridor (as per standard criteria 1.2.6) and there seems little likelihood of that changing (in the sense of standard criterion 1.3);
- Standard criterion 2 is not met because the reserve does not have an unusually high diversity of species or communities and it does not contain a highly endemic species or taxon;
- Standard criterion 3 is not met because: (a) no significant species were observed; and (b) none of the vegetation meets the relevant definition of a 'patch', i.e. at least 0.25 ha with native understorey cover of 10% or more;
- Standard criterion 4 is not met because the reserve does not include an important representative example of any natural vegetation type or significant variant thereof;
- Standard criterion 5.1 is not met because the reserve is not used for scientific research or long-term ecological monitoring; and
- Standard criterion 5.2 is not met because the reserve is not believed to be the type locality of any taxon.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit people visiting the site or living nearby. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The reserve's natural ambience is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors and those who pass through.

Those benefits are spread into neighbouring streets and gardens by birds, butterflies and other animals moving between the site and other areas of habitat.

The vegetated landscape contributes in a small way to Heathmont's 'green and leafy' character.

Strategic planning

The reserve is zoned 'Public Park and Recreation Zone'. Its surroundings are zoned 'Neighbourhood Residential Zone – Schedule 3'. Schedule 3 of the Significant Landscape Overlay covers the whole neighbourhood, requiring a permit for the removal of canopy trees.

Taking into account the reserve's type of vegetation and that it does not meet any of the standard criteria for a site of biological significance, there is no need to introduce any new planning controls.

Information sources

The analysis above draws on the following sources of information about the site:

- A site inspection for this study on 15/11/19;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 130. Heathmont East Primary School (Discontinued)

Biological Significance Level: *Not Significant*

Site description and changes

Site 130 of the 1997 report, *'Sites of Biological Significance in Maroondah'*, comprised a 0.4-hectare treed area in the eastern quarter of the schoolgrounds. The biological significance was described as 'A population of several species of remnant eucalypts with no remaining understorey'.

Approximately one-third of that area has since been cleared for new buildings. The remainder of the tree canopy has changed little and there is still negligible indigenous understorey.

The site does not contain a 'patch' of native vegetation as defined by the state government's standard criteria (Amos 2004), i.e. an unbroken area of at least 0.25 ha with native understorey cover of 10% or more. None of the plant species detected in the reserve are rare or threatened, locally or more widely. The site is unlikely to serve as a significant ecological 'stepping-stone' in the sense of standard criterion 1.2.6.

The site therefore falls into the 'Not Significant' category in the scheme of Amos (2004).

However, the native vegetation and associated birdlife have value for climate moderation, amenity and natural heritage. These sorts of values are not considered by Amos (2004).

Strategic planning

The school is zoned 'Public Use Zone - Education'. Its surroundings are zoned 'Neighbourhood Residential Zone – Schedule 3'. Removal of native vegetation in the schoolgrounds is controlled under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. In addition, Schedule 3 of the Significant Landscape Overlay covers the whole neighbourhood, requiring a permit for the removal of canopy trees.

As the site does not meet any of the standard criteria for a site of biological significance, there is no need to introduce any new planning controls.

Information sources

The analysis above draws on the following sources of information about the site:

- A brief site inspection of the schoolgrounds from the fenceline for this study on 18/10/19;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) and an associated field data sheet by John C. Reid on 21/4/96; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No relevant information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 131. Bungalook Creek Corridor, Bayswater North

Biological Significance Level: *Local* as part of a habitat corridor



The orange star near the right edge above matches the one near the left edge below.

1:4500
0 50 100 150 200 m



Aerial photos Feb 2017

Legend

Site 73 Site 92 Properties
Site 131 Site 64 Bungalook Ck

Boundaries, land use and tenure

Site 131 contains the vegetated parts of the corridor of Bungalook Creek between Bayfield Road and Canterbury Road in Bayswater North. It is outlined in mid-blue on the aerial photographs above.

The westernmost property in the site is reserved for the proposed Healesville Freeway. The rest of the site is a stream reserve managed by Melbourne Water.

General description

Site 131 occupies 5.4 hectares of the floodplain of Bungalook Creek. The direct distance from one end to the other is 1.3 km and the creek descends 6 m vertically.

The lower of the two aerial photographs above shows no creek channel at all toward the site's northeastern (upstream) end because the creek has been replaced there by a low-flow pipe with an earthen floodway above it. That segment is included in the site because of the revegetation beside the floodway, which slightly reduces the habitat gap to Site 64 further upstream.

At the downstream end of the floodway, the low-flow pipe discharges into a litter trap. The creek then flows above-ground in a channel that follows its natural course (with two short exceptions) until 200 m before Bayswater Road. From there to Bayswater Road, the creek flows in a concrete low-flow channel at the base of a floodway.

For some decades up to 2006, the banks of the creek upstream of Bayswater Road had very little native vegetation other than copses of Swamp Paperbark (*Melaleuca ericifolia*), a small number of eucalypts and scattered rushes. However, introduced trees formed a fairly dense, narrow gallery beside the creek. Then in 2004–2005, the abovementioned litter trap was constructed and the banks and channel were almost completely cleared for 275 m downstream of the trap. Revegetation with indigenous plants was undertaken along the cleared section in 2006. The same process of clearing and revegetation occurred in 2009–2010 along the next reach of the creek, to 200 m upstream of Bayswater Road.

Downstream of the Bayswater Road bridge, the creek follows a natural, meandering path, which is uncommon for a creek in the Dandenong Creek catchment. The channel does not seem to have been subjected to much engineering and the natural sculpting processes of the water can still be observed. There are many more indigenous plants than upstream of Bayswater Road but they are intermingled with many introduced plants that have gone wild, from creepers to mature trees.

Relationship to other land

The spatial context of Site 131 relative to other significant habitat can be seen on the key map of sites of biological significance on p. 1.

Site 131 is one of three almost-contiguous sites along Bungalook Creek, with Site 64 upstream and Site 73 downstream. Site 73, in turn, connects with Tarralla Creek (Site 62) and the Dandenong Creek habitat corridor (Sites 69, 72 and 74–80). The eastern end of Site 64 is something of an ecological dead-end but it has substantial areas of habitat.

Bioregion: Gippsland Plain

Habitat types

The description of vegetation below includes only naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Swampy Riparian Woodland (EVC 83, **Endangered** in the bioregion)

Dominant canopy trees: The main species are Swamp Gum (*Eucalyptus ovata*) and Mealy Stringybark (*E. cephalocarpa*). Messmate Stringybark (*E. obliqua*) is scarce.

Lower trees: Segments with native vegetation are mostly dominated variously by Swamp Paperbark (*Melaleuca ericifolia*). Blackwood (*Acacia melanoxylon*) is also fairly abundant.

Shrubs: Most shrubs have been planted but the following occur naturally: Sweet Bursaria (*Bursaria spinosa*), Prickly Currant-bush (*Coprosma quadrifida*), Hop Goodenia (*Goodenia ovata*) and Tree Everlasting (*Ozothamnus ferrugineus*).

Ferns: None seen.

Climbers: None seen

Creepers: Bidgee-Widgee (*Acaena novae-zelandiae*).

Grasses, rushes and sedges: Rushes, particularly Pale Rush (*Juncus pallidus*) and Hollow Rush (*J. amabilis*) are scattered widely. West of Bayswater Road, there is also Veined Spear-grass (*Austrostipa rudis*), Thatch Saw-sedge (*Gahnia radula*), Variable Sword-sedge (*Lepidosperma laterale*), Spiny-headed Mat-rush (*Lomandra longifolia*) and Weeping Grass (*Microlaena stipoides*).

Other groundcover: Severely depleted, the only wild species recorded being Hairy Willow-herb (*Epilobium hirtigerum*) and Native Flax (*Linum marginale*).

Perennial stream & stream channel (No EVC number)

Trees and shrubs: Very scarce, mostly represented by Swamp Paperbark (*Melaleuca ericifolia*) spreading into the creek channel from the banks.

Non-woody species: Pacific Azolla (*Azolla rubra*), Water Plantain (*Alisma plantago-aquatica*), Swamp Club-rush (*Isolepis inundata*), Hollow Rush (*Juncus amabilis*), Green Rush (*Juncus gregiflorus*), Tall Rush (*Juncus procerus*), Common Duckweed (*Lemna disperma*), Slender Knotweed (*Persicaria decipiens*), Common Reed (*Phragmites australis*), Blunt Pondweed (*Potamogeton ochreatus*) and the cumbungi, *Typha orientalis*.

Significant plants

Senecio minimus (Shrubby Fireweed) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. It was recorded west of Bayswater Road in the most recent thorough flora survey of that area (1996) and it may well persist. This species is generally subject to large population fluctuations.

Fauna habitat

- The water and stream channel provide habitat for common fish, frogs, waterbirds and aquatic invertebrates;
- The structure and composition of the terrestrial vegetation represents low-grade habitat for common forest birds, bats, possums and invertebrates;
- The fertility of the valley favours high production of carbohydrates by plants, thereby strengthening the base of the food chain.

Ecological condition

The site's vegetation is in poor to fair ecological condition – ratings 'C' and 'D' on the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 131 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to **Local** significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The site's trees reduce wind speed. They cool the local microclimate in hot weather through shade and transpiration. These effects of microclimate moderation benefit neighbours and people using the shared path. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation adds a 'green and leafy' character to the area. The vegetation and associated birdlife provide amenity to local residents and users of the shared path.

The site's location along a stream has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Revegetation upstream of Bayswater Road has added 0.2 hectares of habitat to the site since 2006. Most or all of the small amount of tree loss that can be detected from aerial photographs since 2001 involves introduced species that were diminishing the site's habitat value.

Change in the ecological condition of habitat

Upstream of Bayswater Road, revegetation since 2006 has significantly improved the complexity and ecological condition of the affected parts of the site. In the revegetated section of the site and also downstream of Bayswater Road, the habitat for native birds has been improved since c. 2005 by the removal of introduced plants such as willows, Sweet Pittosporum (*Pittosporum undulatum*) and Monterey Pine (*Pinus radiata*).

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Construction of the Healesville Freeway, which would probably destroy the biodiversity of the site's westernmost lot;
- Erosion, loss of riparian vegetation and disruption of aquatic ecological processes by pulsed flows caused by increasing impervious surfaces in the catchment, exacerbated by climate change;
- Displacement of indigenous plants by introduced plants;
- Water pollution, affecting vegetation, aquatic invertebrates, fish, frogs and waterbirds; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The part of the site west of Bayswater Road is zoned 'Urban Floodway Zone' for varying widths along the creek and 'General Residential Zone – Schedule 1' at greater distances from the creek. The main property that extends from Bayswater Road to the litter trap is zoned 'Public Use Zone – Service and Utility'. The abutting, narrow strip with the shared path is zoned 'General Residential Zone – Schedule 1'. Upstream of Bayview Rise, the zoning is 'Industrial 1 Zone'.

Tree removal downstream of Bayswater Road is regulated under Schedule 4 of the Significant Landscape Overlay. In addition, removal of all native vegetation (trees to groundcover and aquatic plants) is regulated throughout the site by the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions. However, Melbourne Water's removal of vegetation on stream banks is often exempt from clause 52.17.

The current planning controls over vegetation removal in the site seem adequate, taking into account that:

- The site's biological significance is only at the Local level;
- The western end of the site is proposed to be occupied by the Healesville Freeway; and
- In the rest of the site, there are no apparent reasons why native vegetation would be removed except for dead, dying or dangerous trees.

Information sources

The analysis above draws on the following information:

- A brief site inspection by the author for this study;
- The author's occasional walks and bike rides east of Bayswater Road between 2002 and 2016;
- A plant list compiled by the author on 16/1/04 for the section of Site 131 beside Bayview Rise;
- A plant list compiled for the section west of Bayswater Road by the author and John C. Reid in February to April 1996 as part of fieldwork for *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), even though the site was not discussed in the publication;
- The author's frog call surveys and spotlighting for the same project, conducted at Bayswater Road on 12/3/96 and at Canterbury Road on 19/2/96 and 12/3/96,
- Aerial photographs from 1945, 2001, 2011 and 2017; and
- A sequence of satellite images in Google Earth Pro from 29/4/05 to 12/12/18.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 132. Wyett Court Reserve, Bayswater North (Discontinued)

Biological Significance Level: *Not significant*

Site description and changes

The reserve at 12 Wyett Court, Bayswater North, was Site 132 of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). It was recognised as being of Local significance for the presence of approximately 25 Swamp Gums (*Eucalyptus ovata*), some of which were very large and old. There was hardly any indigenous understorey. A 2001 aerial photograph indicates that the Swamp Gums at that time were spread over an area of approximately 0.25 ha.

Some of the Swamp Gums have since died and there is still hardly any indigenous understorey. However, the indigenous flora still contains over a dozen Swamp Gums (three of them with trunk diameters over 70 cm), four other tree species and one shrub species.

The reserve does not contain a 'patch' of native vegetation as defined by the state government's standard criteria (Amos 2004), i.e. an unbroken area of at least 0.25 ha with native understorey cover of 10% or more. None of the plant species detected in the reserve are rare or threatened, locally or more widely. The site is unlikely to serve as a significant ecological 'stepping-stone' in the sense of standard criterion 1.2.6.

The site therefore falls into the 'Not Significant' category in the scheme of Amos (2004).

However, the vegetation and associated birdlife have value for amenity and natural heritage. These sorts of values are not considered by Amos (2004).

Strategic planning

The reserve is zoned 'Public Park and Recreation Zone'. Its surroundings are zoned 'General Residential Zone – Schedule 1'. Schedule 4 of the Significant Landscape Overlay covers the whole neighbourhood, requiring a permit for the removal of canopy trees. In addition, removal of native vegetation in the reserve is controlled under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

As the site does not meet any of the standard criteria for a site of biological significance, there is no need to introduce any new planning controls.

Information sources

The analysis above draws on the following sources of information about the site:

- A site inspection for this study on 14/9/19;
- *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997); and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 133. 9 Lillypilly Lane, Kilsyth South

Biological Significance Level: *Local* as an important part of a habitat corridor



Boundaries, land use and tenure

Site 133 occupies most of 9 Lillypilly Lane, Kilsyth South, excluding 4,800 m² in the east that has no biological significance. The property is residential, with multiple dwellings.

General description

9 Lillypilly Lane occupies 3.0 hectares on the floodplain of Dandenong Creek, with the Little Bungalook Creek drain flowing westward along the northern fence. The part of the property within Site 133 contains approximately 2 hectares of tree cover made up overwhelmingly of indigenous Swamp Gums (*Eucalyptus ovata*) and Blackwoods (*Acacia melanoxylon*). These trees are remnants of the endangered Ecological Vegetation Class (EVC) called Swampy Woodland. The shrub layer and groundcover are very sparse due to horse grazing.

Relationship to other land

As can be seen on the aerial photograph above, 9 Lillypilly Lane abuts Site 68 (Eastwood Golf Course) to the north and Site 70 (Appletree Hill Reserve) to the west. Sites 66, 67 and 95 are contiguous with Site 68. The important wildlife corridor of Dandenong Creek (Site 69) lies 190 m to the south – see the key map on p. 1.

There is very little tree cover in the area other than within these sites and some Swamp Gums on a few other properties along Lillypilly Lane.

For tree-dependent bird and insect species, Sites 70 and 133 represent a single patch of tree cover of approximately 4½ ha. If not for 9 Lillypilly Lane, the area of tree cover would be halved. That would significantly diminish the attractiveness of the habitat as a stepping-stone for tree-dependent birds and insects to move between the Dandenong Creek habitat corridor and Sites 66–68.

Birds and flying insects flying between the sites are likely to carry pollen and seeds, improving the viability of the indigenous flora.

The habitat on 9 Lillypilly Lane also represents an ecological buffer for the state-significant habitat of the abutting Appletree Hill Reserve (Site 70).

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the dominant indigenous plant species that could be readily seen from outside the property in a brief inspection.

Swampy Woodland (Ecological Vegetation Class no. 937, **Endangered** in the bioregion)

Canopy trees: A near-pure stand of Swamp Gum (*Eucalyptus ovata*) but with at least one Narrow-leaved Peppermint (*E. radiata*).

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*), with a trace of Swamp Paperbark (*Melaleuca ericifolia*).

Shrubs: The only species visible was the Large Kangaroo-apple (*Solanum* ?*laciniatum*).

Fauna habitat

- The tree canopy represents suitable habitat for forest birds but the value of that habitat is diminished by the paucity of shrubs;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There are at least four large, old Swamp Gums, which are of high value as habitat trees;
- The habitat features above are made more valuable by the property's location next to Appletree Hill Reserve and positioned between the Dandenong Creek habitat corridor and Sites 66–68; and
- A dam supports waterbirds, frogs and aquatic invertebrates.

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), the property's vegetation falls into category 'D' (poor) due to lack of shrubs and native undergrowth. That, in turn, is due to grazing.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local as part of an ecological stepping-stone

Ecological corridor

> Referring to the section above headed 'Relationship to other land', the combination of 9 Lillypilly Lane and Appletree Hill Reserve fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Such a site is recognised by the standard criteria as having **Local** significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit reserve the residents of 9 Lillypilly Lane and neighbouring properties, as well as visitors to Appletree Hill Reserve and golfers at Eastwood Golf Course. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation preserves something of the area's natural landscape. It, and the associated birdlife, help to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Birds that travel to and from the property do so via the surrounding residential area and golf course, thereby enriching the birdlife experienced by golfers and residents in their daily lives.

The site's location on a floodplain has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, most of 9 Lillypilly Lane is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, the extent of tree cover on 9 Lillypilly Lane has increased by an amount estimated as slightly over 0.1 ha during that period. The increase has occurred through growth of tree crowns over land that previously had no native vegetation, as well as a lesser amount of natural regeneration of indigenous trees.

Change in the ecological condition of habitat

There is no prior information about the ecological condition of the property's vegetation other than aerial photographs. Aerial photographs from 2001, 2011 and 2017 indicate that some eucalypts died between 2001 and 2011 (during the Millennium Drought) and perhaps a few more since then.

Threats

This study has identified the following threats to the site's biodiversity:

- Possible subdivision if the Urban Growth Boundary is moved;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Horse grazing, although most species sensitive to horse grazing have already died out; and

- Further eucalypt deaths. The deaths will occur mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

The property lies just outside the Urban Growth Boundary and it is zoned 'Green Wedge A Zone'. Tree removal is regulated under Schedule 1 to the Significant Landscape Overlay. In addition, removal of all native vegetation (trees to groundcover) is regulated under the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the whole of Site 133 as outlined in magenta on the aerial photograph on p. 803.

Information sources

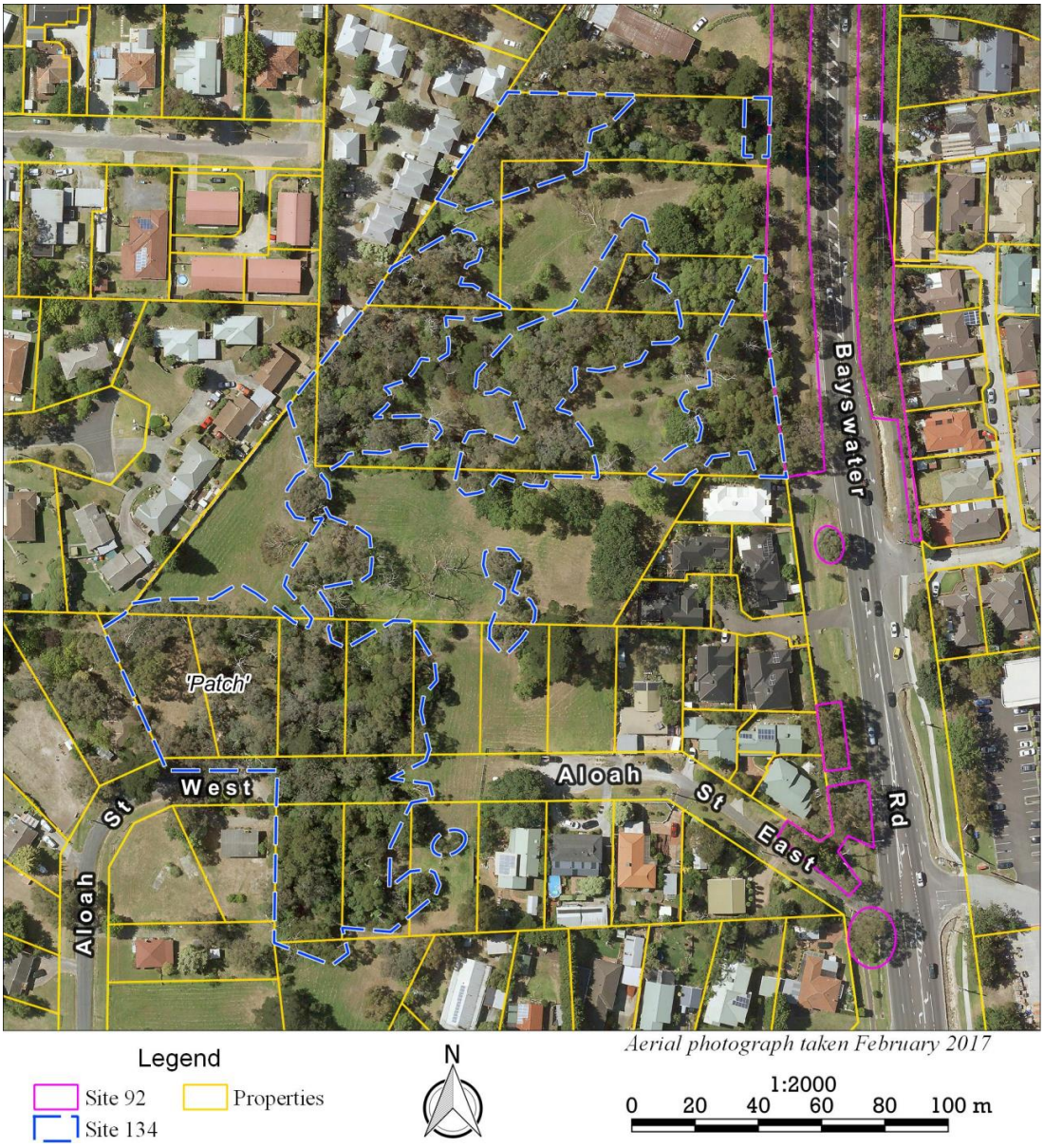
The analysis above draws on the following information:

- An inspection by the author from outside the property boundary on 28/3/18 and 14/9/19; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 134. Freeway Reservation, Aloah Street, Bayswater North

Biological Significance Level: *State* due to the presence of an endangered vegetation type



Boundaries, land use and tenure

Site 134 has a dashed blue outline on the aerial photograph above. Where yellow or magenta appears in the gaps between the dashes, the outlines follow property boundaries. As with all sites in this volume, the precise boundary is available in a shapefile for geographic information systems.

The site contains native vegetation on land owned by the Victorian Government, reserved for the proposed Healesville Freeway. The small rectangle in the northeast corner has very little native vegetation but is

included in the site because a patch of the endangered flat-pea, *Platylobium infecundum*, abuts the rectangle's eastern side.

The land is currently vacant.

General description

Site 134 occupies a total of 1.55 hectares divided among six polygons. North of the properties fronting Aloah Street West and Aloah Street East, there is a gentle gradient of typically 1:20 to the southwest. The rest of the site has a similar gradient but slopes to the west.

The complexity of the site boundary arises from a history of grazing and residential land uses followed by periodic slashing in recent years. The land between the site's polygons is either abandoned pasture or densely covered with introduced plants going wild. The most prolific of those introduced species are also competing with the indigenous plants within the site.

The site's most natural vegetation lies immediately north of Aloah Street West and is labelled 'Patch' on the aerial photograph above. (See also the section below headed 'Significance ratings'.) Even some of the least natural vegetation contains indigenous species that are very scarce or absent from the more natural areas.

This study detected thirty naturally-occurring, indigenous plant species within the site. Others would be expected to be found in a more thorough flora survey.

Relationship to other land

As can be seen on the aerial photograph above, Site 134 abuts the Bayswater Road habitat corridor (Site 92). Site 134 may act as a habitat node along the corridor but the abundance of Sweet Pittosporums, pines and other introduced plants probably inhibits that function. Site 134 may also provide some birds and flying insects with a habitat connection between the habitat corridors along Bayswater Road, Tarralla Creek (Site 62, 150 m west) and Bungalook Creek (Site 131, 140 m south). The spatial arrangement of these sites can be seen on the key map of sites of biological significance on p. 1.

Bioregion: Gippsland Plain

Habitat type

Valley Heathy Forest (Ecological Vegetation Class no. 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Mealy Stringybark (*Eucalyptus cephalocarpa*) and Bundy (*E. goniocalyx*). Messmate Stringybark (*E. obliqua*) is also fairly abundant. Red Stringybark (*E. macrorhyncha*), Swamp Gum (*E. ovata*) and Narrow-leaved Peppermint (*E. radiata*) are scarce.

Lower trees: The stratum of subcanopy trees is dominated by the non-indigenous Sweet Pittosporum (*Pittosporum undulatum*). The indigenous species include Black Wattle (*Acacia mearnsii*), Blackwood (*A. melanoxylon*), Cherry Ballart (*Exocarpos cupressiformis*) and Swamp Paperbark (*Melaleuca ericifolia*).

Medium to large shrubs: Sweet Bursaria (*Bursaria spinosa*) and Yarra Burgan (*Kunzea leptospermoides*) are fairly abundant. Sifton Bush (*C. sifton*) and Prickly Tea-tree (*Leptospermum continentale*) are scarce. Prickly Currant-bush (*Coprosma quadrifida*) was present in 1996.

Small shrubs: None seen.

Ferns: Austral Bracken (*Pteridium esculentum*) is scarce.

Climbers and creepers: No indigenous species were seen but Ivy (*Hedera helix*) and Wandering Trad (*Tradescantia fluminensis*) are abundant.

Grasses, rushes and sedges: Indigenous grasses are abundant and rich in species. In the more open areas, the groundcover is dominated by Weeping Grass (*Microlaena stipoides*) or Clustered Wallaby-grass (*Rytidosperma racemosum*). Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) and Kangaroo

Grass (*Themeda triandra*) are also abundant in some areas. The following species are fairly abundant or widespread within the site: Thatch Saw-sedge (*Gahnia radula*), Hollow Rush (*Juncus amabilis*), Green Rush (*Juncus gregiflorus*), Pale Rush (*Juncus pallidus*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*). Other species are scarce.

Other groundcover: Greatly depleted. The only species seen in this study were Chocolate Lily (*Arthropodium strictum*) and Common Raspwort (*Gonocarpus tetragynus*), both of which are scarce.

Significant plants

Red Stringybark (*Eucalyptus macrorhyncha*) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. It is scarce in Site 134 but numbers were not counted.

Fauna habitat

- The structure and composition of the native vegetation represent suitable habitat for common forest birds, bats, possums and invertebrates but the value of that habitat is diminished by the abundant environmental weeds, particularly Sweet Pittosporum;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- There is at least one large, old eucalypt, which is of high value as a habitat tree;
- The habitat features above are made more valuable by the site's location abutting the Bayswater Road habitat corridor (Site 92) and its proximity to other corridors (Sites 62 and 131); and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), approximately two-thirds of the site's vegetation falls into category 'C' (fair) and the rest falls into category 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Regionally threatened Ecological Vegetation Class

The part of Site 134 extending 50 m north from Aloah Street West (labelled 'Patch' on the aerial photograph on p. 807) meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The vegetation type is Valley Heathy Forest, which is listed by the state government as 'endangered' within the relevant bioregion – the Gippsland Plain. It follows that the site meets standard criterion 3.2.3 for a site of **State** significance.

The brief survey for this study was inconclusive about whether two other parts of the site also qualify as 'patches' and represent State significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', there is a substantial likelihood that Site 134 acts as an ecological 'stepping-stone' between three habitat corridors (Sites 62, 92 and 131). If so, it fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment". Such a site is recognised by the standard criteria as having Local significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the residents of neighbouring properties. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

Changes

Change in the extent of habitat

Changes in vegetation cover were assessed by comparing aerial photographs from 2001 and 2017. Approximately 0.15ha of Site 134 appears to have changed from native vegetation to pasture weeds and no tree cover.

Change in the ecological condition of habitat

The information from the two available flora surveys (in 1996 and this study) is inadequate to make a quantitative comparison of ecological condition. The lists of plant species suggest that any changes have been minor. However, aerial photographs show that a substantial number of eucalypts died between 2001 and 2011, attributable to the Millennium Drought.

Threats

This study has identified the following threats to the site's biodiversity, in decreasing order:

- Construction of the Healesville Freeway, which would probably destroy the site's biodiversity;
- Further displacement of indigenous flora by 'environmental weeds' such as Sweet Pittosporum and Monterey Pine;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Further eucalypt deaths. The deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

Site 134 is zoned 'Neighbourhood Residential Zone – Schedule 3'. Tree removal is regulated under Schedule 3 of the Significant Landscape Overlay. In addition, removal of all native vegetation (trees to groundcover) is regulated by the state-wide planning controls of clause 52.17 of the Victoria Planning Provisions.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to Site 134. It would also be appropriate to extend the application of ESO1 to the whole of each lot affected by Site 134 because:

- Land uses and developments between the polygons of Site 134 can materially affect the site's ecological condition;
- ESO1 does not affect non-indigenous vegetation, whereas there is hardly any indigenous vegetation outside the site's polygons; and

- Simplification of overlay boundaries makes them less susceptible to misinterpretation.

Information sources

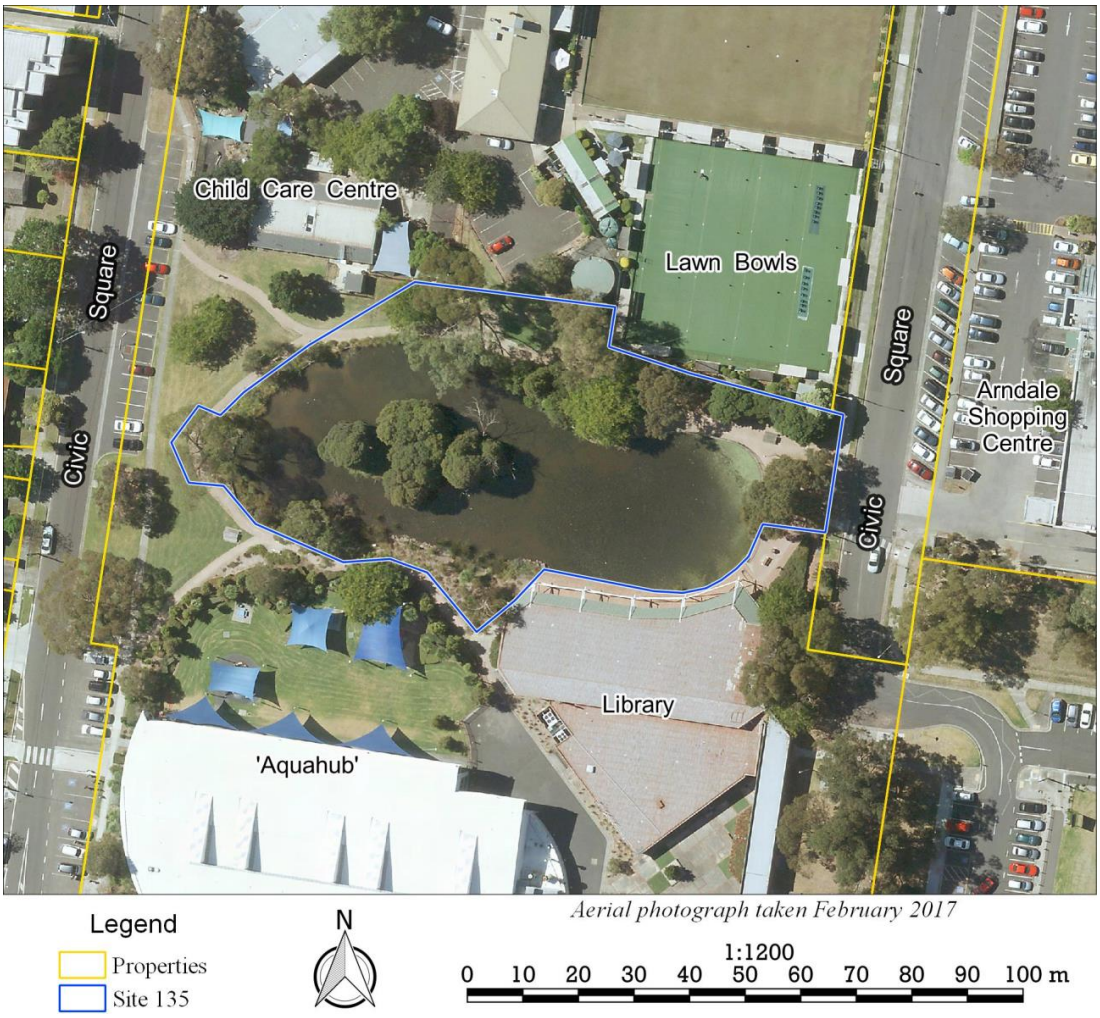
The analysis above draws on the following information:

- An inspection by the author for this study, including compilation of a list of plant species and their abundances;
- A plant list compiled by John C. Reid on 12/2/96 as part of his fieldwork for *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), even though the site was not discussed in the publication; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Victorian Biodiversity Atlas and the Atlas of Living Australia.

Site 135. Croydon Library Pond

Biological Significance Level: *State* for occurrences of the endangered Blue-billed Duck



Boundaries, land use and tenure

Site 135 is outlined in blue on the aerial photograph above. The boundary has been drawn to encompass the area most used by waterbirds. The site is an amenity asset owned by Maroondah City Council, part of Croydon's Civic Square community precinct.

General description

Site 135 includes the pond next to the Croydon Library as well as its surrounding vegetation and treed island. The whole site occupies 0.46 hectares.

The pond is less than a metre deep. It is rarely dry, and then only to allow removal of sediment. It has vertical sides but the western half is so shallow that mudflats and reedbeds become exposed when the water level is toward the lower end of its normal range. The bottom of the pond is well-vegetated with Curly Pondweed (*Potamogeton crispus*) and Blunt Pondweed (*P. ochreatus*), providing a base for the aquatic

food chain upon which the site's pondlife and waterbirds rely. The introduced Mosquitofish (or Eastern Gambusia) is abundant.

Waterbirds abound. Most of them are common species but there are rare species at times, particularly during drought when most of the landscape is dry. The rare waterbirds are what give the site its biological significance.

The site is also significant from a human perspective, particularly for the opportunity it provides people to connect with nature. Urban-adapted waterbirds (mainly Pacific Black Ducks) solicit food from the many people who visit the site. While people receive benefit from feeding ducks, the resulting excess of duck food and guano in the pond creates a significant problem of excessive nutrients in the water and sediment. That creates the undesirable environmental condition called eutrophication.

Relationship to other land

As this site's biological significance relates to waterbirds, the important aspect of its relationship to other land involves the ability of waterbirds to fly to and from elsewhere.

Waterbirds are highly mobile and often nomadic or migratory. That is because the suitability of aquatic habitat typically varies greatly by season or due to droughts or floods. The Croydon Library Pond's proximity to other wetland habitat is therefore much less important than the proximity of a forested site to other forest.

The pond's most common waterbirds move between there and nearby habitat, often on a daily basis. The closest suitable habitat is at the stormwater treatment wetlands on Tarralla Creek (part of Site 62), 400 m to the south. The next-closest suitable habitat is at the Dorset Golf Course (another part of Site 62, roughly 2 km to the southeast), The Range estate (Site 59, 2.8 km northeast), Yarrunga Reserve (Site 18, 3.1 km north) and Candlebark Walk (Site 17, 3.5 km north-northwest). These distances are easily traversed by waterbirds, even if the intervening landscape is inhospitable.

Much larger distances are traversed by waterbirds in pursuit of habitat when their current habitat dries up or becomes otherwise unsuitable. That explains why the threatened species Blue-billed Duck and Great Egret took up residence at the Croydon Library pond during the Millennium Drought, when the pond remained full and most wetlands in southeastern Australia dried up.

The most important relationship of the pond to other habitat is therefore that the pond contains permanent water and can act as a refuge when most other wetlands in the region dry up.

Bioregion: Gippsland Plain

Habitat types

Species whose names are asterisked in the following descriptions of vegetation have been planted or are offspring of plantings.

Artificial waterbody with permanent water

Trees: None.

Shrubs: A number of plants of an unidentified, non-indigenous, red-flowered *Callistemon* species grow in cracks in the pond sides. Those plants derive from plantings.

Aquatic plants: Between dredging, the pond becomes heavily populated with Curly Pondweed (*Potamogeton crispus*) and Blunt Pondweed (*Potamogeton ochreatus*). Common Duckweed (*Lemna disperma*) is abundant in season. Common Reed (*Phragmites australis*) and Green Rush (*Juncus gregiflorus*) are fairly abundant at the western end of the pond. Slender Knotweed (*Persicaria decipiens*) is scarce, as is Common Spike-rush (*Eleocharis acuta*), which might have been planted. Jointed Twig-rush (*Baumea articulata*) and Water Ribbons (*Cycnogeton procerum*) are fairly abundant as a result of planting. Purple Loosestrife (*Lythrum salicaria*) has also been planted but is scarce.

Terrestrial vegetation (mainly planted) on the island and fringing the pond

Trees: All planted. Dominated by Prickly Paperbark (*Melaleuca styphelioides*). There are also several planted eucalypts. The only indigenous species is Swamp Gum (*Eucalyptus ovata*).

Shrubs: Hop Goodenia (*Goodenia ovata*) is fairly abundant as a result of planting. There are also a few of the same *Callistemon* species as mentioned above.

Grassy plants: Abundant, entirely due to planting. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) is the most abundant indigenous species, followed by Common Tussock-grass (*Poa labillardierei*), then Tall Sedge (*Carex appressa*) and Leafy Flat-sedge (*Cyperus lucidus*).

Other groundcover: Hairy Willow-herb (*Epilobium hirtigerum*) plants volunteer themselves fairly freely. Tasman Flax-lily (*Dianella tasmanica*) is fairly abundant as a result of planting.

Significant plants

At the time of writing (2019–2020), Curly Pondweed (*Potamogeton crispus*) is abundant in the pond. The only other occurrences detected anywhere in Maroondah during this study are at the Andersons Creek East Branch Reserve in Warranwood (part of Site 9) and sparingly in Dandenong Creek (Site 69). It seems clear that the species falls into the 'critically endangered' category of risk of dying out in Maroondah.

Significant fauna

- Blue-billed Duck, *Oxyura australis* (listed as Endangered throughout Victoria): One individual was present daily at the pond during the latter years of the Millennium Drought;
- Eastern Great Egret, *Ardea modesta* (listed as Vulnerable throughout Victoria): One individual was frequently present the pond during the latter years of the Millennium Drought. The species was also reported on 8/2/13 by Peter Booth via the 'Eremaea Birds List';
- Hardhead, *Aythya australis* (listed as Vulnerable throughout Victoria): an unspecified number of individuals were reported to the eBird website by John Harris on 5/1/14 and by Brett Harman to the Eremaea Birds List on 15/10/12. The species is a rare visitor to the site;
- Nankeen Night Heron, *Nycticorax caledonicus* (listed as Near Threatened throughout Victoria): One individual was resident at the pond during the latter years of the Millennium Drought;
- Yellow-billed Spoonbill, *Platalea flavipes* (threatened in Maroondah): one individual resided at the pond for at least one month during 2016.

Fauna habitat

- The pond's water, aquatic plants and fringing plants provide food and cover for tadpoles, frogs and aquatic invertebrates, all of which provide food for waterbirds;
- The introduced Mosquitofish or Eastern Gambusia (*Gambusia holbrooki*), although more generally regarded as an ecological problem in Australia, provides plentiful food for some waterbirds;
- The island and its vegetation provide resting and perching sites for waterbirds and some forest birds such as corellas, free of the threat of potential predators such as people; and
- Trees around the outside of the pond provide further perching sites that are fairly heavily used.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: State

Threatened fauna

Standard criterion 3.1.2 accords State significance to 'all sites with populations of a taxon listed as critically endangered or endangered and not endemic to Victoria'. The Blue-billed Duck is such a species and it was resident at the pond during latter years of the Millennium Drought. It has not been

reported at the pond since the drought but it would be expected to return in future droughts, in a manner analogous to the seasonal recurrence of migratory birds at other wetlands. Site 135 is therefore regarded as meeting standard criterion 3.1.2 for a site of **State** significance.

On the same basis, the frequent occurrence of the vulnerable Eastern Great Egret during the latter years of the Millennium Drought meets standard criterion 3.1.2 for a site of Regional significance.

Drought refuge

Because the abovementioned significant waterbirds became residents or frequent visitors of the pond in the latter years of the Millennium Drought, the pond can be regarded as a drought refuge. Only a single individual of those species was observed at a time. Those species are so uncommon in Maroondah that even one bird reaches the threshold of being at least 25% of the municipal population. As a result, the site qualifies for Local significance under standard criterion 1.2.5.

Locally threatened plant species

Referring to the section above headed 'Significant plants', Curly Pondweed is locally threatened in Maroondah and abundant in the pond. Such a population meets standard criterion 3.1.5 for Local significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The pond adds greatly to the amenity of the Civic Square community precinct. Its location and the overlooking glass wall of the Croydon Library mean that the site is enjoyed by large numbers of people.

The high visitation rate of children to the library, pond and adjacent child care centre make the site particularly important for providing children with contact with nature. Contact with nature has been scientifically shown to be highly beneficial to childhood development (Section 1.3 of Volume 1; Chawla 2015).

For local workers and visitors of all ages, the semi-natural landscape and the abundance of birdlife are expected to contribute to health, wellbeing and quality of life. The site also contributes to the municipality's prized 'green and leafy' character and image.

Changes

Change in the extent of habitat

A sequence of aerial photographs indicates that the garden bed west of the library was reduced in area by 260 m² as part of the construction of Aquahub in c. 2008. That represented a small reduction in the extent of habitat. On the other hand, the site's trees have grown, providing a slow, steady increase in the extent of arboreal habitat.

Change in the ecological condition of habitat

From the author's incidental observations of the site, the ecological condition of the pond and its vegetation varies cyclically due to dredging that occurs in some years to remove nutrient-laden sediment. That cyclic variability masks any trends that may have occurred in the condition of the aquatic habitat.

The habitat value of the surrounding trees and garden beds has been slowly improving over the past decade as the plants grow.

Threats

At the time of writing, a draft 'Croydon Community Precinct Masterplan' is being created. Maroondah City Council's website says that the proposals in the masterplan include 'Retention and enhancement of part of the existing water body (duck pond) to complement the surrounding areas'. This would mean that part of the pond would be removed. Presumably, some of the vegetation that forms habitat would also be removed. Any reduction in size would compromise the pond's ability to continue as a drought refuge for threatened waterbirds.

The greatest medium- to long-term threats to the site's biodiversity values are the current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents.

Strategic planning

The site is zoned 'Public Use Zone – Local Government'. There are no planning overlays relevant to surface water, vegetation or the natural environment.

As the site is subject to the abovementioned draft proposal to remove an unspecified part of the site's habitat, it is not possible to recommend appropriate planning protection for the site.

Information sources

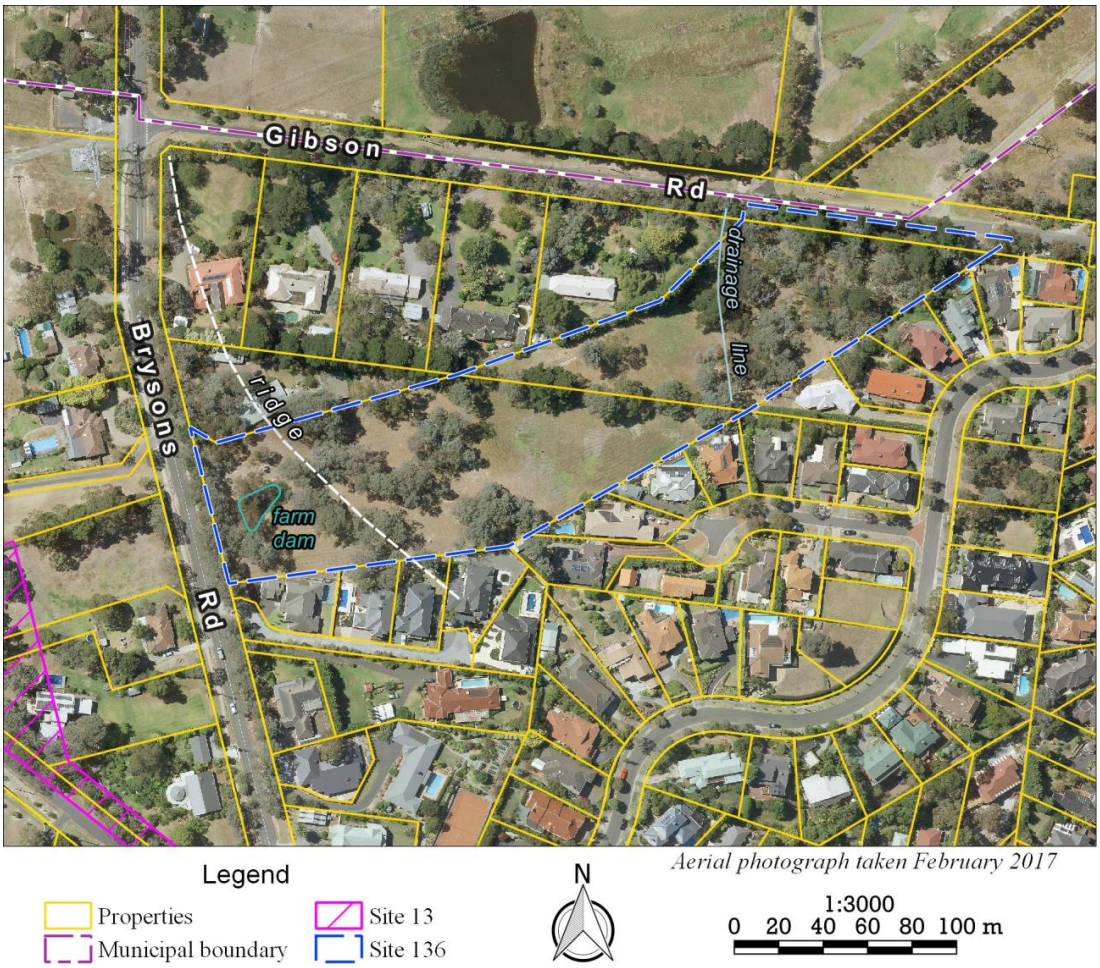
The analysis above draws on the following information:

- Site inspections for this study on 6/3/18 and 8/11/19;
- The author's frequent visits to the site since 2002;
- Bird lists on the online resources, eBird and the Atlas of Living Australia, last checked on 2/11/19; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online Victorian Biodiversity Atlas.

Site 136. Northern Arterial Road Reservation, Warranwood

Biological Significance Level: *Local* as a habitat corridor and for the patch of native vegetation



Aerial photograph taken February 2017

Boundaries

As outlined in blue above, the site occupies 24–32 Gibson Road, its road verge, and 74–80 Brysons Road.

Land use and tenure

The site is part of the reservation for the proposed Northern Arterial Road. It is currently vacant.

General description

Site 136 occupies 2.4 hectares. West of the ridge marked on the aerial photograph, there is a gentle (1:10) slope facing west-northwest, interrupted by an old farm dam. The rest of the site slopes generally to the north with a typical gradient of 1:5, interrupted by the minor drainage line shown on the aerial photograph.

With the exception of the road verge of Gibson Road, the land has a history of grazing by stock. Eastern Grey Kangaroos still graze there.

The most natural vegetation within the site extends eastwards from the drainage line. Most of that area has a near-natural canopy cover and the understorey is dominated by indigenous shrubs and grasses, with a scattering of wildflowers. Even where there is a gap in the canopy, the groundcover is still dominated by indigenous grasses.

The road verge of Gibson Road differs from the vegetation to its south in that its canopy is dominated by pines and it has a deeper groundcover layer because it receives less slashing.

West of the drainage line, the eucalypt cover is rather patchy, as can be seen on the aerial photograph above. The cover of indigenous grasses is similarly patchy but they dominate as much area as introduced grasses do.

The farm dam is well vegetated with indigenous wetland plants.

Across the whole site, this study detected thirty-one naturally-occurring, indigenous plant species.

Relationship to other land

The spatial context of Site 136 relative to other habitat can be seen on the key map of sites of biological significance on p. 1. The site spans most of the distance between habitat to the west (Site 13, 85 m away) and east (Site 14, 175 m away). Eastern Grey Kangaroos can be readily seen grazing in Site 136 and moving along it. Some birds and flying insects may well use the site in similar ways.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below excludes introduced species and inconspicuous indigenous species.

Grassy Dry Forest (Ecological Vegetation Class no. 22, 'Least concern' in the bioregion)

Canopy trees: Strongly dominated by Red Box (*Eucalyptus polyanthemos*). Bundy (*E. goniocalyx*) is fairly abundant and there are at least three Red Stringybarks (*E. macrorhyncha*).

Lower trees: Blackwood (*Acacia melanoxylon*) and Cherry Ballart (*Exocarpos cupressiformis*) are fairly abundant. Lightwood (*A. implexa*) is very scarce.

Medium to large shrubs: Sparse, mainly represented by Sweet Bursaria (*Bursaria spinosa*) and Yarra Burgan (*Kunzea leptospermoides*). Hedge Wattle (*Acacia paradoxa*) is scarce.

Small shrubs: None seen.

Ferns: None seen.

Climbers: Downy Dodder-laurel (*Cassytha pubescens*) is scarce.

Creepers: None seen.

Grasses, rushes and sedges: Rather dense and moderately rich in indigenous species. Areas with little if any tree cover are largely dominated by Clustered Wallaby-grass (*Rytidosperma racemosum*). Weeping Grass (*Microlaena stipoides*) is also abundant in some of the untreed area. In the treed areas, Thatch Saw-sedge (*Gahnia radula*) or Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) are dominant and the following species are fairly abundant: Cluster-headed Mat-rush (*Lomandra longifolia* subsp. *exilis*), Leafy Wallaby-grass (*Rytidosperma fulvum*), Red-anther (or Silvertop) Wallaby-grass (*R. pallidum*) and Purplish Wallaby-grass (*R. tenuius*).

Other groundcover: Greatly depleted by the history of grazing and slashing. The only species seen in this study was Black-anther Flax-lily (*Dianella revoluta*), which is fairly abundant.

Artificial wetland (no Ecological Vegetation Class number or conservation status applicable)

Trees and shrubs: Absent.

Amphibious species: The most abundant species is Slender Knotweed (*Persicaria decipiens*), followed by Lesser Joyweed (*Alternanthera denticulata*) and Common Blown-grass (*Lachnagrostis filiformis*). Hairy Willow-herb (*Epilobium hirtigerum*) and various species of rush (*Juncus*) are fairly abundant.

Significant plants

Red Stringybark (*Eucalyptus macrorhyncha*) can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah. Three individuals were seen within Site 136 during this study.

Fauna habitat

- The structure and composition of the forest east of the drainage line represents suitable habitat for a range of forest birds, bats and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals;
- The whole site offers good grazing for Eastern Grey Kangaroos, which are fairly abundant on the site and to its north and west;
- The areas with cover of eucalypts and/or shrubs have a layer of forest litter that provides food and cover for a range of invertebrates. Some of the invertebrates become food for vertebrates such as lizards, bats and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), approximately 0.4 ha falls into category 'C' (fair) and the remainder (2 ha), category 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Ecological Vegetation Class

The area of Site 136 east of the drainage line marked on the aerial photograph on p. 817 easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The patch contains Grassy Dry Forest, whose conservation status is listed by the state government as 'least concern' within the relevant bioregion. The author is confident that if a 'habitat score' were determined, it would be less than 0.6. It follows that the patch meets standard criterion 3.2.3 for a site of **Local** significance.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 136 fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to **Local** significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation

benefit the site's neighbours. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The site's vegetation contributes to the 'green and leafy', semi-rural character of the area. It also preserves something of the area's natural landscape. It helps to pass on an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Change in the extent of habitat

When the Site 136 and its surroundings were inspected in 1996 for the report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al*. 1997), the site was part of two grazing paddocks that extended east to Eden Valley Road. By c. 2010, residential development had occurred along the whole of the southeastern boundary of Site 136. Some habitat was certainly lost to the development but the extent could not be determined in this study. That is because most of the development had already happened before the earliest available aerial photograph (dated 2001). Since 2001, approximately 0.07 ha of habitat was removed, which was for the Valley View Drive subdivision in 2011.

Change in the ecological condition of habitat

The level of detail in the flora survey for this study was inadequate to make a quantitative comparison of ecological condition with previous data. The author's recollections and the lists of plant species from 1996 and 2019 suggest that any changes have been minor.

Threats

This study has identified the following threats to the site's biodiversity:

- Construction of the Northern Arterial Road, which would destroy the site's biodiversity;
- Displacement and suppression of indigenous flora by pines as the pines grow and potentially reproduce;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and
- Loss of plant species with low populations due to slow attrition and poor reproductive success. This may represent a vicious spiral because less diverse ecosystems have less capacity to adapt to changes such as drought and climate change, leading to further loss of species.

Strategic planning

The whole site is zoned 'General Residential Zone – Schedule 1'. Vegetation removal in the whole site is regulated under Schedule 4 of the Significant Landscape Overlay and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions.

Those planning controls over vegetation removal seem adequate, taking into account that:

- The site's biological significance is only at the Local level; and
- The site is proposed to be occupied by the Northern Arterial Road.

Information sources

- A site inspection for this study on 20/3/19;
- A plant list compiled by the author on 8/1/96 as part of his fieldwork for *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), even though the site was not discussed in the publication; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in the online resources, eBird, the Atlas of Living Australia or the Victorian Biodiversity Atlas.

Site 137. O'Neill Way Reserve, Warranwood

Biological Significance Level: *Regional to State* due to a vulnerable vegetation type



Boundaries, land use and tenure

This site occupies the whole of O'Neill Way Reserve (7-9 O'Neill Way), Warranwood, as outlined in cyan above. It is a council reserve that serves functions for drainage, amenity and biodiversity. The centre and western parts of the reserve are occupied by a flood retarding basin.

General description

O'Neill Way Reserve occupies 1.1 hectares. A drainage line flows from the reserve's western point to its northeastern point, with a dam across it to create a flood retarding basin. Excluding the dam embankments, the slopes are moderately steep, with gradients of approximately 1:5, facing generally north, northeast or southeast.

The floor of the retarding basin is often boggy. It is covered with introduced plants except for some indigenous waterplants near the outlet. Extending approximately 15 m from the reserve's northwestern boundary, there is a broad strip of revegetation with indigenous plants, planted in c. 1998. In all other directions from the retarding basin and its dam, there is an arc of a type of forest called Valley Grassy Forest, which is listed by the state government as 'vulnerable'. The vegetation close to O'Neill Way appears to grade into a more common vegetation type – Grassy Dry Forest – but there are too few indigenous species to be confident. The reason for so few species in that part of the reserve is regular

mowing, which affects the area between the houses on O'Neill Way and most of the area on and west of the dam embankments.

The vegetation along the reserve's northern edge comprises a dense mixture of indigenous and non-indigenous trees, competing strongly with each other. Some mature eucalypts (including locally threatened species) are threatened by the abundance of introduced tree species.

Across the whole reserve, this study detected twenty-two naturally-occurring, indigenous plant species.

Relationship to other land

Site 137 is just one part of a much larger area of native vegetation in the valley of Jumping Creek and its tributaries. The larger area includes Sites 14–22, 126 and a series of Manningham City Council's Biosites that connect to the Yarra River corridor and beyond (Foreman 2004). The spatial arrangement and extent of these sites can be seen on the aerial photograph on p. 92 and the key map of sites on p. 1.

The near-continuity of habitat through these areas facilitates circulation of mobile fauna such as wallabies, echidnas, birds, bats and flying insects.

The movements of birds and insects through the landscape is important not only for the needs of those animals but also for the pollen and seeds that the animals may disperse as they go. Wallabies may also disperse seeds.

The wallabies and birds that make use of habitat in Site 137 and nearby forest also traverse other land during their movements. In doing so, they bring nature into the lives of residents around Site 137.

Bioregion: Highlands - Southern Fall

Habitat types

The description of vegetation below includes only naturally-occurring, indigenous plant species seen in a brief inspection of the site. It excludes the retarding basin floor, the revegetation to its northwest and the upper slope next to O'Neill Way.

Valley Grassy Forest (Ecological Vegetation Class no. 47, **Vulnerable** in the bioregion)

Canopy trees: Dominated by Yellow Box (*Eucalyptus melliodora*), Red Box (*E. polyanthemos*) and Candlebark (*E. rubida*). Bundy (*E. goniocalyx*) and Red Stringybark (*E. macrorhyncha*) are scattered among the dominant species. Narrow-leaved Peppermint (*E. radiata*) is scarce.

Lower trees: Dominated by Blackwood (*Acacia melanoxylon*). Cherry Ballart (*Exocarpos cupressiformis*) is scattered and Lightwood (*A. implexa*) is scarce.

Medium to large shrubs: Severely depleted in numbers of species and individuals. The only species observed were Sweet Bursaria (*Bursaria spinosa*) and Yarra Burgan (*Kunzea leptospermoides*), both of which are readily found.

Small shrubs: None seen.

Ferns: Austral Bracken (*Pteridium esculentum*) forms dense patches.

Climbers: None seen.

Creepers: None seen.

Grasses, rushes and sedges: Abundant and dense. Areas that have experienced more mowing are dominated by Weeping Grass (*Microlaena stipoides*) or Clustered Wallaby-grass (*Rytidosperma racemosum*). In the unmown areas, the most abundant species are Thatch Saw-sedge (*Gahnia radula*) and Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*). Hollow Rush (*Juncus amabilis*) is scattered liberally along the drainage line; Green Rush (*J. gregiflorus*) less so. Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Cluster- headed Mat-rush (*Lomandra longifolia* subsp. *exilis*) are scarce.

Other groundcover: Severely depleted in numbers of species and individuals. Pale Flax-lily (*Dianella longifolia* var. *longifolia*) and Black-anther Flax-lily (*D. revoluta*) were the only species observed in this study's brief inspection, both of them scarce.

Significant plants

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in O'Neill Way Reserve can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – nine individuals were counted in this study; and
- *Eucalyptus rubida* (Candlebark) – abundant, a dominant species.

Fauna habitat

- Although constrained by the paucity of indigenous shrubs, the native vegetation represents good habitat for a range of forest birds, bats, possums and invertebrates;
- Tree hollows offer roost sites or nest sites for some animals, including bats;
- The location on a tributary of Jumping Creek means Black Wallabies are likely to visit but the paucity of shrubs provides limited forage and cover for them;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the native vegetation is quite variable. Within approximately 30 m of O'Neill Way, it is poor – rating 'D' on the A–D scale of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997). The rest of the naturally-occurring native vegetation is in fair ecological condition (rating 'C'), limited by the paucity of shrubs, the abundance of woody weeds along the northern edge and the depletion of groundcover species by mowing.

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Regional to State.

Presence of a patch of native vegetation

The Valley Grassy Forest in Site 137 includes a core which meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The present author estimates that the vegetation has a habitat score of roughly 0.3, probably less rather than more. Combining a habitat score of below 0.3 with the 'Vulnerable' status of Valley Grassy Forest, the native vegetation has a conservation significance of 'Medium' under the 'Native Vegetation Framework'. Standard criterion 3.2.3 then leads to a rating of **Regional** significance. However, if the habitat score is at least 0.3 (as it may be), the conservation significance rises to 'High' and the site's significance would rise to **State**.

Threatened species

Candlebark and Red Stringybark can be confidently taken to be in the 'critically endangered' category of risk of dying out in Maroondah. Both have substantial, viable populations in the reserve and extending into contiguous sites such as Sites 14 and 16. The plants therefore fit the description in

standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Ecological corridor

Referring to the section above headed 'Relationship to other land', Site 137 forms part of a habitat corridor. It fits the description in standard criterion 1.2.6, "Corridor or component of 'stepping stones'… Local scale link between individual remnant habitat blocks or within subcatchment", which translates to Local significance.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit visitors to the reserve and the residents of abutting properties. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the reserve and adjacent forest is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of visitors, neighbours and people who pass through on walks. By contributing to the enjoyment of walks through the area, the reserve encourages people to get healthy exercise.

The benefits of contact with nature are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the reserve. The wildlife and native vegetation help to convey an appreciation of the area's natural heritage from generation to generation in the local community.

Changes

Comparison of the aerial photographs from 2001, 2011 and 2017 indicates that eucalypt crowns grew noticeably since 2001. At the edges of the treed areas, the crowns have encroached into areas formerly with no native vegetation except perhaps some common native grasses in lawn. In this way, there has been an increase of approximately 0.1 ha in the extent of native vegetation.

Changes in the condition and composition of the understorey cannot be assessed due to absence of any prior data.

Threats

The identified threats to the site's biodiversity are:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Mowing; and
- Death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change.

Strategic planning

Site 137 is in the Neighbourhood Residential Zone – Schedule 3. Removal of native vegetation is regulated under the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. In addition, removal of trees (whether native or not) is regulated under Schedule 3 of the

Significant Landscape Overlay. The Bushfire Management Overlay (BMO) applies to the whole site. The Vegetation Protection Overlay does not apply.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole reserve.

Improvement opportunity

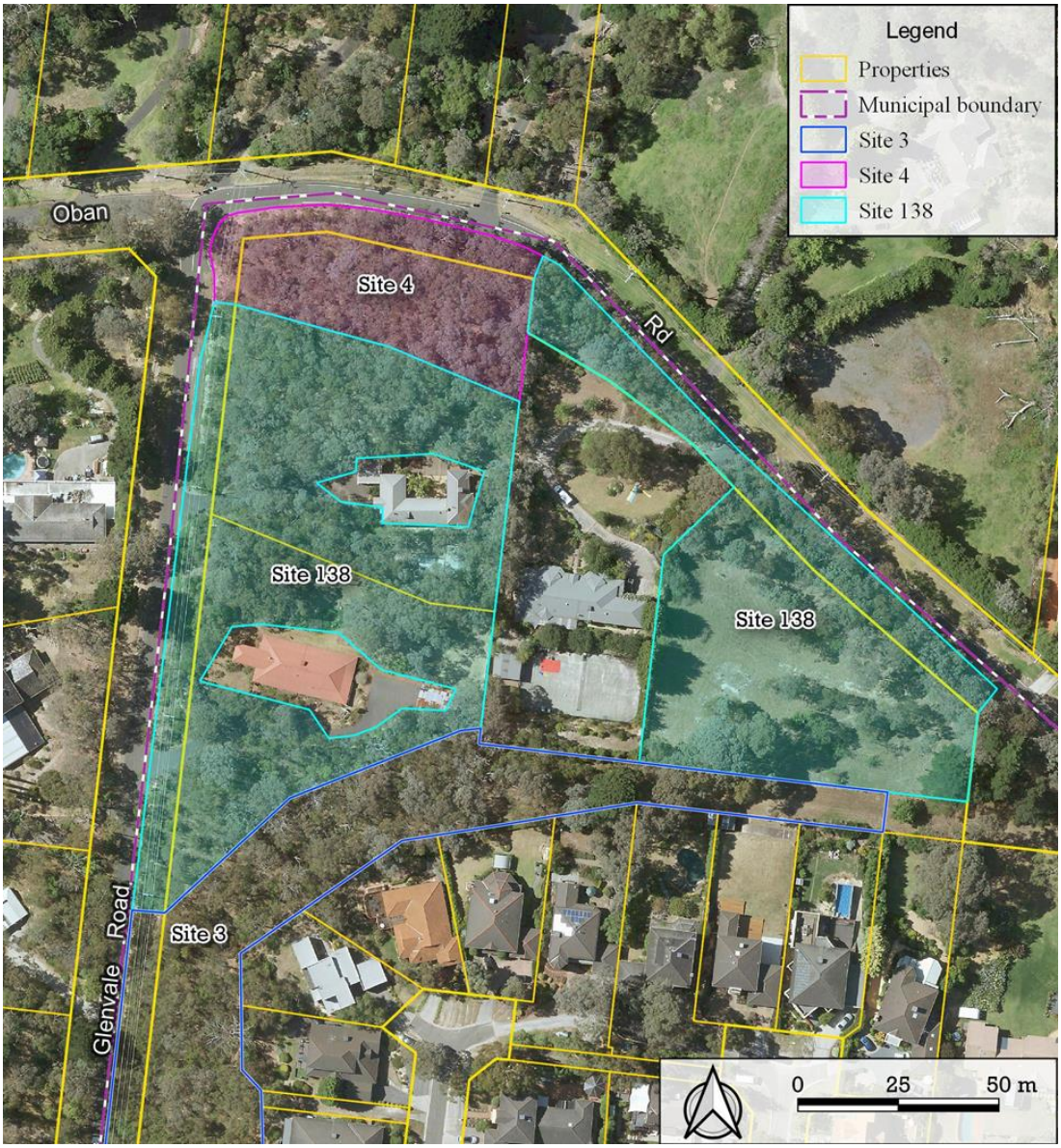
It would be very desirable from the points of view of biodiversity and fire hazard to remove the non-indigenous trees from along the reserve's northern edge.

Information sources

This assessment is based on a flora survey of approximately one hour conducted on 20/3/19. No relevant information could be found in the Victorian Biodiversity Atlas (VBA), eBird or the Atlas of Living Australia. The VBA erroneously shows a 1988 bird list by Steve Rowe to have been from Site 137. The state government's mapping of native vegetation erroneously shows that there is no native vegetation in the site and that the pre-European vegetation was all Grassy Dry Forest.

Site 138. Oban Rd / Glenvale Rd Residential Area, Ringwood North

Biological Significance Level: *Regional* due to the presence of high-quality vegetation



Boundaries, land use and tenure

The aerial photograph above shows the two parts of Site 138 tinted cyan, with a cyan outline. Neighbouring sites are shown for context. The western part occupies most of two residential properties (160–166 Glenvale Road and 168–174 Glenvale Road) and their road verges. Each of those properties has a dwelling, which is excluded from the site. The eastern part of the site comprises the whole of 239 Oban Road, its road verge and the road verge of 247 Oban Road. 239 Oban Road is a vacant residential lot. The sections of road verge within the site mostly extend to the road pavement. The roads are council roads.

General description

The total area of Site 138 is 1.33 hectares.

The forest on the Glenvale Road properties is patchy in ecological condition due to domestic uses and multiple episodes of clearing over many years. The 1945 government aerial photograph, 'Ringwood A2D', shows most of the lots having very young, treeless regrowth. The exception is the southwestern quarter of the site (on 160–166 Glenvale Road), which had a patchy cover of young trees with crowns typically 5–6 m in diameter. Those trees in 1945 are probably among the ones present today. The same area now has the most natural understorey of the whole site – rich in wildflowers, including orchids.

Glenvale Road was not constructed in 1945. Its reservation had a better coverage of trees and shrubs than the private land. In recent times, garden plantings have extended into the road verge and the remaining native vegetation has been modified by powerline clearing, provision of utility services to the homes and dumping of garden waste. At the time of this study's inspection, domestic effluent was discharging into the road verge's native vegetation. Nevertheless, the road verge retains uncommon plant species. They include three species in the 'critically endangered' category of risk of dying out in Maroondah: Leopard Orchid (*Diuris pardina*), five Cranberry Heaths (*Astroloma humifusum*) and at least one Common Globe-pea (*Gompholobium huegelii*).

The 1945 aerial photograph shows 239 Oban Road to have contained open grass interrupted by a driveway to a farmhouse further south. It also shows some young trees beside the driveway, matching a line of mature Red Box trees that grow there today. Although the land may have been mainly pasture in 1945, it must have been native pasture because the vegetation today has few introduced plants and many indigenous species of grass, wildflower and other groundcovers.

The road verge of 239 Oban Road was well forested in 1945. Some of the trees may have been cleared subsequently, as not many of the trees there today appear old enough to have been there in 1945. Nevertheless, the roadside vegetation remains intact enough that it is signposted as a 'no mowing' area to protect its conservation value.

There is an almost continuous corridor of native vegetation beside Oban Road from 239 Oban Road to Site 4 on the Glenvale Road corner.

By walking around the periphery of the site, this study detected forty-four naturally-occurring, indigenous plant species. Others would no doubt be detected if access was available onto the private land.

Until the past year, the Oban Road properties have been unable to be subdivided due to absence of sewerage. However, sewerage is now available.

Relationship to other land

Site 138 is just the private land component of a much larger area of contiguous native vegetation in Ringwood North, encompassing Sites 3 and 4. There is also native vegetation on the opposite side of Glenvale Road in Donvale, extending through a string of Manningham City Council's 'Biosites' (numbers 16–21 of Foreman 2004) to the Yarra River.

That large area of habitat is linked to 239 Oban Road via native vegetation in the narrow northern neck of Site 3 and the road verge of 247 Oban Road.

The near-continuity of habitat through these areas facilitates circulation of mobile fauna such as wallabies, echidnas, birds, bats and flying insects.

The movements of birds and insects through the landscape is important not only for the needs of those animals but also for the pollen and seeds that the animals may disperse as they go. Wallabies may also disperse seeds.

The wallabies and birds that make use of habitat in Site 138 and nearby forest also traverse other land during their movements. In doing so, they bring nature into the lives of residents beyond Site 138.

Bioregion: Highlands - Southern Fall

Habitat types

The description of Grassy Dry Forest below includes only the more abundant or ecologically informative indigenous plant species. It is hoped that the full set of flora data will be made available online.

Grassy Dry Forest (Ecological Vegetation Class no. 22, 'Least concern' in the bioregion). 67 indigenous plant species were recorded in this study or in a quadrat by Catherine Costello in 2005.

Canopy trees: Strongly dominated by Red Box (*Eucalyptus polyanthemos*). Red Stringybark (*E. macrorhyncha*) and Bundy (*E. goniocalyx*) are also present.

Lower trees: Dominated in different areas by Cherry Ballart (*Exocarpos cupressiformis*), Golden Wattle (*Acacia pycnantha*) or Lightwood (*Acacia implexa*).

Medium to large shrubs: Patchy. Dominated by Yarra Burgan (*Kunzea leptospermoides*), followed by Sifton bush (*Cassinia sifton*). Other medium or large shrubs are scarce.

Small shrubs: Not dense, represented mostly by Grey Parrot-pea (*Dillwynia cinerascens*). Common Heath (*Epacris impressa*), Common Flat-pea (*Platylobium obtusangulum*) and Common Beard-heath (*Leucopogon virgatus*) are present.

Ferns: Absent.

Climbers: Small-leafed Clematis (*Clematis decipiens*) is abundant on the Oban Road verge. Common Apple-berry (*Billardiera scandens*), Downy Dodder-laurel (*Cassytha pubescens*) and Love Creeper (*Comesperma volubile*) are also present.

Creepers: Fairly abundant, including Cranberry Heath (*Astroloma humifusum*), Creeping Bossiaea (*Bossiaea prostrata*), Purple Coral-pea (*Hardenbergia violacea*), Slender Speedwell (*Veronica gracilis*) and the wood-sorrel *Oxalis exilis / perennans*.

Other groundcover: Dominated in different areas by Kangaroo Grass (*Themeda triandra*), Leafy Wallaby-grass (*Rytidosperma fulvum*) or Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*). Other abundant species include Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Red-anther Wallaby-grass (*Rytidosperma pallidum*) and Common Raspwort (*Gonocarpus tetragynus*). Characteristically of Grassy Dry Forest, the following species are present: Honey-pots (*Acrotriche serrulata*), Blue Pincushion (*Brunonia australis*), Leopard Orchid (*Diuris pardina*), Scented Sundew (*Drosera aberrans*), Tall Sundew (*D. auriculata*), Thatch Saw-sedge (*Gahnia radula*) and Grey Tussock-grass (*Poa sieberiana*).

Significant plants

Rare (but not otherwise threatened) in Victoria

Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed by the Victorian Government as 'Rare but not otherwise threatened' because despite the species' large population size and apparent security, its geographic range is relatively small – from Warrandyte to Wantirna South and the Dandenong Ranges. A single seedling was found in 2019 close to the northern boundary of 239 Oban Road.

Critically endangered in Maroondah

The following naturally-occurring plant species recorded in Site 138 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Astroloma humifusum* (Cranberry Heath) – five were seen on the road verge of 168–174 Glenvale Road in this study. Others may have escaped detection on the private land, as some were recorded there by Catherine Costello in 2005;
- *Eucalyptus macrorhyncha* (Red Stringybark) – present in moderate density in the site's western polygon and scarce in the eastern polygon – part of a much larger population extending to the west and south;
- *Gompholobium huegelii* (Common Wedge-pea) – one plant was seen on the road verge of 168–174 Glenvale Road in this study. Others may have escaped detection on the private land.

Other

A population of the locally rare *Lyperanthus suaveolens* (Brown Beaks) extends from Site 4 into both of the Glenvale Road properties in Site 138. The size of the population on the private land could not be determined in this study because the inspection was done from the property boundary and the plants are small and grass-like. Nevertheless, it appears that the total population is larger than anywhere else in Maroondah except perhaps Hochkins Ridge Nature Conservation Reserve.

Fauna habitat

- The presence of all strata of native vegetation represents good habitat for a range of forest birds, bats and invertebrates;
- Patches of dense shrubs provide good cover for Black Wallabies (as was observed during this study) and certain species of birds;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards and birds; and
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of the vegetation could only be assessed on, and close to, public land. The habitat in the northern part of the Glenvale Road verge (near Site 4) is in excellent ecological condition (category 'A' on the A–D scale of *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997)). The rest of the road verges in Site 138 are in patchy ecological condition – fair on average (category 'C'). The southern quarter of 160–166 Glenvale Road (abutting Site 3) and the northwest corner of 168–174 Glenvale Road are in excellent ecological condition (category 'A'). The ecological condition of habitat in the rest of the Glenvale Road properties could not be reliably determined. 239 Oban Road is mostly in good ecological condition (category 'B').

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Regional.

Presence of a patch of native vegetation in good condition

In combination with the abutting Sites 3 and 4, Site 138's native vegetation easily meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. The present author estimates that some of that vegetation has a habitat score of 0.6 or above – particularly in the southwest. Combining that assessment with the 'Least concern' status of Grassy Dry Forest, the native vegetation has a 'Medium' conservation significance under the 'Native Vegetation Framework'. Standard criterion 3.2.3 then leads to a rating of **Regional** significance. Parts of the site with habitat scores below 0.6 are only of Local significance but the significance rating of a site as a whole is the highest rating of any part.

Threatened species

The Dandenong Range Cinnamon Wattle (*Acacia stictophylla*) is listed as 'rare' in the state government's *'Advisory List of Rare or Threatened Plants in Victoria – 2014'*. It does not occur outside Victoria. Standard criterion 3.1.2 attributes State significance to any site that provides known habitat for a population of such a species. However, the presence of just one plant of the species in Site 138 – a seedling – is deemed here inadequate to demonstrate habitat for a population of the species. Therefore, State significance does not apply.

The three species listed in the section above headed 'Significant plants' can be confidently taken to be in the 'critically endangered' category of risk of dying out in Maroondah. The plants of *Astroloma humifusum* and *Eucalyptus macrorhyncha* are parts of larger, viable populations extending into Sites 3 and 4 and Manningham City Council's 'Biosites' 16–21. The site's population of these species therefore fits the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The solitary plant of *Gompholobium huegelii* that was detected in this study may be part of a larger, viable population that could not be seen from public land. Even if not, *Gompholobium huegelii* is so close to dying out entirely in Maroondah that Site 138 is an 'important site' in the sense of the quote above. The presence of the plant therefore gives the site Local significance.

A population of approximately fifty plants of the locally rare orchid *Lyperanthus suaveolens* (Brown Beaks) was detected spanning this site and Site 4. It may well be the largest such population in Maroondah, rivalled only by Hochkins Ridge Nature Conservation Reserve (Site 51 on p. 386). Site 138 is therefore an 'important site' for the species in Maroondah. This is another feature of Local significance under standard criterion 3.1.5.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit residents of the properties and (to a lesser degree) abutting properties. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The natural ambience of the site and neighbouring areas is expected to be beneficial to the health, wellbeing, childhood development and quality of life of the residents and neighbours. Those benefits are spread into neighbouring streets and gardens by the movement of birds, butterflies and other animals attracted to the site.

The site's vegetation preserves something of the area's natural landscape. The vegetation and associated wildlife help to pass on an appreciation of the area's natural heritage from generation to generation in the local community. The mature Red Box trees beside the driveway of 239 Oban Road may have some historical significance as relics of the large property that can be seen in the 1945 state government aerial photograph.

Changes

Changes in the vegetation since 1945 are described beneath the heading, 'General description', above.

Comparison of the aerial photographs from 2001, 2011 and 2017 indicates that:

- Eucalypt crowns grew noticeably since 2001 but some eucalypts died since 2011 near the southern boundary of 160–166 Glenvale Road;
- On parts of the Glenvale Road properties, the growth of eucalypt crowns has slightly expanded the area of native vegetation but there have also been losses of native vegetation leading to a small decrease in the extent of native vegetation;
- There has been a very small reduction in the extent of native vegetation on 239 Oban Road due to growth of a pine in the southeast and growth of weeds spreading from beside the driveway of 247 Oban Road, but there has also been an increase in the size and maturity of indigenous shrubs and trees, which represents and improvement in naturalness and wildlife habitat.

Changes in the condition and composition of the understorey cannot be assessed due to paucity of prior data and inability to enter the private land.

Threats

The identified threats to the site's biodiversity are:

- Future development of 239 Oban Road, which is vacant and zoned for residential use;
- Possible subdivision of the Glenvale Road properties following the availability of sewerage in mid-2019;
- Possible future building or works;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Displacement of indigenous plants by garden plants;
- Removal of native vegetation associated with domestic uses of the land;
- Smothering and killing of groundcover, shrubs and small trees by Small-leafed Clematis (*Clematis decipiens*);
- Death and decline of eucalypts, mainly during droughts, which are predicted to worsen with climate change; and
- Discharge or seepage of effluent into native vegetation. During the inspection of Site 138 for this study, smelly wastewater was discharging from 160–166 Glenvale Rd into the Glenvale Road roadside vegetation and table drain. The associated pollution had caused nutrient- and water-loving weeds to displace native vegetation. This problem will worsen if not corrected.

Strategic planning

Site 138 is in the Low Density Residential Zone. It is not affected by the Vegetation Protection Overlay.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 of the Environmental Significance Overlay to the whole site, i.e. the area tinted cyan on the aerial photograph on p. 18. This will provide greater consistency with the ESO that already applies to the opposite sides of Oban Road and Glenvale Road, in Manningham. If desired, the overlay could be extended to the municipal boundary on the road centrelines, to meet the Manningham ESO.

Removal of native vegetation on the two Glenvale Road properties is also regulated under the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. That clause does not apply to 239 Oban Road, which is very slightly smaller than the threshold of 0.4 ha.

Removal of trees (native or otherwise) is further regulated under Schedule 3 of the Significant Landscape Overlay, throughout the site.

The Bushfire Management Overlay (BMO) applies to the whole site.

Revegetation Opportunity

The original northern fence of 247 Oban Road is up to 10 m from the current property boundary. The movement has left a triangle of 260 m² that is rather bare abutting native vegetation beside the road. The effectiveness of the roadside vegetation to facilitate wildlife movement might be improved by planting trees in the denuded triangle.

Information sources

This assessment is based on:

- A flora survey conducted along the road verges on 24/8/17, 27/9/17, 3/4/18 and 22/2/19;
- The author's view of the private lots from the road verges and Sites 3 and 4, as part of this study;

- Flora data from quadrat no. E1176300 by Catherine Costello at 160–166 Glenvale Road on 21/10/05; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

The only useful information that could be found in the Victorian Biodiversity Atlas was the quadrat data cited above. Note that the state government's vegetation mapping wrongly depicts no native vegetation on 239 Oban Road and very little on the Glenvale Road properties.

Site 139. Timbertop Rd Reserve, Ringwood North

Biological Significance Level: *Local* due to presence of a locally-threatened plant species



Aerial photograph taken February 2017

Legend

Municipal boundary
Properties
Site 139
Vegetation types
SRC Swampy Riparian Complex
VHF Valley Heathy Forest

N

1:1,500
0 20 40 60 m

Boundaries

The aerial photograph above has the boundary of Site 139 marked in magenta. The site comprises 1A Timbertop Road and 116–126 Loughnan Rd, Ringwood North.

Land use and tenure

The site is Crown land. A sign on it indicates that it is managed by Parks Victoria. However, it appears to have had no recent use or management.

General description

This 0.86-hectare piece of Crown land has a steep-sided gully flowing west-southwest and hillsides facing northwest and south-southeast. The gully is the area labelled on the aerial photograph on p. 176 as 'SRC' (for 'Swampy Riparian Complex', the vegetation type there). The gully has been excavated for laying pipes

on at least two occasions. Its eastern third has been partly filled in to elevate Timbertop Road, which would otherwise plunge steeply into the natural gully.

The 1997 report, *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997) included this land as part of Site 25. At that time, native vegetation beside Mullum Mullum Creek was only 10 m away on the opposite side of Glenvale Road and the rest of Site 25 was only 15 m away on the other side of Loughnan Road. In the mid-2000s, the construction of Eastlink and the southward relocation of Loughnan Road caused major changes. The former southwest corner of the site was cleared to become part of Eastlink and the native vegetation that had been present on the southern side of Loughnan Road was all removed. Site 139 is segregated here from Site 25 because it has become so ecologically isolated from the Mullum Mullum valley.

The construction of Eastlink also involved the clearing and excavation of approximately 600 m² of forest on the gully floor in Site 139's southwest to install drainage infrastructure for Eastlink. As a result, that area now has a large drain pit surrounded by very little indigenous flora.

The site's ecological values have had a very chequered history. An aerial photograph from 1945 shows that the hillsides were covered with sparse, young regrowth (as in most of this volume's sites) and the gully had a full tree cover. By the time flora surveys were done in 1989 and for at least a decade after, the site had a dense cover of the environmental weed, Sweet Pittosporum (*Pittosporum undulatum*). The pittosporum was strongly out-competing indigenous plants for resources, leading to eucalypt deaths and a breakdown of the site's ecological functions. Nevertheless, flora surveys in 1989, 1996 and 1998 recorded 44 indigenous species of flowering plants, including two species that are now 'critically endangered' with dying out in Maroondah. Those species clearly represent two vegetation types that are listed by the Victorian Government as threatened in the relevant bioregion (the Gippsland Plain).

Since the mid-2000s, the dense cover of Sweet Pittosporum has been cleared and some of the indigenous trees and shrubs have died. The loss of the tree canopy has greatly increased the availability of sunlight, soil moisture and nutrients for a new generation of plants. Unfortunately, little of the regenerating vegetation is indigenous because the prior decades of dense pittosporums had greatly depleted the indigenous flora and allowed many introduced plants to take over. While considerable effort was expended in removing the pittosporums, the regrowth of weeds such as blackberries appears to be receiving little if any attention.

The parts of the site that still have indigenous vegetation are outlined in orange on the aerial photograph on p. 176. Despite the site's chequered history, twenty indigenous plant species were found in a brief inspection around the site's perimeter in 2019. They included at least eleven plants of Drooping Mistletoe (*Amyema pendula*), which appears to be by far the largest population of that locally-threatened species in Maroondah. Without that population, Site 139 would not warrant recognition as a site at all.

Relationship to other land

As discussed above, Site 139 has become somewhat ecologically isolated. The Mullum Mullum valley's native vegetation lies 95 m away on the other side of Eastlink, which is a major barrier to movement of wildlife other than the more mobile birds and flying insects. Any other fauna that visits site 139 have to move through the leafy residential neighbourhood on the northeast side of Eastlink. The leafiness of that neighbourhood is important to the ecological wellbeing of Site 139 because no birds would be able to survive solely within the site.

Bioregion: Gippsland Plain

Habitat type

The description of vegetation below includes only the naturally-occurring, indigenous plant species. 'EVC' means 'Ecological Vegetation Class'.

Valley Heathy Forest (EVC 127, **Endangered** in the bioregion)

Canopy trees: Dominated by Yellow Box (*Eucalyptus melliodora*), with a few Bundy (*E. goniocalyx*) and three Swamp Gums (*E. ovata*). Flora surveys in the 1990s also recorded Narrow-leaved Peppermints (*E. radiata*) and Red Stringybark (*E. macrorhyncha*), the latter being scarce.

Lower trees: Dominated by Black Wattle (*Acacia mearnsii*). There are small numbers of Cherry Ballart (*Exocarpos cupressiformis*), Blackwood (*A. melanoxylon*) and Lightwood (*A. implexa*).

Medium to large shrubs: Sifton Bush (*C. sifton*) and Victorian Christmas-bush (*Prostanthera lasianthos*) are fairly abundant. Sweet Bursaria (*Bursaria spinosa*) is scattered. Burgan (*Kunzea* sp.) is scarce.

Small shrubs: None seen.

Ferns: One small patch of Austral Bracken (*Pteridium esculentum*) was observed.

Climbers: Mountain Clematis (*Clematis aristata*) was recorded in the 1990s.

Creepers: The wood-sorrel, *Oxalis exilis/perennans* and the pennywort, *Hydrocotyle* ?*laxiflora*, were recorded in previous flora surveys.

Grasses, rushes and sedges: Indigenous species are greatly depleted. Weeping Grass (*Microlaena stipoides*) appears to be the most abundant. There are a few Spiny-headed Mat-rush (*Lomandra longifolia* subsp. *longifolia*) and Kangaroo Grass (*Themeda triandra*) as well as at least two Finger Rush (*Juncus subsecundus*).

Other groundcover: None seen during this study's brief inspection.

Swampy Riparian Complex (EVC 126, Endangered in the bioregion)

Canopy trees: A pure stand of Swamp Gum (*Eucalyptus ovata*).

Lower trees: Reduced to a few Blackwood (*Acacia melanoxylon*).

Shrubs: Sifton Bush (*Cassinia sifton*) is fairly abundant.

Small shrubs: None seen.

Ferns: None seen.

Climbers: None seen.

Creepers: None seen.

Grasses, rushes and sedges: Pale Rush (*Juncus pallidus*) is fairly abundant.

Other groundcover: Hairy Willow-herb (*Epilobium hirtigerum*) is scarce.

Significant plants

The following naturally-occurring plant species recorded in Site 139 can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Amyema pendula* (Drooping Mistletoe) – at least eleven grow on eucalypts in the site's southern corner;
- *Eucalyptus macrorhyncha* (Red Stringybark) – recorded until 1998 but not noticed in this study's brief inspection;
- *Eucalyptus* ?*rubida* (Candlebark) – two saplings that may be Candlebarks were seen in the site's southeast corner in 2019.

Fauna habitat

- The structure and composition of the native vegetation represent mediocre habitat for common forest birds and invertebrates;
- The presence of shrubs and leaf litter from native plants in small parts of the site may provide lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1).

Ecological condition

The ecological condition of approximately 0.15 ha of the site's Valley Heathy Forest vegetation is fair and falls within rating 'C' on the A–D scale used in *'Sites of Biological Significance in Maroondah'* (Lorimer

et al. 1997). The remaining 0.5 ha of the site's native vegetation is in poor ecological condition (rating 'D').

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Local

Regionally threatened Ecological Vegetation Classes

The site's vegetation does not meet the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Therefore, the fact that both Ecological Vegetation Classes in the site are endangered does not meet the conditions for significance.

Rare or threatened plant species

Drooping Mistletoes are in the 'critically endangered' category of dying out in Maroondah. The eleven or more of them in Site 139 appear to form a quite viable colony, the biggest in Maroondah. They therefore fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

For people on the footpath beside the site's southern edge, the site's tree canopy provides shade and wind protection. The trees and shrubs provide a natural ambience, which improves the amenity for passers-by. Birds attracted by the trees add to that amenity. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The proximity of the reserve to a Mullum Mullum Creek has cultural significance to Aborigines. Traditional Aboriginal life was focused around streams because of the availability of water and the high productivity of aquatic and riparian habitats. Consequently, most of the site is in an 'area of cultural heritage sensitivity' under the *Aboriginal Heritage Regulations 2018*.

Changes

Change in the extent of habitat

0.12 ha of vestigial native vegetation was cleared in the mid-2000s to provide drainage infrastructure for Eastlink. Aerial photographs from 2001 and 2011 show that some eucalypts died between those dates in the site's north, where there is now little if any native vegetation. That loss of vegetation cannot be reliably quantified from the aerial photographs because the one from 2001 is too fuzzy.

Change in the ecological condition of habitat

The site assessment in 1996 for the report, *'Sites of Biological Significance in Maroondah'*, rated the ecological condition of the site's Valley Heathy Forest as 'C' (fair) and the Swampy Riparian Complex as 'D' (poor). Referring to the paragraph above headed 'Ecological condition', the Swampy Riparian Complex remains in rating 'D' and roughly 0.4 ha of Valley Heathy Forest has apparently deteriorated from 'C' to 'D'. While that decline is consistent with the drop in the number of species recorded, the rating

scheme involves too much professional judgement (as distinct from direct measurements) to provide a reliable quantification of the deterioration.

Changes in the species present

This study's site inspection did not include a thorough flora survey, so the absence from its records of small plant species that cannot be readily detected cannot be used to conclude that those species have died out. However, it is possible to conclude that:

- Narrow-leaved Peppermints (*Eucalyptus radiata*) appears to have died out whereas Yellow Box (*E. melliodora*) has become dominant, consistent with those two species' opposite trends in Melbourne's outer east this century;
- Sifton Bush (*Cassinia sifton*) was absent in all previous studies but is now abundant, consistent with the ecological role of that (questionably indigenous) species as a post-disturbance coloniser and its increasing trend throughout Maroondah; and
- Hairy Willow-herb (*Epilobium hirtigerum*) and Pale Rush (*Juncus pallidus*) are also post-disturbance colonisers that were absent in previous surveys.

Threats

This study has identified the following threats to the site's biodiversity, in approximately decreasing order:

- Introduced plants continuing to displace indigenous plants and inhibit their natural regeneration;
- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents; and
- Loss of plant species with low populations, due to slow attrition and poor reproductive success.

Strategic planning

The whole site is covered by the 'Public Park and Recreation Zone', Schedule 3 of the Significant Landscape Overlay and the state-wide native vegetation planning controls of clause 52.17 of the Victoria Planning Provisions. All but the eastern edge is covered by the Bushfire Management Overlay and all but a 25 m-wide strip along the northern edge is covered by Schedule 2 of the Design and Development Overlay.

The Vegetation Protection Overlay (VPO) applies to the whole site as well as the part of its southern lot (116–126 Loughnan Road) that was excised for the construction of Eastlink.

Consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to remove the VPO altogether and apply the proposed schedule ESO1 of the Environmental Significance Overlay to Site 139 as outlined in magenta on the aerial photographs on p. 176.

Restoration opportunities

The extensive effort put into removing Sweet Pittosporums some years ago will be for nought unless the resultant regrowth of blackberries and other weeds is controlled. Successful re-establishment of native vegetation will require the planting of indigenous trees and shrubs to restore more shade to areas that currently have no tree cover.

Information sources

The analysis above draws on the following information about the site, from the author's work except where otherwise noted:

- A 45-minute inspection of the site for this study on 26/4/19;
- Flora data from quadrat E2506300 by Simon Cropper on 27/6/98 (available in the Victorian Biodiversity Atlas (VBA)), supported by herbarium specimens of three moss species;

- Information used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), including fieldwork in March 1996 involving a flora survey, frog call survey and incidental fauna observations;
- Koala observations at the corner of Glenvale and Loughnan Roads by Andrew Sutherland on 13–16/11/95, the records stored in the VBA;
- Information in *'Flora and Fauna of the Koonung and Mullum Mullum Valleys (Proposed Eastern Arterial Road and Ringwood Bypass), Victoria*' (1990) by J. Yugovic, D. Crosby, K. Ebert, P. Lillywhite, S. Saddlier, M. Schulz, P. Vaughan, J. Westaway and A. Yen. That includes flora data from quadrat E1015900 on 4 October 1989; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No additional useful information could be found in the VBA, Atlas of Living Australia or eBird. Note that the state government's vegetation mapping fails to show the change in Ecological Vegetation Class in the site's steep-sided gully.

Site 140. Brentwood Park, Croydon

Biological Significance Level: *Regional* (or perhaps State) due to presence of a vulnerable vegetation type



Boundaries

Site 140 is an area of bushland in Brentwood Park (23 Mandowie Crescent Croydon), also known as Brentwood Park Reserve. The northern and eastern fences of Brentwood Park Kindergarten form part of the site boundary. In the east-northeast, the site boundary follows the reserve's boundary. The rest of the site boundary has been drawn as an approximation to the edge of native vegetation (both treed and untreed).

Land use and tenure

Brentwood Park is a municipal reserve. The part of it that forms Site 140 is used for amenity.

General description

The site measures 0.91 hectares. The southwestern two-thirds of the site is on a west-facing slope with a gentle gradient of 1:13. The rest of the site has shallower gradients (as low as 1:20), falling variously to the northwest, north or northeast.

The site's most natural vegetation is in the vicinity of the kindergarten, where all strata of natural vegetation are present. Some of the wildflower species there are uncommon in Maroondah. The northern two-thirds of the site contains fewer indigenous plant species and the canopy there is dominated by planted eucalypts. Scattered through the site are patches of dense introduced grass species, suggesting a chequered history of soil disturbance.

The mown strip along the site's western edge is dominated by indigenous grasses, particularly Kangaroo Grass (*Themeda triandra*). Among the wildflowers growing there is a species called Golden Weatherglass (*Hypoxis hygrometrica*), which falls into the 'critically endangered' category of risk of dying out in Maroondah.

Across the whole site, this study detected thirty-seven naturally-occurring, indigenous plant species.

Relationship to other land

Small lizards and non-flying invertebrates would be capable of surviving entirely within Brentwood Park. The rest of the park's native fauna need to move between the park and other areas of habitat. Many of them would make use of the planted Australian native trees elsewhere in the park, as well as the large, naturally-occurring Mealy Stringybark (*Eucalyptus cephalocarpa*) between the playground and the car park. The park's mobile fauna species are also likely to use the habitat represented by the fragmented corridor of native vegetation along Lincoln Road (Site 85, 60 m north of Site 140).

There are roughly thirty Australian native trees and very few shrubs at Charles Allen Reserve, 170 m southeast of Site 140. Otherwise, the neighbourhood is poorly endowed with habitat for indigenous fauna.

Bioregion: Highlands - Southern Fall

Habitat type

The description of vegetation below includes only naturally-occurring, indigenous plant species.

Valley Grassy Forest (Ecological Vegetation Class no. 47, **Vulnerable** in the bioregion)

Canopy trees: Mostly dominated by planted indigenous eucalypts but there are small numbers of apparently wild eucalypts: a few Bundy (*Eucalyptus goniocalyx*), a few Narrow-leaved Peppermint (*E. radiata*), at least one Yellow Box (*E. melliodora*) and at least one Candlebark (*E. rubida*). There is also a single, dead Red Stringybark (*E. macrorhyncha*) whose location and size indicate that it was been planted. Just outside the site, near the kindergarten entrance, is a large, old Mealy Stringybark (*E. cephalocarpa*), reflecting the vegetation's slight tendency toward Valley Heathy Forest and the location's close proximity to the Gippsland Plain bioregion.

Lower trees: Dominated by Black Wattle (*Acacia mearnsii*). There are a few Blackwood (*A. melanoxylon*) and one small Cherry Ballart (*Exocarpos cupressiformis*).

Medium to large shrubs: Sweet Bursaria (*Bursaria spinosa*) is abundant in some areas. Yarra Burgan (*Kunzea leptospermoides*) is scarce.

Small shrubs: None seen.

Shrubby herbs: A few Cotton Fireweed (*Senecio quadridentatus*).

Ferns: None seen.

Climbers: None seen.

Creepers: Kidney-weed (*Dichondra repens*) and the wood-sorrel *Oxalis exilis / perennans* are fairly abundant. Creeping Bossiaea (*Bossiaea prostrata*) and Slender Speedwell (*Veronica gracilis*) are scarce.

Grasses, rushes and sedges: Abundant and dense, dominated in different areas by Weeping Grass (*Microlaena stipoides*), Clustered Wallaby-grass (*Rytidosperma racemosum*) or Kangaroo Grass (*Themeda triandra*). Veined Spear-grass (*Austrostipa rudis* subsp. *rudis*) is also abundant. The following species are fairly abundant: Common Wheat-grass (*Anthosachne scabra*), Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*), Smooth Wallaby-grass (*Rytidosperma laeve*) and Velvet Wallaby-grass (*R. pilosum*). The following species are scarce: Short-stem Sedge (*Carex breviculmis*), Wattle Mat-rush (*Lomandra filiformis* subsp. *filiformis*), Common Woodrush (*Luzula meridionalis*) and Soft Tussock-grass (*Poa morrisii*).

Other groundcover: Yellow Rush-lily (*Tricoryne elatior*) is abundant. The following species are fairly abundant: Chocolate Lily (*Arthropodium strictum*), Pale Flax-lily (*Dianella longifolia*), Common Raspwort (*Gonocarpus tetragynus*), Slender Onion-orchid (*Microtis parviflora*), Broad-leaf Stinkweed (*Opercularia ovata*), Small Poranthera (*Poranthera microphylla*) and Smooth Solenogyne (*Solenogyne dominii*). There is a cluster of Yellow Bulbine-lily (*Bulbine bulbosa*). Golden Weather-glass (*Hypoxis hygrometrica*) and Variable Plantain (*Plantago varia*) are both very scarce.

Significant plants

Critically endangered in Maroondah

The following species growing within the site can be confidently regarded as being in the 'critically endangered' category of dying out in Maroondah:

- *Eucalyptus macrorhyncha* (Red Stringybark) – represented only by a dead tree on the eastern boundary;
- *Eucalyptus rubida* (Candlebark) – a mature tree near the kindergarten is fairly convincingly wild. There are also planted individuals;
- *Hypoxis hygrometrica* var. *hygrometrica* (Golden Weatherglass) – a single plant was seen in November 2019, flowering in the Kangaroo Grass lawn shortly after it was mown. Another five were seen by Daniel Flaim of Maroondah City Council in the lawn in March 2020. The species is extremely hard to see except during its brief, sporadic flowering, so other individuals could easily have gone undetected, particularly in the recently-mown lawn. There are very few only other records of the species in Maroondah this century.

Fauna habitat

- The site's trees and the patchy occurrence of shrubs provide suitable habitat for common forest birds, bats, possums and invertebrates;
- The native vegetation and its litter provide food and cover for a range of invertebrates, some of which then become food for vertebrates such as lizards, bats and birds;
- The presence of shrubs and leaf litter from native plants is important for providing lizards with the cover they need (as discussed in Section 7.1.2 of Volume 1);
- The site's small size and the mediocre habitat elsewhere in the neighbourhood limit the site's attractiveness to most other indigenous fauna.

Ecological condition

Using the A–D scale of ecological condition of vegetation used in *'Sites of Biological Significance in Maroondah'* (Lorimer *et al.* 1997), roughly 0.16 ha falls into rating 'C' (fair) and the remaining 0.75 ha of the site falls into rating 'D' (poor).

Biological significance ratings

This section assesses the site's biological significance against the state government's standard criteria (see p. 2).

Overall biological significance level: Regional

Regionally threatened Ecological Vegetation Class

Immediately north of the kindergarten, the author mapped a contiguous area that has at least 10% cover of indigenous understorey. The area measures 0.25 ha, including the area dominated by Kangaroo Grass that was regularly mown until November 2019. The area meets the definition of a 'patch' of native vegetation adopted by the standard criteria, i.e. at least 0.25 ha with native understorey cover of 10% or more. Under standard criterion 3.2.3, a patch of the vulnerable Valley Grassy Forest is of Regional significance if its 'habitat score' is below 0.3 or State significance otherwise. No habitat score was determined in this study but the author thinks it is likely to be just under 0.3, leading to a rating of **Regional** significance. If a formal assessment finds that the score exceeds 0.3, the result would be State significance. Even if the score is below 0.3 at the time of writing, it would take only a little management effort to raise it above 0.3 and hence raise the significance level from Regional to State.

Rare or threatened plant species

Referring to the section above headed 'Significant plants', Golden Weatherglass is so rare in Maroondah that the plants at Brentwood Park fit the description in standard criterion 3.1.5 of 'An important site for population of the [locally threatened] taxon in the local area under consideration [*viz.* Maroondah], or believed to be a viable population in its own right or with suitable management or as part of a wider ranging population'. These conditions lead to a Local significance rating.

The site's solitary, dead Red Stringybark and the solitary wild Candlebark are deemed not to make a meaningful contribution to those species' survival in Maroondah and therefore not to qualify under standard criterion 3.1.5.

Other values

This section assesses the site's ecosystem services, natural heritage values and capacity to satisfy or foster people's attachment to nature, as per Section 1.3 of Volume 1. These values are not considered in the criteria applied above for biological significance ratings.

The tree canopy reduces wind speed. It cools the local microclimate in hot weather through shade and transpiration. It also keeps the local microclimate warmer on cold winter nights and mornings through atmospheric mixing and infrared radiation from the canopy. These effects of microclimate moderation benefit the kindergarten community, people visiting the park and living adjacent. As part of the 'urban forest', the trees also help reduce the urban heat island effect and sequester carbon dioxide from the atmosphere.

The semi-natural ambience of the site is expected to contribute to the enjoyment, health, wellbeing, childhood development and quality of life of the kindergarten community and park visitors. The most significant of those benefits is probably to children at the kindergarten, as nature helps the development of children's minds (Section 1.3 of Volume 1).

Those benefits are spread into surrounding areas by the movement of birds, butterflies and other animals out of the site into surrounding streets and gardens.

Changes

Change in the extent of habitat

Comparing aerial photographs from 2001 and 2017, no material change can be detected in the extent of native vegetation in the park. However, aerial photographs do not allow detection of native vegetation in mown lawn, which represents an important part of the site's biological significance.

Other changes

The aerial photographs demonstrate that the sizes of eucalypts in Brentwood Park have increased significantly since 2001. They also demonstrate that a substantial number of eucalypts have died and the

foliage density of the survivors has decreased. These observations are similar to many other sites assessed in this volume.

Other than aerial photographs, no prior information was found about the habitat of Site 140. Further assessment of change is therefore not possible.

Threats

This study has identified the following threats to the site's biodiversity:

- Current trends in climate change and global greenhouse gas emissions, which pose a serious threat to most life on Earth – particularly ecological communities and their constituents;
- Continued eucalypt deaths and consequent ecological disruption to understorey and fauna. The deaths will occur mainly during droughts, which are predicted to worsen with climate change; and
- Loss of plant species with low populations, due to mowing, slow attrition and poor reproductive success.

Strategic planning

Site 140 and most of the rest of Brentwood Park are covered by the 'Public Park and Recreation Zone'. Schedule 4 of the Significant Landscape Overlay regulates the removal, lopping and destruction of most trees, whether indigenous or not. Clause 52.17 of the Victoria Planning Provisions regulates the removal, lopping and destruction of most native vegetation, from grasses and wildflowers to trees.

Given Site 140's Regional or State biological significance, and consistent with the principles in Section 11.1.2 of Volume 1, it is recommended to apply the proposed schedule ESO1 to the site. Vegetation in parts of the park outside Site 140 will continue to be subject to the planning provisions of clause 52.17 and SLO4.

Information sources

The analysis above draws on the following sources of information about the site:

- A flora survey on 22/11/19 to assess the site's biological significance against the standard criteria of Amos (2004), which included documenting the abundances of all indigenous plant species (excluding mosses and liverworts) and mapping scarce species and the contiguous area with at least 25% cover of native understorey. The survey was conducted by the author, in part assisted by Council officer, Daniel Flaim; and
- Aerial photographs from 1945, 2001, 2011 and 2017.

No useful information could be found in eBird or the online Victorian Biodiversity Atlas or Atlas of Living Australia.

Biodiversity in Maroondah - Actions for Council Consideration

As part of the Maroondah Vegetation Review that led to the adoption of the Maroondah Vegetation Strategy 2020-2030 in March 2020, Dr Graeme Lorimer (Biosphere P/L) was commissioned to undertake a contemporary assessment of Maroondah's biodiversity and Sites of Biological Significance.
The findings were presented in the report "Biodiversity in Maroondah - Volumes 1 & 2 - 2020"

This report provides valuable insights into Maroondah's biodiversity and is being used by Council in its efforts to protect and manage our biodiversity and habitats. In addition to informing the Maroondah Vegetation Strategy, it is also being used to inform planning scheme amendments, planning decisions, master plans, and reserve management plans amongst other things.

In Section 11 of Volume 1 (pages 83-112), Dr Lorimer presents a number of "Actions for Council Consideration". In late 2022, Maroondah City Council staff from relevant teams were consulted in preparing responses to those suggested actions. These responses are provided below under the respective headings from Dr. Lorimer's report and need to be read in conjunction with the suggested actions.

11.1 Strategic Planning

11.1.1 Establishing Objectives

11.1.1.1 Connecting People with Nature

The principle of helping people experience nature in their daily lives is supported, with a preference to broaden the experience to more than just birds. The role of the planning scheme in facilitating this is limited, and subject to DELWP's views and potential changes to the SLO. Options being considered include the addition of a standard condition that encourages use of indigenous and native plants to any landscaping requirements as part of a development approval (as guided by neighbourhood character and significant landscape objectives), and/or changes to the decision guidelines in the SLO schedules.
Currently all permits issued have notes that refer to the value of planting indigenous species (more generically for flora and fauna, not specifically for birds), including a list of the more common and readily available species in Maroondah, including Eucalyptus species.
We are unlikely to mandate the establishment of rooftop gardens and community gardens as a requirement in the Planning Scheme. However, the establishment of demonstration green roofs, and options for incentivising, are already actions in the Maroondah Vegetation Strategy.

11.1.1.2 Stormwater Management

The principle of restoring more natural patterns of water runoff and seepage to protect significant floodplain vegetation and aquatic habitat is supported.

Statewide planning provisions introduced through *Amendment VC154 - Stormwater management* (refer to Planning Advisory Note 75) address the concerns raised, in particular *Clause 53.18 - Stormwater management in urban development*, that extends the existing stormwater management requirements for residential subdivision and apartment developments to include all commercial and industrial subdivisions and developments, all public use developments, and all residential multi-dwelling developments.

11.1.1.3 Wildlife of Streams, Stream Corridors and Wetlands

The intent of recognising the importance of streams, stream corridors and wetlands as habitat for wildlife is supported, and how best to incorporate into the Maroondah Planning Scheme will considered as part of the planning scheme review.

11.1.2 Sites of Biological Significance

11.1.2.1 Selection of Planning Controls

Preparation of the documentation required to support a planning scheme amendment to largely replace the existing VPOs with ESOs, based on the recommendations in Biodiversity in Maroondah 2020 is underway.

11.1.2.2 Content of Overlay Schedules

The intent of the guidance provided for the schedules to the ESOs is supported, however will be subject to state planning requirements such as the limitation of only one objective being allowed for an ESO. It is expected that this can be addressed by providing more detail in the associated statement of environmental significance.

11.1.2.3 Determination of Overlay Boundaries

As part of the documentation required to support a planning scheme amendment to introduce the ESOs, criteria for deciding where to place the overlay boundaries will be articulated and applied to each situation. These criteria will take into account the possible reasons for doing so that have been articulated in the report.

11.1.2.4 Locally Threatened Plants

The intent of affording protection to locally threatened plant species is supported, however will be subject to state planning requirements such as the limitation of only one objective being allowed for an ESO. It is therefore more appropriate to incorporate it into the associated statement of environmental significance. A schedule of locally threatened species would need to be incorporated, and therefore not readily updateable.

11.1.2.5 'Sites of Biological Significance' Local Planning Policy

It is likely that the current 'Sites of Biological Significance' Local Planning Policy will become obsolete following the translation of the Maroondah Planning Scheme into the new format as required by *Amendment VC148- Planning* (refer to Planning Advisory Note 71) , so much of the intent of this policy will be integrated into the schedules to the new ESOs, and elsewhere as identified through the planning scheme review.

11.1.2.6 Exemption of Species from Clause 52.17

Agree in principle to exempt Sweet Pittosporum and Sallow Wattle from the need to get a permit to remove as they are both recognised as seriously invasive environmental weeds. Exempting the other 21 species suggested is not considered justifiable on these grounds.

11.1.3 Zones

The issues raised will be taken into account when future opportunities for rezoning arise.

11.1.4 Greyfield Redevelopment

Greening the Greyfields is an innovative approach to urban renewal that encourages landowners within a precinct to amalgamate land holdings for improved site and precinct-level outcomes.

The enabling planning scheme amendments C134maro (Ringwood Greyfield Renewal Precinct) and C136maro (Croydon South Greyfield Renewal Precinct) are with the Minister for final approval. Following approval of the amendment Council will commence project promotion and consultation with precinct landowners to encourage implementation of the project.

11.2 Statutory Planning

11.2.1 Planting Guidance

With a focus on locations in environmentally sensitive areas such as those covered by a VPO or ESO, the list of recommended species will be expanded to include plant species in the 'critically endangered' category of dying out in Maroondah that are also considered readily available from the local indigenous nurseries.

11.2.2 Harmonisation of Offsets and other Permit Conditions

Any overlap of 'offsets' or other compensation requirements involving vegetation will be harmonised to achieve the various requirements, and in environmentally sensitive locations such as those covered by a VPO or ESO, species that are 'critically endangered' with dying out in Maroondah, and are readily available, will be favoured.

11.2.3 Mapping Inaccuracies

Where Council has the discretion, Council's Statutory Planners will use the best available spatial information for understanding the relevant vegetation types (EVCs) for a site

11.2.4 Staff Training

Council has an Environmental Planning team within Statutory Planning that has knowledge and skills in plant identification and native vegetation management, and that provides advice and inhouse training to the other statutory planners, including the production and use of associated standard permit conditions for land management activities.

11.3 Locally Threatened Species Strategy

At this point in time, Council has no plans to prepare a threatened species strategy, however the following priority issues are being addressed as described below.

11.3.1 Rescuing Plants of Winter-sodden Soil

The option for redirecting stormwater to rehydrate soils will be investigated in specific and appropriate locations - eg council reserves supporting Swampy Woodland vegetation. Where this is considered feasible it will be incorporated into relevant Master Plans and/or Structure Plans that in turn justify/authorise the investment in design and delivery of any such stormwater diversion project.

The issue with mowing of locally threatened plants on winter-sodden soils of floodplains during their flowering and seeding season, and when the ground is boggy has been recognised and addressed. Mowing schedules and practices have been modified accordingly (under advice from the Bushland Team), and seed is being collected and propagated to reinforce existing or establish new populations in suitable locations

11.3.2 Planting Locally Threatened Plants

Bushland areas are being managed to support biodiversity in general, including the conservation of wild populations of locally threatened plant species, and planting is used as a way of supplementing those small populations. Trial and error has resulted in an improved understanding of which species are better suited to supplementary planting. Several species are proving to be too difficult to propagate and/or sustain in the wild once planted.

The Bushland Team is working closely with the two indigenous nurseries (including doing some seed collection, initial germination, and direct seeding) to enable supplementary plantings for species with small populations.

11.4 Management of Nature Reserves

Drawing on information in Dr' Lorimer's report, Council has devised a simple but repeatable method for monitoring progress towards the following targets adopted at its Council Meeting on 24th April 2017:

- 'No net loss of the area and quality of existing native vegetation on 171 hectares of land managed by the City of Maroondah to 2040';
- 'Improved native vegetation quality on an additional 6.7 hectares of land managed by the City of Maroondah by 2025 and a further 13.1 hectares by 2040'.

A total of 307.13 ha of native vegetation occurs on Council-managed land, of which

- 17.70 ha is in Excellent condition
- 40.64 ha is in Good condition
- 68.63 ha is in Fair condition
- 180.16 ha is in Low condition

A fulltime Biodiversity Officer position has been created within the Bushland Team based at the depot. Interaction between the Biodiversity Officer, and Environmental Planners (part of

Statutory Planning) and the Strategic Environment Planner based at Realm, is facilitated through quarterly meetings of the Vegetation Strategy Implementation Group, consultation on reserve management plan updates, and regular contact and advice on vegetation-related statutory planning issues.

11.5 Management of Other Reserves

The management of areas of significant habitat in reserves not managed by the bushland team is being improved through ongoing liaison between the Bushland and Parks teams. Brush cutting is largely replacing the use of herbicide around the base of trees (herbicide still used around bollards), and mower operators are adjusting their mowing practices around tree bases where they have been advised that valuable indigenous plants exist.

11.6 Eucalypt Deaths

The University of Melbourne investigation into potential causes of eucalypt dieback being observed in Maroondah (and elsewhere) was inconclusive.
Internal investigations into potential causes are ongoing, and include seeking advice from experts and other councils, conducting *Phytophthora* pear baiting trials, and experimental tree banding to exclude possums. The results of these investigations will inform the next steps. In the meantime, replacement trees of local provenance are being planted to fill canopy gaps.

11.7 Water Management

The issue of soils and wetlands drying out due to prolonged drought, urbanisation and climate change is acknowledged as a major threat of plant species dying out in Maroondah, in particular those associated with Swampy Woodland and specially adapted to winter-sodden floodplains. Also acknowledged is that stream ecology and stability are affected by unnaturally large fluctuations in flow resulting from stormwater inflows resulting from high levels of impervious surfaces in the catchments.
Council responses include:

- Designing drainage works to avoid unnecessary draining of areas of swampy native vegetation whilst also taking into account other drainage objectives
- Stabilising and correcting gully erosion particularly in Maroondah's north:
    - The retarding basin and ponds have been desilted and creek erosion stabilised in Warranwood Reserve
    - At the time of writing the pond system and creek through Nangathan Way (adjacent to Hochkins Ridge Flora Reserve) were scheduled for desilting and erosion control works
    - The series of ponds through Candlebark Walk have been re-excavated and flows stabilised

  - Similar works have been undertaken in Yarrunga, Yanggai Barring, Settlers Orchard, Narr-Maen reserves
  - The pondage systems through Ringwood Lake Park, and the dam in Monterey Park have been desilted
  - The Range wetlands have been desilted and flow and function restored
  - Downstream of the retarding basin at Warranwood Reserve is experiencing erosion issues, however access is highly restricted and attempting repair works is expected to have a significant impact on the vegetation
- Investigating options for diverting stormwater flows that return water to floodplains and wetlands. For example Council is negotiating with Reece Plumbing in Bayswater North to enable stormwater coming off their property to be directed into the nearby Connollys Reserve
- Designing and installing new wetlands to provide habitat and manage stormwater when identified in master plans or similar

The health of trees and other vegetation on the banks of Dandenong Creek near the 'daylighting' project is not being actively monitored. Anecdotally at least their health appears to be good.

The concerns with potential lowering of water tables as a result of creek daylighting, as well as the possibility of installing groundwater monitoring bores along Tarralla Creek will be discussed with Melbourne Water.

11.8 Planting

11.8.1 The Trend Toward Smaller Tree Species

There is no policy to replace larger tree species with smaller species when selecting street trees. Council seeks to plant larger street trees wherever possible but diminishing space in which to plant is limiting opportunities to do so. Mature tree size is matched to the space available - pressures on space include subdivisions leading to more crossovers (this is amplified in cul-de-sac settings), and the need to keep foliage clear of overhead powerlines (Energy Safe Victoria will fine Council if pruning to provide clearance from power lines is deemed inadequate). Options for creating more space to allow for more and larger street trees continue to be explored.

11.8.2 Diversity of Tree Species

Council's planting of trees in Maroondah continues to be dominated by eucalypts. For street tree plantings there is no policy to reduce the proportion of trees in the Myrtle (Myrtacea) family, however we are looking into diversification of provenance and genus/species to optimise urban forest resilience (eg potential impacts of disease and /or future climate)

For tree planting in parks species from the Myrtle family are predominant, with indigenous species always a component.

11.8.3 Correas

The issue of hybrid versions of Common Correa (*Correa reflexa* variety *reflexa*) displacing the indigenous form and becoming a serious environmental weed is recognised.
The Bushland team has completed a training course on Correa hybridisation, and Correas are not being planted while investigating options to source pure forms.
The two local indigenous plant nurseries, CRISP and Candlebark, have been made aware of the issue, and are only propagating the pure form. Any plantings in Parks in close proximity to bushland reserves use plants sourced from these nurseries

11.8.4 Stormwater Treatment Wetlands

The concerns regarding the use of River Club-rush (*Schoenoplectus tabernaemontani*) in artificial wetlands to remove stormwater pollution, and/or provide wildlife habitat is recognised, and this species is not being planted.

11.8.5 Planting into Forests, Wetlands and Roadsides

The issue of using plant species that are not indigenous to Maroondah (but probably presumed to be) into forests and wetlands in nature reserves during past years is recognised. The Bushland Team strictly limit their planting to local provenance indigenous species. The species and provenance is driven by what the two local indigenous nurseries can supply.

Past practices of planting of trees in too high densities is also recognised.
The spacing of trees in revegetation works is now largely based on filling large gaps in the canopy, with a level of over planting to allow for losses. When planting, the Bushland Team takes into account on mature canopy extent for tree spacing, and eucalypt planting is very limited due to the relatively small size of the revegetation areas. This advice is also passed on to volunteers working with Council.

The risk of unintentionally introducing soil-borne plant diseases into high value bushland reserves is recognised and managed through the use of PhytoClean used to treat boots and equipment for staff working in a bushland reserve.

11.9 Support for Private Biodiversity Stewardship

The value of providing support for private landowners with high value remnant vegetation on their properties to be good stewards of the nature in their care is acknowledged.
How best to do so is the focus of Action 2.3(i) *Evaluate the options for engaging and supporting landholders to increase habitat provision on private land within or next to sites of biological significance, and/or along important habitat corridor routes, in order to support biodiversity and help build a community culture supportive of biodiversity* in the Maroondah Vegetation Strategy 2020-2030.

11.10 Support for Community Involvement with Nature

11.10.1 'Get to Know Your Park' Tours

Guided tours with one of Council's bushland management staff of selected bushland reserves were done in the past, however the covid-19 pandemic ensured a cessation to any plans to do so for the past few years.

Council has recently been participating in the global citizen science events, City Nature Challenge and Great Southern Bioblitz, and as part of doing so running 'nature discovery' activities in Council nature reserves.

Council has also just created and filled a Bushland Revegetation and Community Officer position to support the existing Bushland Revegetation and Community Supervisor. This role is likely to enable more activities to be run that help community discover nature in Council's reserves.

11.10.2 Events for Volunteer Groups

Friends groups and other volunteers are provided with advice and plants, and informal adhoc plant identification. Any training provided is delivered in accordance with Maroondah's broader volunteer guidelines.

Environmental volunteers across Maroondah were brought together in a forum in April 2021 to meet, share understanding of what each were doing, and explore options for networking, cooperating, and working together. This was well-received, but Covid-19 stalled the momentum. Council's intention is to in the near future, endeavour to restore the momentum and connections created.

11.10.3 Citizen Biological Surveys

Council is supporting the engagement of community to get involved in citizen science activities under the banners of two global events - the City Nature Challenge and the Great Southern Bioblitz. These involve encouraging local community members to get out and see what nature they can find, and record their observations on the citizen science platform, iNaturalist. It is hoped that this will help build a broad network of local citizen scientists, who can competently add high quality data to this platform.

11.10.4 Art

When commissioning works of public art, Council has been drawing inspiration from the suite of 'Engagement species' that were identified as part of the habitat connectivity modelling project completed in 2021.

11.11 Social Licence

This document outlines how Council will use the information in this report.

11.12 Monitoring

The importance of monitoring of changes in flora and fauna in helping Council better manage bushland reserves, other habitats, and biodiversity more generally is recognised.

A simple, but repeatable method for annually measuring the extent and condition of natural habitats has been devised by Council's Biodiversity Officer, and will enable tracking of progress towards the targets Council committed to in the Port Phillip and Westernport Regional Catchment Strategy:

- 'No net loss of the area and quality of existing native vegetation on 171 hectares of land managed by the City of Maroondah to 2040'
- 'Improved native vegetation quality on an additional 6.7 hectares of land managed by the City of Maroondah by 2025 and a further 13.1 hectares by 2040'

Methods for monitoring changes at a reserve level are being explored, with aspects of the Eastern Alliance for Greenhouse Action (EAGA) model providing a good basis.
The use of remote sensing data such as LiDAR and computer detection of vegetation from aerial imagery is also being explored.

Maroondah City Council

MAROONDAH CITY COUNCIL

2021 STANDARD FORM

COMMUNITY FACILITY LEASE

St John Ambulance Australia (Victoria) Inc

This lease package is a controlled document and is one of a suite of documents used by Council when granting third parties the use of Council premises. Permission for the use of this document by Council staff must be obtained from Council's Manager Leisure.

pfpc044_211129_056.doc

Maroondah City Council 2021 standard community facility lease package

This lease has been developed for use in the lease of community facilities by Maroondah City Council (**Council**). It is based on a standard document prepared by Council's lawyers, modified for Council's own purposes.

The Council documents used to lease or licence the use of Council premises include:

- This standard community facility lease;
- A standard community facility licence;
- Standard documents to vary, surrender and renew community facility leases and community facility licences;
- A suite of documents relating to the seasonal allocation of Council premises (through a form of licence); and
- Overarching policy documents, including –
  - Community Facilities Occupancy policy (2020); and
  - Community Facilities Pricing policy (2020).

This community facility lease consists of two parts:

Part One – Recitals and Execution Page

The Recitals set out the factual circumstances in which the lease was entered into. They do not form an operative part of the lease (i.e. grant rights or create obligations) but Council can rely and may be able to take action based on any representations made by the tenant (usually in Recital I).

The execution page is where Council and the tenant formally sign (or execute) the lease to confirm their mutual acceptance of the terms and conditions of the lease.

Part Two – Particulars, Standard Clauses and Annexures

The Particulars are the specific details of each lease: the parties to the lease, the land being leased, the period of the lease, the rent etc. There are then 24 standard clauses which set out Council's community facility lease terms. These Particulars must be completed for the standard terms to be able to have effect.

There are four Annexures to each Council lease:

- Annexure A records any amendments to the standard clauses and includes any additional special conditions (which prevail over standard clauses).
- Annexure B inserts a plan of the premises. It is this plan that shows the specific land and buildings being leased to the tenant.
- Annexure C inserts a copy of the Ministerial Determination dated 13 October 2014[1].
- Annexure D are Council's standard documents to exercise any option to extend the term of the Lease.

[1] This Determination exempts certain Local Government leases from retail tenancy lease laws.

Part One – Recitals

A. Maroondah City Council owns the land known as –
   a. 45 Lacey Street, Croydon. Vic 3134
   b. CT-6722/280 & CT-8814/045 & CT-11356/176
   (**Council's Land**)

B. St John Ambulance Australia (Victoria) Inc (A0021449L) is a Not for Profit incorporated association that is registered in Victoria and operates within the municipality of Maroondah (**Tenant**).

C. The Tenant wishes to lease part or all of the Council Land from Council.

D. Council has granted the Tenant a lease of the part of Council's Land bounded in red on the aerial photograph or other plan shown in Annexure B of Part Two of this lease package on the terms and conditions set out in this lease (**Premises**).

E. Located on the Premises are the following Council assets –

   Council Buildings

F. Located on the Premises are the following assets not owned by Council: the Tenant's property

G. Subject to the terms of this lease, the Tenant has the exclusive use of the Premises and all Council assets located on the Premises.

H. The purpose of Council granting this lease to the Tenant is to enable the Tenant to carry out activities/services normally associated with care giving at events within the community. (First Aid)

I. In granting this lease to the Tenant, the Tenant acknowledges it has made and Council has relied upon the following representations –

   1. The Premises will only be used for Not for Profit purposes and not for any commercial purposes;
   2. The Tenant will only use the Premises in a manner that complies with the terms and conditions of this lease;
   3. The Tenant is financially sound and will be able to pay its rent and all other of its debts as and when they fall due; and
   4. The Tenant has disclosed to Council all matters about the Tenant and about this lease known by the Tenant which may materially affect either Council's decision to grant this lease to the Tenant or the terms of this lease.

Part One – Execution Page

The Council leases the Premises to the Tenant subject to the terms contained in this Lease.

This Lease is executed as a deed on the day of 20

The Common Seal of **Maroondah City Council** was affixed in the presence of:)

..... Councillor

..... Chief Executive Officer

Dated this ..... day of 20

Executed for and on behalf of St John Ambulance Australia (VIC) in accordance with its Constitution by:)

(Signed).....

Gordon Botwright - Chief Executive Officer

..... PRINT name and position held

(Signed).....

Karen Hensgen - Chief Financial Officer

..... PRINT name and position held

Dated this 13th day of February 2023

Part Two – Standard terms of Maroondah City Council community facility lease

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Particulars

Item 1.	**Council:** (Clause 1)	**Maroondah City Council** of Realm, 179 Maroondah Highway, Ringwood 3134
Item 2.	**Tenant:** (Clause 1)	**St Johns Ambulance Australia (Victoria) Inc** (A0021449L) 170 Forster Road, Mount Waverley 3149
Item 3.	**Land:** (Clause 1)	The land contained in certificate of title volume 6722 folio 280 and title volume 8814 folio 045 and title volume 11356 folio 176 and known as 45 Lacey Street, Croydon 3136
Item 4.	**Premises:** (Clause 1)	That part of the Land shown bounded in red on the plan in Annexure B
Item 5.	**Commencement Date:** (Clause 1)	4 June 2021
Item 6.	**Term:** (Clause 1)	3 years
Item 7.	**Further Term(s):** (Clause 1 & 3.2)	2 further term(s) of 3 year(s)
Item 8.	**First and Last dates for exercising the Option for the Further Term:** (Clause 3.2.1)	4 December 2023 and 4 March 2024
Item 9.	**Rent :** (Clause 1 & 3)	Year 1: $810.00 incl GST Year 2: $830.25 incl GST Year 3: $851.00 incl GST The Rent is payable annually in advance, within 28 days of Council issuing an invoice for the Rent, commencing on the Commencement Date, and then on each anniversary of the Commencement Date during the Term and any Further Term. Council will generally issue its tax invoice for the Rent in March or April preceding the next anniversary of the Lease. This payment obligation also applies to the payment of Rent during any Further Term.
Item 10.	**Rent During Further Term:** (Clause 1 and 5)	To be determined by Council in accordance with Council's Community Facilities Pricing Policy.

Particulars (continued)

Item 11.	**Security Deposit:** (Clause 1 & 9.1)	$1,000 plus GST
Item 12.	**Community Use:** (Clause 1 & 14.1)	The carrying on of Not for Profit activities normally associated with care giving at events within the community. (First Aid)
Item 13.	**Hours of Use** (Clause 14.4)	Not Applicable
Item 14.	**Special Conditions:** (Clause 1 & 22.6)	The Special Conditions in section two of Annexure A form part of this Lease. • Special Condition 3 added
Item 15.	**Changes to Council's standard terms:** (Clause 23.6)	The following standard clauses have been amended (as set out in section one of Annexure A):

1. Definitions

In this Lease unless expressed or implied to the contrary[2]:

AGM Report means the annual report submitted by the Tenant to its Annual General Meeting.

Child Safe Policy means a child safety policy maintained by the Tenant from time to time including but not limited to WWC Checks.

Commencement Date means the date specified in Item 5.

Community Use means the permitted use of the Premises specified in Item 12 which falls within the uses specified in the Determination.

Council means Maroondah City Council as stated in Item 1 and includes the Council's successors and assigns and where it is consistent with the context includes the Council's employees and agents.

Council's Fixtures means all fittings, fixtures, and chattels contained in the Premises at the Commencement Date or installed by the Council during the Term.

CPI means the Consumer Prices Index – All Groups (Melbourne) or agreed equivalent

Determination means the Ministerial Determination dated 13 October 2014, a copy of which is attached at Annexure C.

Financial Year means a period of twelve months commencing on 1 July of each year and ending on 30 June of the following year.

Further Term means the further term(s) specified in Item 7.

Hours of Use means the hours specified in Item 13.

Item means an item in the Particulars to the Lease.

Land means the land specified in Item 3.

Lease means this Lease.

Lettable Area(s) means the lettable area of the Land assessed for Rates and Taxes as determined by a surveyor engaged by the Council.

Maintenance Schedule means the schedule published on Council's internet website[3] which sets out the repair and maintenance responsibilities of the parties to the Lease.

Municipal Emergency Management Plan means the management plan prepared by Council and other agencies that is applied in the event of an emergency.

[2] Note: clause, Particular and annexure are defined in clause 23.5.1.

[3] Subject to Council complying with the requirements of clause 23.10 which require notice to the Tenant and an explanation of any changes made compared to the preceding version (if any).

Not for Profit means:

(i) an individual who is not conducting activities for the purposes of deriving a financial return for themselves or anyone else; or

(ii) an organisation that exists exclusively for charitable purposes or as an amateur sporting group, arts, craft or other special interest group established for the benefit of the community of the Maroondah City Council and which is primarily run by voluntary staff and/or a committee; or

(iii) an organisation which provides services to the Maroondah community, consisting of primarily paid staff and which returns all profits into the operation of the organisation to carry out its purposes.

Part means one of the two (2) parts to this Lease, which collectively constitute and form the terms of this Lease.

Premises means the premises specified in Item 4 and includes the Council's Fixtures.

Rates and Taxes means the rates, taxes, charges and levies specified in clause 6.1.

Rent means the amount specified in Item 9 as reviewed, adjusted or increased under this Lease.

Security Deposit means a Security Deposit for the amount specified in Item 11.

Services refers to utilities in connection with the Premises including but not limited to electricity, gas, water, telephone, internet and cable communications or entertainment services.

Special Conditions means the conditions referred to in Item 14.

Tenant means the Tenant specified in Item 2 and includes the Tenant's successors and assigns and where it is consistent with the context includes the Tenant's employees, contractors, agents, invitees and persons the Tenant allows in the Premises.

Tenant's Property means all property in the Premises including all fixtures and fittings owned or leased by the Tenant but excluding the Council's Fixtures.

Term means the term specified in Item 6 and includes any period of overholding.

WS Act means the *Worker Screening Act 2020* (Vic)

WWC means Working with Children.

WWC Check means checks conducted by the Tenant and issued by the Department of Justice and Community Safety pursuant to the WS Act.

2. Compliance with *Local Government Act 2020* (Vic)

Where applicable, the grant of this Lease is subject to the Council giving notice of its intention to grant this Lease and resolving to grant this Lease pursuant to the requirements of the *Local Government Act 2020* (Vic).

3. Duration of the Lease

3.1 Term

This Lease is for the Term starting on the Commencement Date.

3.2 Option for a Further Term

The Council will agree to the Lease being extended for the Further Term if the Tenant:

3.2.1 gives the Council written notice in a form similar to the relevant letter in Annexure D asking to exercise the option to extend the term of the Lease, provided such notice is given not earlier than 6 months nor later than 3 months before the end of the Term (the first and last dates for exercising the option for the Further Term are specified in Item 8);

3.2.2 has remedied any breach of this Lease of which the Tenant has received written notice from the Council;

3.2.3 has not persistently defaulted under this Lease where the Council has given written notice of the defaults; and

3.2.4 complies with all reasonable requirements of the Council.

3.3 Process to exercise an option for a Further Term

The process to exercise an option for a Further Term once Council has received the written request from the Tenant's pursuant to clause 3.2.1 above is –

3.3.1 Council will advise the Tenant in writing whether Council agrees to the option for the Further Term being exercised[4];

3.3.2 If Council agrees to the option being exercised, then Council will send the Tenant an exercise of option agreement in a form similar to the relevant letter in Annexure D; and

3.3.3 The Tenant must then execute the exercise of option agreement and return it to the Council within 28 days of receipt failing which the option lapses at Council's discretion. If an option for a Further Term lapses, then Council will confirm same to the Tenant in writing[5].

3.4 Commencement and terms of the Further Term

Where an option for a Further Term has been exercised then the Further Term will commence on the day after the initial Term ends and operates on the same terms and conditions as the initial Term save that

3.4.1 there will be with no option for a Further Term where the last option for a Further Term has been exercised; and

3.4.2 the Rent for the Further Term will be the Rent stated in Item 10.

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[4] If the Tenant has complied with the four requirements of clause 3.2 then Council is required to agree to the option being exercised. The option is the Tenant's, not Council's.

[5] This signed letter of agreement is the formal documentation confirming the lease has been extended for the Further Term. It should be added to both parties' copy of the Lease. Council does not execute a new lease when an option is exercised.

3.5 Overholding

If the Tenant continues in occupation of the Premises after the end of the Term, without objection by the Council:

3.5.1 the Tenant occupies the Premises subject to the same terms and conditions contained in this Lease;

3.5.2 the Council or the Tenant may end this Lease during any period of overholding by giving 30 days written notice to the other party expiring at any time; and

3.5.3 the Council may increase the Rent and the amount of any Security Deposit by giving the Tenant one month's written notice and those increases will apply from the end of the notice, even where the Tenant has already paid Rent further in advance.

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4. Payment of Rent

The Tenant must pay the Rent to the Council in the manner specified by the Council in Item 9.

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5. Rent for any Further Term

The Rent for any Further Term will be set for each year of the Further Term by Council prior to the Further Term commencing. The Rent will be determined by the application of any relevant policy adopted by Council or by reference to the historical and expected future movement in the CPI rounded up or down to the nearest $50 or $100 as Council reasonably determines.

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6. Outgoings

6.1 Rates and Taxes

Subject to clause 6.2, the Tenant must pay to the Council, or the relevant authority 100% of the following:

6.1.1 water rates and charges, including water usage charges;

6.1.2 sewerage and drainage rates and charges;

6.1.3 essential safety measures (if applicable);

6.1.4 land tax (assessed on a single holding basis) (if applicable); and

6.1.5 all other rates, taxes, charges and levies assessed in connection with the Premises save that the Tenant will not be required to pay for the waste collection services set out in clause 18.7 that Council will provide.

6.2 Proportion of Rates and Taxes

If any Rates and Taxes are not separately assessed in connection with the Premises, the Tenant must pay to the Council within 30 days of demand the proportion of the Rates and Taxes that the area of the Premises bears to the total Lettable Area assessed.

6.3 Receipt for Payment

The Tenant must provide to the Council receipts for any Rates and Taxes paid by the Tenant within 30 days of request by the Council.

7. Other expenses

7.1 Services

The Tenant must, by the due date specified on the demand, pay for all Services in connection with the Premises, and where any Service is not separately metered, the Tenant must pay for a reasonable proportion of those Services as determined by Council, acting reasonably.

7.2 Costs and Duty

The Tenant must pay to the Council within 30 days of demand:

7.1.1 Council's reasonable costs of preparing, negotiating and finalising this Lease;

7.1.2 the stamp duty payable on this Lease (including penalties and fees) (if any);

7.1.3 the Council's reasonable costs in considering the granting of any consent or approval under this Lease (regardless of whether the Council actually gives such consent or approval);

7.1.4 the Council's architects or contractor's fees payable pursuant to clause 11.3;

7.1.5 the Council's costs (including charges on a solicitor-own client basis) incurred as a result of a breach of this Lease by the Tenant; and

7.1.6 the Council's reasonable costs in the exercise or attempted exercise by the Council of any right or remedy against the Tenant.

8. GST

8.1 Definitions

In this clause:

8.1.1 words and expressions that are not defined in this Lease, but which have a defined meaning in the GST Law have the same meaning as in the GST Law;

8.1.2 GST Law has the meaning given to that term in the A New Tax System *(Goods and Services Tax) Act* 1999.

8.2 GST Exclusive

Except as otherwise provided by this clause, all consideration payable under this Lease in relation to any supply is exclusive of GST.

8.3 Increase in Consideration

If GST is payable in respect of any supply made by a supplier under this Lease (**GST Amount**), the recipient will pay to the supplier an amount equal to the GST payable on the supply.

8.4 Payment of GST

Subject to clause 8.3 the recipient will pay the GST Amount at the same time and in the same manner as the consideration for the supply is to be provided under this Lease.

8.5 Tax Invoice

The supplier must provide a tax invoice to the recipient before the supplier will be entitled to payment of the GST Amount under clause 8.4.

8.6 Reimbursements

If this Lease requires a party to reimburse an expense or outgoing of another party, the amount to be paid or reimbursed by the first party will be the sum of:

8.6.1 the amount of the expense or outgoing less any input tax credits in respect of the expense or outgoing to which the other party is entitled; and

8.6.2 if the payment or reimbursement is subject to GST, an amount equal to that GST.

8.7 Adjustment events

If an adjustment event occurs in relation to a taxable supply under this Lease:

8.7.1. the supplier must provide an adjustment note to the recipient within 7 days of becoming aware of the adjustment; and

8.7.2. any payment necessary to give effect to the adjustment must be made within 7 days after the date of receipt of the adjustment note.

9. Security Deposit

9.1 Council's Right to Use Security Deposit

The Council may call up payment of the Security Deposit required by clause 9.2 if the Tenant does not comply with any of its obligations under this Lease.

9.2 Delivery of Security Deposit

The Tenant must:

9.1.2 pay to the Council the Security Deposit by way of bank cheque together with the Tenant's tax file number on or before the Commencement Date; or

9.1.3 if the Council requires, deliver to the Council a bank guarantee for an amount equal to the Security Deposit (the bank guarantee must be on terms acceptable to the Council acting reasonably) on or before the Commencement Date; and

9.1.4 pay any additional amount towards the Security Deposit within 14 days of demand to maintain the Security Deposit at the required level.

9.3 Tenant to replace Security Deposit

The Tenant must, within 14 days of demand, replace any amount of the Security Deposit used by the Council (including providing a replacement or additional bank guarantee).

9.4 Return of Security Deposit

The Council must, if the Tenant has complied with all of its obligations under this Lease, return the Security Deposit to the Tenant within 60 days of the end of this Lease.

9.5 Sale of the Land

The Tenant must provide the Security Deposit to any future owner of the Land if this Lease continues beyond the sale of the Land.

10. Payment requirements

10.1 No Deduction or Right of Set-off

The Tenant must pay all amounts due under this Lease to the Council (including the Rent and Rates and Taxes) without deduction or right of set-off.

10.2 Interest on Late Payments

The Tenant must pay to the Council on demand interest at the rate per annum equal to the current rate fixed under section 2 of the *Penalty Interest Rates Act* 1983 (Vic) on any money payable by the Tenant under this Lease and remaining unpaid after the due date. Interest will be computed from the date on which such payment became due.

10.3 Payment after Termination

The Tenant must:

10.3.1 make all payments due under this Lease; and

10.3.2 provide all information to the Council under this Lease to calculate any such payments,

even if this Lease has ended.

10.4 Method of payment

The Tenant must make all payments under this Lease in such manner as the Council reasonably requires, which may include by electronic funds transfer or direct debit.

11. Repairs, Refurbishment and Alterations

11.1 Repairs and Maintenance

11.1.1 The Tenant must maintain[6] and repair the Premises in accordance with Maintenance Schedule, published on Council's internet website. For the sake of certainty, the Tenant's obligations as set out in the Maintenance Schedule from time to time form part of its obligations under this Lease.

11.1.2 Without limiting clause 11.1.1, the Tenant must:

(a) keep the Premises and the Tenant's Property clean and free from rubbish, store all rubbish in proper containers and have it regularly removed;

(b) keep the Premises in the same condition as it was in at the date the Tenant first entered occupation of the Premises (fair wear and tear excepted);

(c) pay to Council any costs incurred by Council in maintaining, repairing or replacing items in the Premises that are damaged, worn or destroyed with items of at least the same quality which are:

(i) the Tenant's responsibility under the Maintenance Schedule; or

(ii) not listed on the Maintenance Schedule,

and which are not maintained, repaired or replaced by the Tenant as required under this Lease[7];

(d) make good any damage caused to any adjacent property by the Tenant;

(e) take all reasonable measures to ensure that any fair wear and tear to the Premises does not cause any loss or damage to the Premises or to any person;

(f) give the Council prompt written notice of any material damage to the Premises or anything likely to be a risk to the Premises or any person or property in or near the Premises; and

(g) comply with the procedures for maintenance and repairs set out in Council's Community Facilities Occupancy Policy (provided a copy is given to the Tenant) to the extent that Policy is not inconsistent with this Lease.

11.2 Electrical Equipment

The Tenant must ensure that all electrical equipment and appliances are inspected, tested and tagged in accordance with, and as often as required by, the standards contained in the Standard Inspection and Testing AS/NZS 3760.

[6] Maintenance includes the regular servicing of specific items such as air conditioners, heaters, dishwashers and the like.
[7] As the failure to repair or replace is a breach of this Lease then Council can immediately access the Tenant's Security Deposit, if there is one, rather than making demand for payment from the Tenant. Refer to clause 9.2.

11.3 Alterations to Premises

The Tenant must ensure any alterations or works to the Premises, any services to the Premises or the Tenant's Property are carried out strictly in accordance with the process set out in Council's policy for alterations to premises under a community facilities lease published on Council's internet website[8].

The Tenant is not required to seek the Council's consent to making any alterations to the display of the Tenant's property in the Premises.

11.4 Not Interfere with Services

The Tenant must not interfere, misuse or overload any services to the Premises, including electricity, gas and water.

11.5 Defacing Premises

The Tenant must not deface or damage the Premises (including drilling holes in the Premises) except where approved by the Council in accordance with clause 11.3.

11.6 Failure to Repair and Maintain

If the Tenant does not carry out any repairs, maintenance or other works required under this Lease within 14 days of receiving written notice from the Council to do so, then the Council may enter the Premises to carry out such repairs, maintenance and works at any reasonable time after giving the Tenant further reasonable notice. The cost of all such repairs, maintenance and works must be paid by the Tenant to the Council on demand[9].

11.7 Repairs to Council's Fixtures

The Tenant must reimburse the Council for the cost of any repairs to the Council's Fixtures within 14 days of demand[10].

12. Insurance[11]

12.1 Public Liability and Glass Insurance

12.1.1 The Tenant must throughout this Lease maintain insurance, in the name of the Tenant and with Council named as an interested party for:

(a) public liability for the amount of $20 million for each single event (or such greater sum as reasonably required by the Council); and

(b) any windows and any other glass in the Premises for their full replacement value

[8] Subject to Council complying with the requirements of clause 23.10 which require notice to the Tenant and an explanation of any changes made compared to the preceding version. A policy titled 'Process for a tenant carrying out any alterations or works to the Premises' was published in 2013.

[9] As the failure to repair or maintain is a breach of this Lease then Council can immediately access the Tenant's Security Deposit, if there is one, rather than making demand for payment from the Tenant. Refer to clause 9.2.

[10] A failure to reimburse entitles Council to access the Tenant's Security Deposit, if there is one. Refer to clause 9.2.

[11] Insurance of Council buildings and improvements (e.g. tennis courts, baseball fields, soccer fields etc) and Council's fixtures (generally anything fixed to the building or improvement) are Council's responsibility. Tenants are not required to insure these.

12.1.2 The Tenant acknowledges that the insurance set out in clause 12.1.1(a) must extend to the whole of the Premises and all activities of the Tenant including the activities of any volunteers and invitees of the Tenant.

12.2 Tenant's Property

The Tenant must insure the Tenant's Property for loss and damage from risks including fire and water damage for its full replacement value.

12.3 Payment and Production of Policies

The Tenant must pay all insurance premiums on or before the due date for payment and produce to the Council copies of the certificate of currency at any time on reasonable request.

12.4 Not Invalidate Policies

The Tenant must:

12.4.1 not do anything which may make any insurance effected by the Council or the Tenant invalid, capable of being cancelled (by the insurer) or rendered ineffective, or which may increase any insurance premium payable by the Council; and

12.4.2 pay any increase in any insurance premium payable by the Council where such increase has been caused by the Tenant's act, default or use of the Premises.

12.5 Requirements by Insurer

The Tenant must comply with all reasonable requirements of the Council's insurer in connection with the Premises.

12.6 Other Insurance

The Tenant must, at its cost, effect and maintain workers' compensation insurance for its employees, to the reasonable satisfaction of Council.

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13. Release, Indemnity, Compensation and Liability

13.1 Release

The Tenant uses and occupies the Premises at its own risk and releases the Council from all claims resulting from any damage, loss, death or injury in connection with the Premises except to the extent that such claims arise out of the Council's negligence.

13.2 Indemnity

The Tenant must indemnify and hold harmless the Council against all claims resulting from any damage, loss, death or injury in connection with the Premises and the use and occupation of the Premises by the Tenant. The Tenant's liability to indemnify the Council will be reduced proportionally to the extent that the Council's negligence contributed to the loss or liability.

13.3 No Compensation

The Council is not liable to the Tenant for any loss or damage incurred by the Tenant due to:

13.3.1 any damage to the Premises;

13.3.2 the failure of the Council's Fixtures or any plant and equipment (including air conditioning and water or other heaters) to operate properly;

13.3.3 the interruption or damage to any services (including electricity, gas or water) to the Premises; and

13.3.4 the overflow or leakage of water in the Premises.

13.4 No Liability

The Tenant acknowledges and agrees that the Council will not be liable to the Tenant under this Lease (including but not limited to a breach of the covenant of quiet enjoyment or a derogation of the grant of this Lease) for any acts or omissions of the Council undertaken in any capacity including (but not limited to) in exercising any powers under the *Local Government Act 2020* (Vic) or the *Planning and Environment Act 1987* (Vic) except nothing in this clause releases Council from any obligations it owes to the Tenant under this Lease in its capacity as the owner of the Premises.

14. Community Use

14.1 Permitted Use

14.1.1 The Tenant must use the Premises for the Community Use and not use the Premises for any other purpose, with the intention being that the Tenant will maximise community use of the Premises within the **Community Use.**

14.1.2 If there are times where the Tenant is not using all or part of the Premises for the Community Use, then subject to clause 16 and Special Condition 1, Council may permit the Tenant to make the Premises or part thereof available for use or hire by other organisations, community groups or individuals in the wider Maroondah community ("the Hirer") who shall use the Premises in a manner that reflects the best fit with the Community Use, the needs of the intended Hirer and the other terms of this Lease.

14.2 No Warranty

The Tenant:

14.2.1 acknowledges that the Council does not represent that the Premises are suitable for the Community Use; and

14.2.2 must make its own enquiries as to the suitability of the Premises for the Community Use.

14.3 Illegal Purpose

The Tenant must not use the Premises for any illegal purpose or carry on a noxious or offensive activity on the Premises.

15. Other obligations concerning the Premises

15.1 Compliance with Laws

The Tenant must comply with all laws and any requirements of any authority in connection with the Premises and the Tenant's use and occupation of the Premises including but not limited to, any requirements of the *Equal Opportunity* Act *2010* (Vic), *Occupational Health and Safety Act 2004* (Vic), *Accident Compensation Act 1985* (Vic), *Workplace Injury Rehabilitation and Compensation Act 2013* (Vic), *Worker Screening Act 2020* (Vic) and the *Workers Compensation Act 1958* (Vic) if applicable, except the Tenant will not be required to carry out any structural works unless the need for such works arises from:

15.1.1 the negligent act or omission of the Tenant;

15.1.2 the failure by the Tenant to comply with its obligations under this Lease; or

15.1.3 the Tenant's use of the Premises.

15.2 Licences and Permits

The Tenant must maintain all licences and permits required for the Tenant's use of the Premises and obtain the prior written consent[12] of the Council before varying any licence or permit or applying for any new licence or permit.

15.3 Nuisance

The Tenant must not do anything in connection with the Premises which may:

15.3.1 cause a nuisance or interfere with any other person; or

15.3.2 be dangerous or offensive in the Council's reasonable opinion.

15.4 Security

The Tenant must:

15.1.1 [12] **Clause 22.12 provides how Council can exercise this consent right.**

15.4.1 keep the Premises secure at all times when the Premises are not being used by the Tenant;

15.4.2 comply with any building security policy or procedure, key policy or procedure or similar policy or procedure published by Council on its internet website[13];

15.4.3 not have additional keys cut or install any security system without the prior written consent[14] of Council. The Tenant acknowledges that the Council may (in granting such consent) require the Tenant to provide Council with any access codes, cards or key servicing the Premises. If the Tenant fails to comply with any such condition Council may remove or temporarily or permanently disable the security system servicing the Premises at the Tenant's cost;

15.4.4 be able, at all times, to identify the person in possession of any key issued to the Tenant by Council. If the Tenant is not able to identify such persons to Council's reasonable satisfaction then, in addition to any other rights or remedies under this Lease, Council reserves the right to change the locks and re-key the Premises and issue new keys, the costs of which becomes a debt due and payable to Council by the Tenant upon the written demand of Council;

15.4.5 pay the cost of all security attendance at the Premises unless a police report is produced, or panel fault is identified;

15.4.6 ensure all alarm codes are kept secure and that all alarms are in good working order[15] and are properly de-armed during the Tenant's use of the Premises and re-armed after the Tenant's use of the Premises. If any Council officer, contractor or an emergency service, including, but not limited to a fire brigade, attends the Premises in response to an alarm that is triggered other than in an emergency situation, then the Tenant will be responsible for paying directly or reimbursing Council in respect of any cost or payment that must be made to the Council officer, contractor and/or emergency service as a result.

15.5 Signs

The Tenant must seek the prior written consent[16] of the Council before displaying or affixing any signs, advertisements or notices to any part of the Premises where such signs, advertisements or notices are visible from outside the Premises.

15.6 No Smoking

The Tenant must:

15.6.1 not permit any smoking in the Premises; and

15.6.2 display 'no smoking' signs in the Premises if requested by the Council.

15.7 Reputation

The Tenant shall not, and shall ensure that its employees, agents, volunteers, participants and any other people representing the Tenant (other than mere attendees) shall not, do anything which brings, or would be likely to bring, either the Council or the Tenant into disrepute, harm the reputation or interests of the Council or which could reasonably be expected to lead to unwanted or unfavourable publicity to the Council.

[13] Subject to Council complying with the requirements of clause 23.10 which require notice to the Tenant and an explanation of any changes made compared to the preceding version. A policy titled 'Maroondah Key Policy 2012' was published in 2013.
[14] Clause 22.12 provides how Council can exercise this consent right.
[15] Council, at its cost, will undertake regular inspection and maintenance of Council provided security systems. If there is any fault in a security system, the Tenant is to promptly inform Council so an inspection can be undertaken.
[16] Clause 22.12 provides how Council can exercise this consent right.

15.8 Vacation of Premises

The Tenant must not leave the Premises vacant for more than 45 continuous days without the prior written consent[17] of Council.

15.9 Emergency Procedures

The Tenant must:

15.9.1 keep a fully stocked first aid kit at the Premises and replenish it when required;

15.9.2 establish and display an emergency evacuation plan, and test the utility of any such evacuation plan, at regular intervals during each year of the Term; and

15.9.3 only use emergency equipment at the Premises for genuine emergencies and must promptly inform Council if emergency equipment is utilised by the Tenant and the reasons for such utilisation. If Council is of the view that the emergency equipment has been properly and reasonably used, then Council will replenish the emergency equipment at Council's cost. However, if Council is not satisfied that the emergency equipment has been properly and reasonably used for an emergency, then the Tenant will be responsible for replenishing the emergency equipment at the Tenant's cost.

15.10 Heavy Objects and Flammable Substances

The Tenant must not:

15.10.1 store any flammable or explosive substances in the Premises unless they are required for the Community Use; or

15.10.2 store any unreasonably heavy objects in the Premises or store anything likely to damage the Premises.

Where flammable or explosive substances are stored in the Premises not in breach of this Lease, then the Tenant must give Council written notice of same including details of the substances, their volume, storage container and location.[18]

15.11 Television and Radio

The Tenant must not install any televisions, radios, music systems or other equipment in the Premises which can be heard outside the Premises without obtaining the prior written consent[19] of the Council.

15.12 Endanger Premises

The Tenant must not do or permit anything to be done in connection with the Premises which in the opinion of the Council may endanger the Premises or be a risk to any person or property.

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17 Clause 22.12 provides how Council can exercise this consent right.

18 This notification enables Council to determine whether additional safety measures, such as emergency services warning signs, are required for the Premises. If there are any questions or concerns about chemicals in the Premises, then Tenants are encouraged to contact Council so Council's corporate occupational health and safety adviser can review the circumstances and situation.

19 Clause 22.12 provides how Council can exercise this consent right.

15.13 Tenant's Employees

The Tenant must use all reasonable endeavours to ensure that the Tenant's employees, agents, contractors and invitees observe and comply with the Tenant's obligations under this Lease, where appropriate.

15.14 Animals

The Tenant must not allow any animals other than assistance dogs to enter the Premises, unless the animals are required for or part of the Community Use of the Premises.

15.15 Auction Sales

The Tenant must not conduct or allow to be conducted any auctions, garage sales, car boot sales, fetes or similar activities without the prior written consent[20] of Council.

15.16 Liquor Licence

The Tenant must:

15.16.1 seek the prior written consent[21] of the Council before applying for any licence or permit under the *Liquor Control Reform Act 1998* (Vic) ("Licence or Permit"), or applying for any variation, removal, transfer, surrender or release of the licence or permit or nominating any person to be a licensee or permittee;

15.16.2 produce the Licence or Permit to the Council for inspection upon demand;

15.16.3 comply with any conditions of the Licence or Permit imposed by the Council;

15.16.4 comply with all conditions of the Licence or Permit and all laws relating to the Licence or Permit;

15.16.5 not allow the Licence or Permit to be cancelled or suspended;

15.16.6 renew the Licence or Permit and notify the Council in writing within 14 days of the renewal;

15.16.7 promptly notify the Council in writing if the Licence or Permit is cancelled or suspended or if the Tenant receives any notice, summons or fine in relation to the Licence or Permit;

15.16.8 indemnify the Council for any damages or costs incurred in relation to the Licence or Permit or a breach of this clause by the Tenant; and

15.16.9 surrender the Licence or Permit within 21 days of receiving a written notice from the Council, which the Council may give to the Tenant if the Tenant's use of the Premises is causing or likely to cause a nuisance to local residents.

[20] Clause 22.12 provides how Council can exercise this consent right.
[21] Clause 22.12 provides how Council can exercise this consent right.

15.17 Gambling

15.17.1 The Tenant must not conduct any form of gambling on or associated with the Premises, whether such gambling requires a permit or licence or not, without the prior written consent[22] of Council.

15.17.2 The Tenant must not apply for a licence or permit pursuant to the *Gambling Regulation Act 2003* (Vic) (GRA) without the prior written consent of Council.

15.17.3 The Tenant must provide a copy of any licence or permit issued pursuant to the GRA to Council.

15.18 Tenant Membership

The Tenant will:

15.18.1 permit residents and ratepayers of the municipality of Maroondah to become members of the Tenant upon satisfying the Tenant's reasonable requirements for membership;

15.18.2 upon demand, inform the Council of the overall number of members of the Tenant and the number of Maroondah residents that are members of the Tenant; and

15.18.3 within 7 days of demand, provide the Council with access to all necessary documents to enable the Council to verify the membership of the Tenant. For the sake of clarity, Council will not copy or record the personal details of any member of the Tenant during any verification inspection.

15.19 Tenant Reporting Obligations

The Tenant must give Council by no later than the last day of February each year the following reports for the just completed (preceding) Financial Year:

15.19.1 an audited financial report or review (as per the requirements of the *Associations Incorporation Reform Act 2012* (Vic)) including a statement of assets and liabilities and profit and loss statement for the Tenant; or

15.19.2 if an audited report is not legislatively required, then a copy of the AGM Report together with any additional information requested by Council from time to time; and

15.19.3 a written report in a format similar to the template report for Tenants that Council makes available on its internet website[23] and, as a minimum, detailing:

(a) If not comprised within the AGM report, the activities conducted by the Tenant during the preceding year and, where applicable, a list of the groups which have used the Premises;

(b) the elected office bearers of the Tenant for the next year;

(c) if requested in writing by Council, any significant or cyclical maintenance of the Premises undertaken by the Tenant in accordance with the Maintenance Schedule or otherwise;

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[22] Clause 22.12 provides how Council can exercise this consent right.

[23] Subject to Council complying with the requirements of clause 23.10 which require notice to the Tenant and an explanation of any changes made compared to the preceding version

(d) a current list of each person who holds a key to the Premises including a reference to the key number (if any) allocated to the key by Council;

(e) If requested in writing by Council, annual reports of all OH&S incidents (including near misses and those causing injury) arising on, in or near the Premises or in connection with the Tenant's use of the Premises;

(f) a copy of the Tenant's Child Safe policy and record of all employees, contractors and volunteers;

(g) copies of current permits and licences required for the conduct of the Tenant's business from the Premises; and

(h) copy Certificate of Currency of Insurance current as at the date of submitting the report;

(i) if requested in writing by Council, a report on the current number of active members of the Tenant and how many of the active members live within the municipality of Maroondah.

15.19.4 Notwithstanding clause 15.20.3(e), the Tenant shall report to Council all OH&S incidents (including near misses and those causing injury) arising on, in or near the Premises or in connection with the Tenant's use of the Premises immediately such incident occurs.

15.20 Working with Children Checks and Child Safety

15.20.1 The Tenant shall do all such acts and things as may be required to comply with the WS Act. In particular, the Tenant must at all times maintain an up to date Child Safe Policy and ensure compliance by itself and all current and prospective employees, contractors, volunteers and participants, who are or shall be engaged in activities where children would be expected to be present. Participants refers to training, playing, assisting, mentoring, coaching or other work (excluding incidental or occasional contact with children), whether paid or volunteer; but does not include barrack or attend.

15.20.2 The Tenant agrees that it shall maintain an up to date register of WWC Checks for all employees, contractors and volunteers and shall, in addition to its reporting obligations in clause 15.20, submit a copy of the register to Council at any time upon reasonable request.

15.20.3 The Tenant warrants that it shall implement and maintain at all times the Child Safe Standards as prescribed in the National Principles for Child Safe Organisations (if applicable).[24]

15.20.4 This clause does not apply if the Tenant's activities do not include children as participants, spectators or bystanders.

[24] The Child Safe standards can be found on the https://ccyp.vic.gov.au/child-safety/being-a-child-safe-organisation/the-child-safe-standards/ website

15.21 Determination Warranty and Obligations

15.21.1 The Tenant acknowledges that the Council has entered into this Lease on the basis that the Tenant warrants that:

(a) the Tenant is a body corporate that exists for the purposes of providing community or similar facilities or promoting community objectives and that it applies its profits in promoting its objects and prohibits payment of any dividend or amount to its members; and

(b) accordingly, pursuant to the Determination, the *Retail Leases Act 2003* (Vic) does not apply to this Lease.

15.21.2 The Tenant warrants that its constitution or rules of association prohibit payment of any dividend, benefit or other amount to its members.

15.21.3 The Tenant agrees and acknowledges that during the Term and any further term:

(a) it must apply any profits that it receives in promoting its objects;

(b) it must not amend its rules or its constitution without the prior written consent[25] of Council; and

(c) it must provide a copy of its constitution or rules to Council within 7 days of the Commencement Date and otherwise upon demand by Council.

15.22 Tax Exempt

The Tenant must not undertake any activity or permit anything to be done which may cause it to cease being exempt from Commonwealth income tax under the *Income Tax Assessment Act 1997* (Cth). Dealing with Interest in the Premises

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16. Dealing with Interest in the Premises

16.1 No Parting with Possession

16.1.1 Subject to clause 14, the Tenant must not give up possession of the Premises including assigning this Lease, subleasing the Premises or granting to any person a licence in respect of the Premises, without the prior written consent[26] of Council.

16.1.2 For the sake of certainty, having regard to the positive obligation of the Tenant to maximise community use of the Premises under clause 14.1, Council permits the temporary hiring of the Premises on a regular or casual basis pursuant to Special Condition1 of this Lease.

[25] Clause 22.12 provides how Council can exercise this consent right.
[26] Clause 22.12 provides how Council can exercise this consent right.

16.2 Change in Shareholding

If the Tenant is a corporation (other than a corporation listed on any stock exchange in Australia) a change in the control of the corporation as such control existed at the Commencement Date (whether occurring at the one time or through a series or succession of issues or transfers) or a change in the holding of more than one-half of the issued share capital, either beneficially or otherwise, will be deemed to be a novation or assignment of this Lease. Before any such novation or assignment of this Lease can be effective and binding upon the Council the Tenant must seek the Council's prior written consent[27].

16.3 Mortgage of Lease

The Tenant must not create any security over this Lease or the Tenant's Property.

17. Tenant's obligations at the end of this Lease

17.1 Tenant's Obligations

At the end of this Lease, the Tenant must:

17.1.1 vacate the Premises and give the Premises back to the Council in a condition consistent with the Tenant having complied with its obligations under this Lease;

17.1.2 remove the Tenant's Property (including all signs and lettering) and reinstate the Premises in the condition the Premises were in prior to the installation of the Tenant's Property including making good any damage caused by the removal of the Tenant's Property; and

17.1.3 give to the Council all keys and other security devices for the purposes of obtaining access to and securing the Premises.

17.2 Tenant's Property Left in Premises

Anything left in the Premises after 7 days of the end of this Lease will be deemed to be abandoned by the Tenant and will become the property of the Council and may be kept or removed or disposed of (including being sold by private sale) by the Council at the Tenant's cost and at the Tenant's risk.

18. Council's rights and obligations

18.1 Quiet Enjoyment

As long as the Tenant does not breach this Lease, the Council must not interfere with the Tenant's use and occupation of the Premises except as provided by this Lease.

[27] Clause 22.12 provides how Council can exercise this consent right.

18.2 Alterations to the Premises

The Council may carry out any works, alterations, renovation or refurbishment of the Premises which may include extending or reducing any buildings on the Premises at any reasonable time after giving the Tenant reasonable notice of any work proposed pursuant to this clause.

18.3 Dealing with the Land

The Council may:

18.3.1 subdivide the Land or grant easements or other rights over the Land or the Premises except where it will unreasonably interfere with the Tenant's use and occupation of the Premises;

18.3.2 install, repair and replace pipes, cables and conduits in the Premises; and

18.3.3 use the roof and external walls of the Premises for any purposes the Council determines.

18.4 Entry by Council

The Council may enter the Premises at any reasonable time after giving the Tenant reasonable notice to:

18.4.1 inspect the condition of the Premises;

18.4.2 rectify any default by the Tenant under this Lease;

18.4.3 carry out any inspection, repairs, maintenance, works or alterations in the Premises which the Council decides to or is required to carry out by any law or authority.

For the purposes of this clause, where the Tenant has previously lodged a maintenance request and Council is entering the Premises to action that request, then prior notice of entry from Council to the Tenant is not required.

The Council must use all reasonable endeavours to cause as little disruption as possible to the Tenant's use of the Premises in exercising the Council's rights under this clause.

18.5 Emergency Entry, Municipal Emergencies and Disasters

18.5.1 The Council may enter the Premises at any time without giving notice to the Tenant in an emergency.

18.5.2 If the Council's Municipal Emergency Management Plan or Business Continuity Plan (or equivalent plans however titled) is activated then, notwithstanding any other provision of this Lease, Council reserves the right to enter and assume control of part or all of the Premises for emergency management or business continuity purposes for as long as is reasonably needed.

18.5.3 If Council assumes control of the Premises pursuant to clause 18.5.2 then Council must:

(a) use reasonable efforts to secure and protect the Tenant's Property, including data and confidential/personal information;

(b) return the Premises to the Tenant in the same condition that the Premises were in when Council assumed control of the Premises;

(c) acting in good faith, pay a reasonable proportion of any Rates and Taxes or Services assessed to the Premises during the period of the Council's occupation of the Premises; and

(d) reduce the Rent on a proportionate basis during the Council's occupation of the Premises.

18.5.4 The Tenant acknowledges and agrees that under no circumstance will the Tenant hinder the Council's use of the Premises or the Council's ability to respond to or deal with a municipal emergency or business continuity situation.

18.6 Reletting and Sale

The Council may:

18.6.1 once the Tenant has indicated that they will not exercise the option for a further term, affix a 'For Lease' sign on the Premises and show the Premises to intending tenants at any reasonable time upon reasonable notice to the Tenant during the 6 months prior to the end of the Term (except where the Tenant has validly exercised an option for a Further Term); and

18.6.2 affix a 'For Sale' sign on the Premises and show the Premises to intending purchasers of the Premises at any reasonable time upon reasonable notice to the Tenant during the Term.

Any sign erected by the Council must not unreasonably interfere with the Tenant's use and occupation of the Premises.

18.7 Waste services

Council will provide, without charge to the Tenant, one (1) two hundred and forty (240) litre waste bin and one (1) two hundred and forty (240) litre recyclables bin for the use of the Tenant in accordance with Council's waste collection practices current at the time. Any additional waste collection services that Council agrees to provide will be provided at the Tenant's cost.

19. Termination of Lease

19.1 Re-entry

The Council may re-enter the Premises and terminate this Lease if:

19.1.1 any part of the Rent is in arrears for 30 days (whether or not the Council has demanded payment);

19.1.2 the Tenant breaches this Lease and does not remedy the breach within 14 days of receipt of written notice from the Council; or

19.1.3 any funding or service agreement between Council and the Tenant ends.

19.2 Damages following Determination

If this Lease is terminated by the Council, the Tenant agrees to compensate the Council for any loss or damage the Council suffers arising in connection with the Tenant's breach of this Lease including the loss of the benefit of the Tenant performing its obligations under this Lease up to the expiration of the Term.

19.3 Essential Terms

The essential terms of this Lease are clauses 3, 4, 6.1, 7, 8, 9, 11.1, 11.3, 11.7, 12, 14.1, 15.1, 15.7, 15.15, 15.16, 15.17, 15.18, 15.19, 15.20, 16.1, 18.5 and any special condition that is expressed to be an essential term of this Lease. The breach of an essential term is a repudiation of this Lease.

19.4 No Deemed Termination

If the Tenant vacates the Premises, the Council will not be deemed to have terminated this Lease merely by the acceptance of keys from the Tenant, entry into the Premises for any purpose, or the showing of the Premises to prospective tenants or purchasers. This Lease will be deemed to continue until such time as the Council gives notice to the Tenant terminating this Lease, or otherwise agrees with the Tenant that this Lease is terminated.

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20. Insolvency Event

20.1 If:

20.1.1 the Tenant is insolvent or admits or is presumed to be so;

20.1.2 an application or order is made for the winding up or dissolution of the Tenant, or a resolution is passed, or any steps are taken to pass a resolution for a winding up or dissolution of the Tenant;

20.1.3 an administrator, provisional liquidator or person having a similar or analogous function under the laws of any relevant jurisdiction is appointed in respect of the Tenant, or any action is taken to appoint any such person and the action is not stayed, withdrawn or dismissed within fourteen days; or

20.1.4 the Tenant enters into, or takes any action to enter into, an arrangement (including a scheme of arrangement or deed of company arrangement), composition or compromise with, or an assignment for the benefit of, all or any class of its creditors or members or a moratorium involving any of them,

20.1.5 the Tenant is de-registered even if solvent; ASIC commences a strike-off application; or the Tenant ceases to have any directors

then an act of insolvency has occurred, and the Council may then terminate this Lease at any time by giving the Tenant 14 days written notice.

21. Destruction or Damage of Premises

21.1 Reduction in Rent

If the Premises, or any part of the Premises, are destroyed or damaged to the extent that the Tenant cannot use or have access to the Premises (except if the Tenant causes or contributes to the destruction or damage, or the Council's insurer is not legally required to reinstate the Premises because the Tenant caused or contributed to the destruction or damage) then the Council will reduce the Rent and any outgoings by a reasonable amount depending upon the nature and extent of destruction or damage until the Tenant can use or have access to the Premises.

21.2 Reinstatement of Premises

If the Premises or any part of the Premises are destroyed or damaged, the Council may, within 6 months from the date of such damage or destruction, give notice to the Tenant:

21.2.1 terminating this Lease, where the Council considers that the damage or destruction is such that repairing it is impracticable or undesirable; or

21.2.2 that the Council will commence reinstatement of the Premises to a condition where the Tenant can use or have access to the Premises.

The Council does not have to reinstate the Premises.

21.3 Tenant's Right of Termination

Where the Tenant has not caused or contributed to the damage or destruction of the Premises and the payment of the insurance for the Premises is not refused due to the act or default of the Tenant, the Tenant may give written notice to the Council terminating this Lease where the Council does not:

21.3.1 give notice to the Tenant pursuant to clause 21.2; or

21.3.2 commence reinstatement within 12 months of the date of damage or destruction.

Upon termination of this Lease, each party is released from all further obligations under this Lease except nothing in this clause releases either party from any breach of this Lease arising prior to the date of termination.

21.4 No Compensation

The Tenant acknowledges that if the Premises are destroyed or damaged, the Tenant is not entitled to receive any compensation from the Council. If however, the damage is at Council's fault then any insurance excess will be compensated.

22. Dispute Resolution

22.1 In the event of any dispute between the parties, each party agrees to mediate in good faith for the purpose of resolving the dispute.

22.2 In the event that any such dispute is unable to be resolved by mediation, the dispute shall be referred to arbitration before an arbitrator appointed by agreement between the parties or failing agreement an arbitrator nominated by the President for the time being of the Law Institute of Victoria. In any arbitration, each party shall be required to co-operate in the arbitration and do all such acts and tings as may be necessary for the effective conduct of the arbitration proceedings.

22.3 Each party may be represented by a legal practitioner in the arbitration. The decision of the arbitrator shall be final and binding upon the praties.

22.4 Each party shall bear its own costs of any mediation or arbitration. The fees of any mediator or arbitrator shall be borne equally by the parties.

23. General

23.1 Notices

Any notice required to be served under this Lease must be in writing and must be served by post, email transmission, or hand delivered to:

23.1.1 the Tenant at its address or email address set out in this Lease, the Tenant's registered office address, the Premises, or the last known address or email address of the Tenant; and

23.1.2 the Council at its address set out in this Lease or any other address notified in writing to the Tenant by the Council.

23.1.3 notices sent by email need not be marked for the attention of a specific person. However, the email must state the first and last name of the sender. Notices sent by email are taken to be signed by the named sender and constitute a notice in writing for the purpose of this clause 23.1.

23.2 Time of Service

A notice or other communication is deemed served:

23.2.1 if served personally or left at the person's address, upon service;

23.2.2 if posted, 2 business days after posted;

23.2.3 if served by email:

(a) when the sender receives an automated message confirming delivery; or

(b) 30 minutes after the time sent (as recorded on the device from which the sender sent the email) unless the sender receives an automated message that the email has not been delivered

whichever happens first; and

23.2.4 received after 6.00 pm in the place of receipt or on a day which is not a business day, at 9.00 am on the next business day.

23.3 Entire Understanding

This Lease contains the entire understanding between the parties as to the subject matter contained in it. All previous agreements, representations, warranties, explanations and commitments, expressed or implied, affecting this subject matter are superseded by this Lease and have no effect.

23.4 Variation of this Lease[28]

This Lease may only be varied by agreement recorded in a written document headed 'Variation of Lease' or similar and signed or executed by both parties.

23.5 Waiver

If the Council accepts the Rent or any other monies under this Lease (before or after the end of this Lease) or does not exercise or delays exercising any of the Council's rights under this Lease, it will not be a waiver of the breach of this Lease by the Tenant or of the Council's rights under this Lease.

23.6 Special Conditions

This Lease is subject to the Special Conditions set out in section two of Annexure A. The Special Conditions override any inconsistent provisions in this Lease.

23.7 Standard terms

The twenty three (23) clauses contained in this Part Two constitute Council's standard terms for a community facilities lease. Changes to those clauses noted in section one of Annexure A are deemed to be made to the relevant clauses in this Lease.

23.8 Council's Consent

If Council's consent is required under this Lease, Council may withhold or give its consent in its absolute discretion and, if it gives its consent, it may give its consent subject to such conditions as, in its absolute discretion, it requires.

23.9 Relationship of parties

This Lease does not create any relationship between the parties other than as landlord and tenant in respect of the Lease of the Premises. The Tenant must not hold itself out or allow anyone associated with the Tenant to hold themselves out, as being an agent of Council or being in any other way entitled to make any contract or representation for or on behalf of Council or to bind Council to the performance, variation, release or discharge of any obligation.

[28] A renewal of this lease (by the exercise of an option, if any, to extend its term) is not a variation. Similarly, an exercise of an option is on the same terms and conditions. If the parties wish to change any terms and conditions when exercising an option then they must execute a formal variation (which can be done at the same time that the options is exercised).

24. Interpretation

24.1 Governing Law and Jurisdiction

This Lease is governed by and is to be construed in accordance with the laws of Victoria. Each party irrevocably and unconditionally submits to the non-exclusive jurisdiction of the courts of Victoria and waives any right to object to proceedings being brought in those courts.

24.2 Persons

In this Lease, a reference to a person includes a firm, partnership, association, corporation or other corporate body.

24.3 Joint and Several

If a party consists of more than 1 person, this Lease binds them jointly and each of them severally.

24.4 Legislation

In this Lease, a reference to a statute, determination, standard, guideline, policy or similar document includes regulations under the statute and any consolidations, amendments, re-enactments, replacements or updates of any of them.

24.5 Clauses and Headings

In this Lease:

24.5.1 a reference to a clause, Particulars or Annexure is a reference to a clause, Particulars or Annexure in or to this Lease; and

24.5.2 headings and sub-headings and footnotes are inserted for ease of reference only and do not affect the interpretation of this Lease.

24.6 Severance

In this Lease:

24.6.1 if a provision is held to be illegal, invalid, void, voidable or unenforceable, that provision must be read down to the extent necessary to ensure that it is not illegal, invalid, void, voidable or unenforceable; and

24.6.2 if it is not possible to read down a provision as required in this clause, that provision is severable without affecting the validity or enforceability of the remaining part of that provision or the other provisions in this Lease.

24.7 Number and Gender

In this Lease, a reference to:

24.7.1 the singular includes the plural and vice versa; and

24.7.2 a gender includes the other genders.

24.8 Exclusion of Statutory Provisions

The following statutory provisions are excluded from this Lease:

24.8.1 Section 144 of the *Property Law Act* 1958 (Vic); and

24.8.2 Division 7 of Part IV of the *Transfer of Land Act* 1958 (Vic).

24.9 No restriction of Council's powers, duties or discretions

Nothing in this Lease fetters or restricts the powers, duties or discretions of Council in the exercise of its statutory or other functions, powers, duties and authority.

24.10 Council documents relevant to this Lease published on Council's internet website

24.10.1 Where this Lease requires the Tenant to comply with a document, policy, procedure or form ("Documents") published on Council's internet website then Council must give written notice to the Tenant of the publishing of the Document and the Document's general intent and effect before the Tenant is bound by that Document.

24.10.2 If Council makes any changes to a Documents published pursuant to clause 24.10.1 then those changes only apply to the Tenant once the Tenant is given written notice (including by email) by Council of the change to the relevant Document and the intent and effect of any changes.

24.10.3 For clarity, it is not intended by Council that Documents published by Council pursuant to this clause 24.10 will impose additional financial burden on the Tenant or shift liabilities or responsibilities of Council under this Lease to the Tenant. The Documents are intended to be policy and procedural documents forming part of this Lease.

24.11 General

To the extent permitted by law, no rule of interpretation must be applied in the interpretation of this Lease to the disadvantage of one party on the basis that it prepared or put forward any document comprising part of this Lease.

Annexure A

Section One – Changes to Council's standard community lease terms

The following standard clauses from Part Two of this Lease are amended as noted below:

Clause	How amended (changes tracked)	Final form of amendment (untracked)
14.4	~~14.4 Hours of Use~~ ~~The Tenant:~~ ~~14.4.1 must only use the Premises during the Hours of Use set out in Item 13;~~ ~~14.4.2 may use the Premises outside the Hours of Use if the Tenant complies with all laws and first obtains:~~ ~~(a) the written consent[29] of the Council; and~~ ~~(b) any permits and consents required for such use at the Tenant's cost and provides copies of any such permits or consents to the Council upon request; and~~ ~~(c) pays any additional costs incurred by Council in allowing the Premises to be used outside of the Hours of Use.~~	Not Applicable - all hours access
23.6		Special Condition 3 added

[29] Clause 22.12 provides how Council can exercise this consent right.

Section Two - Special Conditions

1. Relocation

1.1 Relocation

If the Council wants to redevelop the Land and/or the Premises, subdivide the Land, grant easements or other rights over the Land or carry out any works on the Land and/or the Premises, which the Council cannot adequately carry out due to the Tenant's occupation of the Premises under this Lease, the Council may give written notice to the Tenant:

1.1.1 requiring the Tenant to surrender this Lease by executing a deed of surrender in a form prepared by the Council (**Deed**) on a date being not earlier than 6 months after receipt of the notice by the Tenant; and

1.1.2 offering the Tenant a new lease of alternative premises on suitable land (**Alternative Premises**) which must, as far as practicable, be suitable for the Community Use.

The Council must also provide to the Tenant at the time of giving the Tenant the notice specified above, reasonable details of the Council's proposal for any redevelopment, works or other use determined by Council.

1.2 Terms of New Lease on the Land

The new lease of the Alternative Premises offered to the Tenant under Special Condition 5.1 must be on the same terms as this Lease except:

1.2.1 the term of the new lease will be equal to the remainder of the Term as at the date that this Lease is to be surrendered by the Tenant; and

1.2.2 the Alternative Premises will be in a location selected by the Council taking into account any reasonable requirements of the Tenant.

1.3 Surrender of Lease and New Lease

1.3.1 If the Council gives the Tenant a notice under Special Condition 5.1, the Tenant must:

(a) execute and return the Deed to the Council within 30 days of receipt by the Tenant;

(b) give notice within 30 days of receipt of the notice under Special Condition 3.1 to the Council either accepting or rejecting the offer of a new lease of the Alternative Premises; and

(c) where the Tenant accepts the new lease of the Alternative Premises, execute and return to the Council the new lease within 30 days of receipt of the new lease by the Tenant.

1.3.2 If the Tenant does not give the Council any notice under Special Condition 5.3.1(b), the Tenant will be deemed to have rejected the offer of the new lease of the Alternative Premises.

1.3.3 If the Tenant gives the Council a notice rejecting the offer of the new lease of the Alternative Premises or is deemed to have rejected such offer under Special Condition 5.3.2, the Tenant must vacate the Premises in accordance with the terms of this Lease and the Deed on the date specified in the notice under Special Condition 5.1.

1.4 **No Compensation**

The Tenant acknowledges that it is not entitled to receive any compensation from the Council where the Council requires the Tenant to surrender this Lease in accordance with this Special Condition and, on and from the date of the surrender of this Lease, (irrespective of whether the Deed is executed by the Tenant), the Tenant releases the Council from all further obligations under this Lease.

1.5 **Limit on Relocation**

The Council must not serve a notice on the Tenant pursuant to Special Condition 5.1 more than once during the Term.

1.6 **Relocation Period**

If requested by the Tenant in the notice given by the Tenant to the Council pursuant to Special Condition 5.1, the Council will provide that the new lease of the Alternative Premises will commence 30 days prior to the expiration of this Lease, during which time the Tenant may complete the relocation of the Tenant's Property, so long as the Tenant has complied with its obligations under this Special Condition.

2. Demolition

2.1 **Notice to the Tenant**

The Council may give a notice to the Tenant, which provides for the termination of the Lease on the grounds of a proposed demolition, on a date not being earlier than 6 months after receipt of the notice by the Tenant.

2.2 **Surrender of Lease**

If the Council gives the Tenant a notice under Special Condition 6.1, the Tenant must execute and return to the Council a deed of surrender of this Lease within 14 days of receipt by the Tenant.

2.3 **Compensation**

The Tenant acknowledges that it is not entitled to receive any compensation from the Council where the Council requires the Tenant to surrender this Lease in accordance with this Special Condition and, on and from the date of surrender of this Lease (irrespective of whether a deed

of surrender of lease is executed by the Tenant), the Tenant releases the Council from all further obligations under this Lease.

3. Tenant's Services

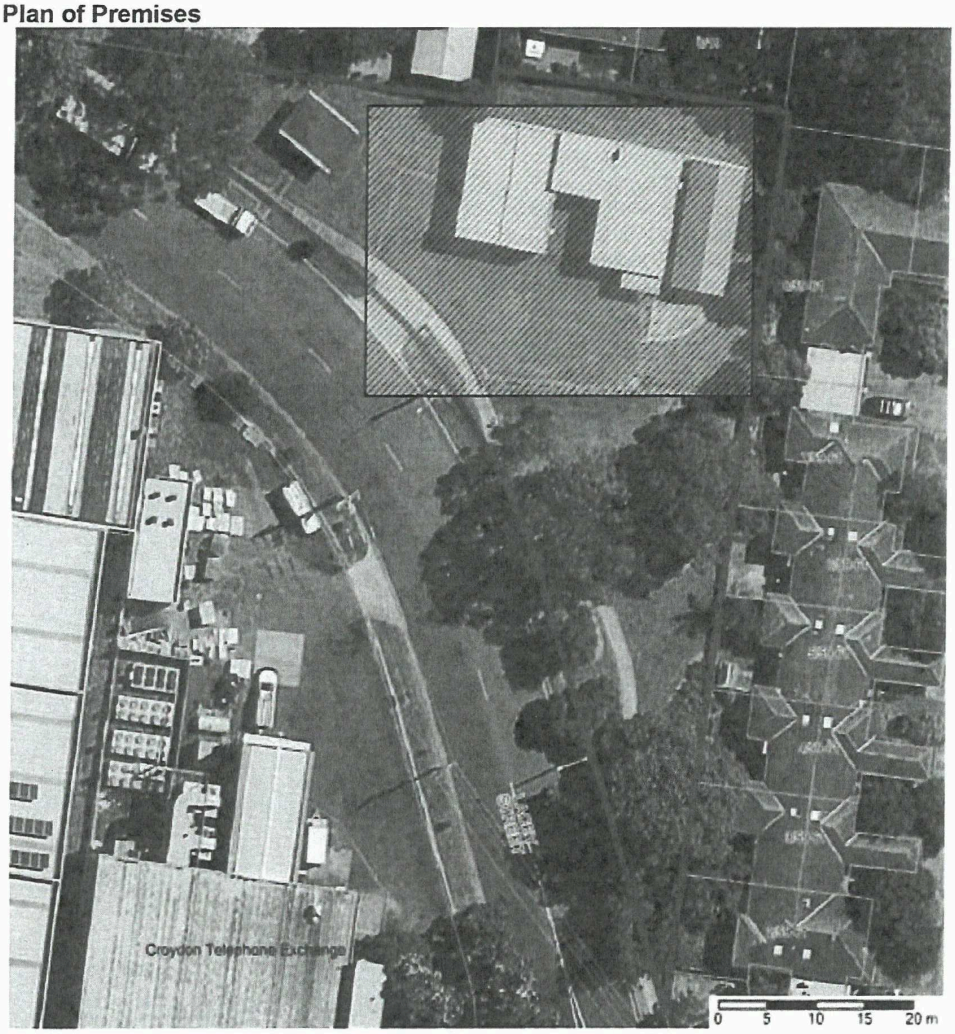
3.1 The Tenant must provide its services to Council free of charge at the following events during the Term and any Further Term:

(a) Carols by Candlelight;
(b) Australia Day; and
(c) Maroondah Festival

3.2 This Special Condition 3 is an essential term

Annexure B

Plan of Premises



17/05/2021

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Maroondah City Council
PO Box 156
Ringwood 3134
Victoria
Tel: 1300 88 22 33
Email:
maroondah@maroondah.vic.gov.au

Annexure C

Determination

Victoria Government Gazette

No. S 362 Monday 13 October 2014
By Authority of Victorian Government Printer

Retail Leases Act 2003

DETERMINATION UNDER
SECTION 5

Premises Not Constituting Retail Premises

I, Russell Northe MP, Minister for Small Business, and Minister responsible for administering the **Retail Leases Act 2003** (the Act), determine under section 5(1)(e) of the Act –

1. The following kinds of leases are leases of premises to which section 4(2)(h) of the Act applies, being premises which are not 'retail premises':
   - (a) A lease of premises under which the rent payable is not greater than $10,000 per annum and under which the premises are used wholly or predominantly for any one ormore of the following purposes –
     - (i) public or municipal purposes;
     - (ii) charitable purposes;
     - (iii) the education and training of persons to be ministers of religion;
     - (iv) as a residence of a practising minister of religion;
     - (v) as a club for or a memorial to persons who served in the First or Second WorldWar or in any other war, hostilities or special assignment referred to in the **Veterans Act 2005**;
     - (vi) the purposes of the Returned Services League of Australia;
     - (vii) the purposes of the Air Force Association (Victoria Division); or
     - (viii) the purposes of the Australian Legion of Ex-Servicemen and Women (VictorianBranch).
   - (b) A lease of premises under which the rent payable is not greater than $10,000 per annum and under which the premises are used wholly or predominantly by a body orassociation, whether incorporated or unincorporated –
     - (i) that exists for the purposes of (and which uses the premises for) providing or promoting community, cultural, sporting, recreational or similar facilities or activities or objectives; and
     - (ii) that applies its profits in promoting its objects; and
     - (iii) that prohibits the payment of any dividend or other amount to its members –

   whether or not the premises are occupied by the tenant, held by the tenant in trust for the occupant or sub-leased by the tenant to another person.
2. The Ministerial Determination dated 22 July 2008 made by the Minister for Small Business and notified in the Victoria Government Gazette No. S209 on Thursday

24 July 2008 (the former Determination) is revoked.

3. The revocation of the former Determination by this Determination does not affect the operation of the former Determination in relation to leases to which the former Determination applied. Accordingly, any leases to which the former Determination applied, that was in force immediately before 31 December 2014, continues to be excluded from the definition of ***retail premises*** in section 4 of the **Retail Leases Act 2003** until –

(a) the lease expires or is terminated under the Act; or

(b) it is no longer possible, under the terms of the lease, for the tenant to exercise an option to renew the lease.

This Ministerial Determination comes into effect on 1 January 2015.

Dated 6 October 2014

THE HON. RUSSELL NORTHE MP
Minister for Small Business

SPECIAL

bluestar PRINT

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Annexure D

Pro-forma letter from the Tenant to Council providing notice pursuant to clause 3.2.1

[Date]

[Council officer name and title]
Maroondah City Council
P.O. Box 156
Ringwood Vic 3134

Dear [salutation],

Lease of [insert premises details] **by** [insert tenant details] (**Tenant**)
Notice of desire to exercise the option to renew the lease

Please accept this letter as formal notice pursuant to clause 3.2.1 of the above lease that the Tenant wishes to exercise the option to renew the lease for a further term of [insert number of years].

To my knowledge the Tenant is not currently in breach of any provision of the lease nor has the Tenant persistently defaulted under the lease. The Tenant also agrees to comply with all reasonable requirements of Council in renewing the lease.

Under the lease I understand the next step is Council will respond in writing to this notice.

I look forward to hearing from you.

Yours sincerely,

[Insert name]
[Insert position held at the Tenant e.g. public officer and the Tenant's name]

Annexure D (continued)

Pro-forma Letter from Council granting the Tenant a new lease for a Further Term pursuant to clause 3.3.2

[Date]

[Tenant officer name and title]
[Tenant name and address]
... Vic 31..

Dear [salutation],

Lease of [insert premises details] **by** [insert tenant details] (**Tenant**)
Confirmation of the exercise of an option to renew the lease

Council confirms receipt of the Tenant's notice dated [insert date] indicating the Tenant's wishes to exercise the option to renew the lease for a Further Term of [insert number of years].

Please accept this letter as formal notice pursuant to clause 3.3.2 of the above lease that Council agrees to the option for a Further Term being exercised. Please sign the enclosed duplicate of this letter and return it to Council. These exchanges of letters constitute the exercise of the option for to extend this lease for the Further Term.

This means the key details of the option term of the lease will be:

1. Commencement date of the Further Term: [insert time and date]
2. End date of the Further Term: [insert time and date]
3. Rent for each year of the Further Term:
    a. Further Term year one – $ [insert amount]
    b. Further Term year two – $ [insert amount]
    c. Further Term year three – $ [insert amount]
    d. Further Term year four – $ [insert amount]
    e. Further Term year five – $ [insert amount]

4. Additional Further Terms: [insert, if none write 'nil']

All other terms of the Lease remain as the same terms and conditions for the initial term of the Lease.

Council looks forward to receiving the return of the enclosed duplicate of this letter, executed by [insert name of the Tenant] and to your continued occupation and use of the Premises.

Yours sincerely,

[Insert Council officer name]
[Insert Council officer title]

Then create a duplicate of the letter with the following execution clause for the Tenant at the end –

The Tenant agrees to extend the term of the above Lease of the above Premises for the Further Term on the terms and conditions contained in the letter from Council dated [insert date] of one page of which this is a reformatted duplicate:

.....
Signed for and on behalf of [insert Tenant's name] in accordance with its constitution by –

PRINT name:
Position held:
Date: