

CITY OF PORT PHILLIP BIODIVERSITY STUDY

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BIODIVERSITY STUDY

City of Port Phillip Biodiversity Study and Action Plan

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Cover photo: Coast Banksia *Banksia integrifolia*, by Renae Walton.

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SUMMARY

Background

Arcadis was commissioned by the City of Port Phillip to undertake a Biodiversity Study and Action Plan project. This has comprised three parts:

- A thorough desktop review of ecological data available electronically and authoring of an associated Background Research Discussion Paper (Discussion Paper) to present the findings and identify ecological knowledge gaps that could be filled with further survey work.
- A Biodiversity Study (this report) to present the findings of field surveys undertaken in response to the findings of the Discussion Paper.
- Preparation of a Biodiversity Action Plan to promote, protect and enhance biodiversity values within the municipality.

The Discussion Paper identified the flora and fauna field survey priorities necessary to improve the knowledge of, and documentation consistency for, ecological values across the municipality. This formed the basis of site and survey type selection for this Biodiversity Study, which included the following:

Study site location	Vegetation mapping	Floristic quadrat establishment	Fauna surveys
Port Melbourne Foreshore (Sandridge Beach and First Point)	✓	✓	
St Kilda West Beach	✓	✓	
Port Melbourne Light Rail*	✓		
Elwood Coastline			
MO Moran Reserve	✓	✓	
Point Ormond/Elwood Teatree	✓	✓	✓ (1)
Elwood Foreshore and Reserve	✓	✓	✓ (1)
Elwood Canal Linear Reserve	✓		✓ (1, 2, 3)
Alma Park East	✓		
Canterbury Road Urban Forest			✓ (1)
St Kilda Breakwater			✓ (3,4)
St Kilda Botanical Gardens			✓ (2)

1 = Fauna habitat and microbat surveys

2 = Amphibians

3 = Reptiles

4 = Rakali (Water-rat)

*Refers to the parkland reserves either side of the light rail between Boundary Street and Graham Street, Port Melbourne.

Field surveys were used to identify and assess the natural values of the study area. The Ecological Vegetation Classes (EVCs) present at each site were identified and divided into zones based on variations in vegetation quality. Planted indigenous vegetation was included in assessments where it

resembled an EVC. Where indigenous amenity plantings bore little resemblance to remnant vegetation they were mapped as separate 'plantings' zones.

A range of fauna survey methods were deployed using passive (sound recorders) and active methods. The studies concentrated on mammals—specifically microbats and Rakali—frogs and reptiles. A shorebird count was added to the surveys based on discussions with local naturalist, Gio Fitzpatrick. The targeted fauna surveys were as follows:

1. Canterbury Road Urban Forest – Bat survey
2. St Kilda Botanical Gardens – Bat and frog survey
3. Elwood Canal / Elster Creek – Bat, frog and reptile survey
4. Point Ormond Reserve – Bat survey
5. St Kilda Breakwater – Rakali survey
6. St Kilda Spit (a tidal sandbar artefact of the breakwater construction at St Kilda West Beach) – Shorebird / wader survey.

Results

Vegetation values

This study identified and mapped nine EVCs across the six study sites where vegetation surveys were conducted. They are:

- EVC 2: Coast Banksia Woodland (Coast Banksia dominated foreshore woodland, inland of Coastal Dune Scrub)
- EVC 3: Damp Sands Herb-rich Woodland (Eucalypt dominated woodland of inland areas with sandy-loamsoils)
- EVC 10: Estuarine Wetland (Sea Rush dominated plantings in drainage wetlands along the coast)
- EVC 160: Coastal Dune Scrub (Commonly salt-pruned and wind-swept scrub occurring on the primary dunes)
- EVC 175: Grassy Woodland (River Red-gum and Yellow Box dominated woodland of inland reserves)
- EVC 311: Berm Grassy Shrubland (Coast Saltbush dominated shrubland on breakwater groynes and berms)
- EVC 821: Tall Marsh (Common Reed dominated vegetation in an artificial wetland)
- EVC 879: Coastal Dune Grassland (Hairy Spinifex dominated grassland on the foredunes)
- EVC 914: Estuarine Flats Grassland (Grassland vegetation occupying moist depressions on primary dunes).

A total of 30 condition zones (Zone IDs) were identified across the six sites, including two zones defined as planted and not assigned to an EVC.

Of the 28 Zone IDs assessed against EVC benchmarks for condition, most were scored between 30% and 50% of pre-European condition. The highest condition score was 55%, which was for an area of Coastal Dune Grassland at Port Melbourne Foreshore. There were several areas of vegetation mapped that scored less than 20% for condition. These areas were all non-coastal, woodland vegetation and were often predominantly planted for utility and sometimes completely lacked understory, or in other cases lacked canopy. The condition scores of such sites are expected to increase as plantings mature, especially if understory enrichment plantings are continued and weeds are controlled.

Six permanent vegetation monitoring quadrats were established in four coastal EVCs at the targeted sites as indicated in the above table. Stakes, photographic records and location data were used to allow these quadrats to be accurately relocated in future years for monitoring purposes.

Two species classified as rare in Victoria were recorded, all or most of which appear to have been planted. Namely, Marsh Saltbush *Atriplex paludosa* subsp. *paludosa* and Coast Wirilda *Acacia uncifolia*.

Fauna values

Five microbat species were identified from their call features and, three species call complexes. A species call complex is where the characteristic call features used for identification are not present and the call could be of more than one species. The species and call complexes identified were as follows:

1. Chocolate Wattled Bat – *Chalinolobus morio*
2. Gould's Wattled Bat – *Chalinolobus gouldii*
3. Large Forest Bat – *Vespadelus darlingtoni*
4. Little Forest Bat – *Vespadelus vulturnus*
5. White-striped Freetail Bat – *Austronomus australis*

The three call complexes recorded were:

1. Forest bat complex – *Vespadelus* sp.
2. Long-eared bat complex – *Nyctophilus* sp.
3. Freetail / Gould's wattled bat complex – *Ozimops* / *Chalinolobus* sp.

Two species of frogs were recorded at the St Kilda Botanical Gardens, namely Peron's Tree Frog *Litoria peronii* and Southern Brown Tree Frog *Litoria ewingii*. Neither of these species are typically associated with urbanised environments.

Two species of shorebird were observed at the St Kilda Spit: Black-winged Stilt *Himantopus himantopus* and Red-necked Stint *Calidris ruficollis*. Two Chestnut Teal *Anas castanea* and four Nankeen Night Heron *Nycticorax caledonicus* were also observed whilst surveying for shorebirds and waders.

Twenty Rakali *Hydromys chrysogaster* were observed on the St Kilda Breakwater during the survey period with a further two observed coincidentally when leaving the study site.

Significant Tree mapping

Aerial photography was analysed to predict the potential occurrence of Significant Trees on private property, as defined in the City of Port Phillip's Local Law (trees or palms with a trunk circumference of ≥ 150 cm measured 1 m from the base).

This analysis revealed that potential Significant Trees were more commonly located in the southern portions of the municipality, compared to the north, primarily in residential areas compared to industrial areas. The highest concentration of private properties with a high likelihood of containing Significant Trees were centred in Elwood (155 parcels) and St Kilda (115 parcels). St Kilda and St Kilda East contained the highest concentration of properties determined to have a Moderate likelihood, with 214 parcels and 147 parcels, respectively.

A comparison of different mechanisms available to protect Significant Trees and other ecological values is provided herein.

Recommendations

Further survey work is recommended at a number of sites not included in this Biodiversity Study, along with 10 yearly monitoring of the ecological values within the sites assessed and development of a Vegetation and Fauna Habitat Management Plan. These recommendations are incorporated and built upon in the City of Port Phillip Biodiversity Action Plan also being prepared as part of this project.

1 INTRODUCTION

The City of Port Phillip is a highly urbanised Council located near the heart of Melbourne with over 11 km of frontage onto Port Phillip Bay. The ecological values of the municipality are highly modified and have been subject to various levels of survey over the years, from extensive repeated bird surveys, NatureSpot monitoring to collect data on all lifeforms (from vertebrate animals and vascular plants to invertebrates, bryophytes and fungi), through to a near absence of ecological survey in some areas.

Arcadis was commissioned by the City of Port Phillip to undertake a Biodiversity Study and Action Plan project. This included a thorough desktop review of all ecological data available electronically and preparation of a Background Research Discussion Paper (Arcadis 2020; herein referred to as the Discussion Paper) to present the findings and identify ecological knowledge gaps that could be filled with further survey work. This Biodiversity Study is the second phase of the project to present the findings of field surveys undertaken in response to the findings of the Discussion Paper. The final stage is preparation of a Biodiversity Action Plan to promote, protect and enhance biodiversity values within the municipality. Through the project, consultation with important stakeholders has been undertaken, including Council departments, natural resource management contractors, the Boon Wurrung Foundation, environmental organisations and local naturalists in the community.

The Discussion Paper identifies an abundance of bird surveys across the municipality, while other ecological surveys have been generally lacking or undertaken on an ad hoc basis. To improve the knowledge of, and documentation consistency for, ecological values across the municipality, it was recommended that further surveys be undertaken as follows:

- Sandridge Foreshore and First Point: vegetation mapping and floristic quadrat
- St Kilda West Beach: vegetation mapping and floristic quadrat
- MO Moran Reserve: vegetation mapping
- Point Ormond: vegetation mapping, floristic quadrat, fauna habitat, microbat survey
- Elwood Teatree: vegetation mapping
- Elwood Foreshore and Reserve: vegetation mapping, floristic quadrat
- Port Melbourne Light Rail: vegetation mapping
- Elwood Canal Linear Reserve, Elster Creek: vegetation mapping, microbat, amphibian and reptile surveys
- Alma Park East: vegetation mapping
- Canterbury Forest – Middle Park: fauna habitat and microbat survey
- St Kilda Breakwater: fauna habitat, reptile and Rakali survey
- St Kilda Botanical Gardens: fauna habitat, microbat and amphibian survey.

This Biodiversity Study documents the findings of these field surveys and will be used to inform the Biodiversity Action Plan.

This study also includes the results of aerial photography analysis to predict potential occurrence of Significant Trees as defined in the City of Port Phillip's Local Law. Recommendations are made regarding potential planning mechanisms available to protect these trees and other biodiversity values.

1.1 Study area

The City of Port Phillip is 20.62 km² and lies within the Port Phillip and Westernport Catchment Management Authority region and Gippsland Plain bioregion. Most of the municipality is used for residential, business and industrial purposes, which have resulted in removal of most native vegetation and fauna habitat, and extensive modification of what little remains.

Situated on a 'sandbelt', the underlying geology primarily consists of coastal dunes from the Quaternary period or older (Cenozoic period) dunes that have formed into consolidated siliclastic rocks. There are also smaller areas of Quaternary alluvium along the banks of the Yarra River,

Cenozoic volcanic rocks to the north of Albert Park Lake and a small outcrop of Silurian sedimentary rock (mudstone, siltstone, sandstone and conglomerate) (GeoScience 2020).

The average annual rainfall for the nearest weather station (Essendon Airport, approximately 11 km north-west of the municipality) between 1991 and 2020 was 503.6 mm, most of which falls in November (and December), and the least falling in March. The warmest month is January with an average daily maximum of 27.5°C while the coldest is July with an average daily maximum of 13.9°C (BOM 2020).

Climate projections released for Victoria and the Greater Melbourne region by CSIRO and DELWP (Clarke et al 2019a, b) indicate that the climate will continue to warm. For Melbourne, the climate could be more like the current climate of Wangaratta by the 2050s, with:

- Maximum and minimum daily temperatures continuing to increase over this century (very high confidence)
- Rainfall continuing to be very variable over time, with a long-term projection of continued decline in winter and spring (medium to high confidence), and autumn (low to medium confidence), but with some chance of little change, and
- Increased intensity of extreme rainfall events, but these will remain very variable in space and time.

The foreshore reserves provide a narrow corridor of habitat along most of the coastal boundary of the municipality, while the internal reserve system comprises a suite of parks and reserves with varying levels of habitat and connectivity.

Six study sites were selected for flora surveys and six for fauna surveys as follows (illustrated in Figure 1);

Flora surveys

- Port Melbourne Foreshore (Sandridge Foreshore and First Point)
- St Kilda West Beach
- Elwood Coastline (MO Moran Reserve, Point Ormond, Elwood Teatree, Elwood Foreshore Reserve)
- Port Melbourne Light Rail
- Elwood Canal Linear Reserve
- Alma Park East

Fauna surveys

- Canterbury Road Urban Forest – Bat survey
- St Kilda Botanical Gardens – Bat and frog survey
- Elwood Canal / Elster Creek – Bat, frog and reptile survey
- Point Ormond Reserve – Bat survey
- St Kilda Breakwater – Rakali survey
- St Kilda Spit (a tidal sandbar artefact of the breakwater construction at St Kilda West Beach) – Shorebird / wader survey.

City of Port Phillip City of Port Phillip Biodiversity Study
 City of Port Phillip



Study area

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 QA by: FS

Figure 1. The sites selected for flora and/or fauna survey as part of this City of Port Phillip Biodiversity Study.

2 METHODS

2.1 Desktop review

In addition to the thorough desktop review completed as part of the Discussion Paper (Arcadis 2020), the following databases and literature were also reviewed:

- Department of Environment, Land, Water and Planning (DELWP) NatureKit interactive map for Ecological Vegetation Class (EVC) mapping/modelling of the area (both extant and pre-1750) (DELWP 2020a), and EVC Benchmarks (DELWP 2020b)
- Planning Schemes Online (DELWP 2020c)
- Relevant GIS data and aerial photography
- Relevant publications, legislation, government policies and strategies.

2.2 Field survey

2.2.1 Vegetation and flora surveys

2.2.1.1 Vegetation mapping

The vegetation field surveys were conducted by two botanists between 5 December 2019 and 22 January 2020 at the following sites:

- Port Melbourne Foreshore (Sandridge Foreshore and First Point area)
- St Kilda West Beach
- Elwood coastline (including MO Moran Reserve, Point Ormond Reserve, Elwood Teatree, Elwood Park and Elwood Foreshore Reserve)
- Port Melbourne Light Rail corridor (including Cook Reserve, Smith Reserve, Turner Reserve, Hester Reserve, Fennell Reserve, Page Reserve, Gill Reserve, Howe Reserve and Walter Reserve)
- Elwood Canal Linear Reserve, Elster Creek
- Alma Park East (east of the railway line).

Vegetation field survey site locations are shown in Figure 1.

The sites were surveyed on foot to map native vegetation communities and record vascular plant species within them. All indigenous and naturalised vascular flora were identified to species level where adequate features were present to do so. Planted non-indigenous species were noted when they occurred within a native vegetation patch but a definitive list of cultivated species at each site was not created.

Within each site, native vegetation was mapped as either a 'patch' or 'scattered tree' as per the definitions specified in the Victorian *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017):

- Patch
 - An area of vegetation where at least 25% of the total perennial understorey plant cover is native
 - Any area with three or more native canopy trees where the where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy, or
 - Any mapped wetland included in the Current wetlands map, available in DELWP systems and tools.
- Scattered tree
 - A native canopy tree that does not form part of a patch.

Native vegetation was assigned an EVC with reference to DELWP's EVC modelling (DELWP 2020a) and EVC benchmarks (DELWP 2020b). Vegetation Quality Assessments were completed for patches of native vegetation following the Vegetation Quality Assessment Manual (DSE 2004).

Vegetation that was exclusively planted, apparently within the past five years, was not assigned to an EVC but instead mapped as a recent indigenous or mixed planting. More mature plantings were often indistinguishable from naturally colonised or remnant vegetation and were therefore treated as such. Indigenous enhancement plantings within mature patches were also assessed as part of the remnant.

2.2.1.2 Floristic quadrats

Six permanent quadrats were established across the study area to provide a reference for changes in floristic assemblages over time. They were established in areas of representative remnant vegetation where stakes could be easily disguised from tracks when necessary. Garden beds and more highly modified areas of vegetation were avoided.

As patches of remnant vegetation within the sites are generally quite small and/or narrow, 10 m x 10 m quadrats were determined to be the most suitable size. Each quadrat was aligned in a (true) north-south orientation and marked with a permanent wooden stake with a pink spray painted top in the north-west corner. The stake was photographed *in situ* from an angle that showed any nearby landscape or vegetation feature that would facilitate finding it again in future years.

At each 10 m x 10 m quadrat (100 m²), the following data were collected:

- GPS coordinates at the location of the stake
- Two photos of the quadrat taken from just behind the stake in the north-west corner (one facing east-south-east, the other south-south-east) to encompass the entire quadrat within the photo-point.
- EVC: Where possible, quadrats were positioned within a single EVC.
- Native and exotic vascular plant species occurring within or overhanging the quadrat, with the following data recorded:
 - Cover, estimated as <1%, 1–5%, 5–10%, 10–15% and so on in 5% intervals to 95–100%
 - Distribution classed as Localised, Scattered or Widespread
 - Recruitment, assessed for all indigenous woody species only, with the definition of a recruit being “*an immature woody plant that contains no evidence of flowering or fruiting material*” (DSE 2004).
- Cover of the following attributes occurring with the quadrat (estimated as <1%, 1–5%, 5–10%, 10–15% and so on in 5% intervals to 95–100%):
 - Non-vascular plants (mosses, liverworts) and lichens
 - Bare ground
 - Rock
 - Organic litter and logs.

2.2.2 Fauna surveys

A range of fauna surveys were deployed using both passive and active methods. Birds have been extensively studied across the municipality by various organisations and individuals. It is for this reason that surveys for the current project concentrated on mammals, specifically microbats and Rakali, amphibians and reptiles. Gio Fitzpatrick, a local field naturalist, raised the significance of the St Kilda Spit for Red-necked Stint at St Kilda Spit with a recent observation. Gio has observed up to 200 birds feeding at St Kilda Spit. Red-necked Stint are a listed migratory species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999). Subsequently a shorebird / wader count was added to the surveys undertaken. A total of six survey locations were selected based

on a stakeholder workshop held on 12 November 2020. The locations and survey types were as follows:

1. Canterbury Forest – Bat survey
2. St Kilda Botanical Gardens – Bat and frog survey
3. Elwood Canal / Elster Creek – Bat and frog survey
4. Point Ormond Reserve – Bat survey
5. St Kilda Breakwater – Rakali survey
6. St Kilda Spit – Shorebird / wader survey.

Where the results were inconclusive or limited, further advice was sought from Gio Fitzpatrick.

Details are provided in Figure 1 where the relevant surveys were undertaken.

2.2.2.1 Bat detector survey

Four Anabat Express (Tittley Electronics™) bat detectors were strategically placed in habitat likely to maximise recording bat calls. The detectors were set-up where bats were likely to commute (flyway) to their foraging areas and / or where foraging was likely to occur.

For the reasons outlined above, a detector was setup on the municipal boundary of City of Port Phillip and Elsternwick Park in the adjoining Bayside City Council as opposed to within the Elwood Canal area. This location was less channelised, and there was mature native overstorey and aquatic vegetation present.

The bat detectors were deployed for a period varying from 7 to 10 days and comprised a total of 34 detector nights. Due to equipment failure at the St Kilda and Elster Creek sites in January 2020, the surveys were repeated in February 2020. Weather conditions were considered suitable for bat activity for the majority of the survey period (refer to Section 4.2.6).

The bat detectors were deployed at the following four sites:

1. Canterbury Forest; 16–25 January 2020
2. St Kilda Botanical Gardens; 9–15 February 2020
3. Elster Creek; 9–15 February 2020
4. Point Ormond Reserve; 16–25 January 2020

Analysis of bat calls was undertaken using AnaloookW Ver. 4.4a software. A filter was used in the AnaloookW software to delete files without bat calls e.g. insect noise.

Refer to Appendix A for photographs showing the placement of bat detectors and adjacent habitat, and Appendix B for field survey location maps.

2.2.2.2 Amphibian recorder survey

Two Song Meter SM4 acoustic recorders (Wildlife Acoustics™) were deployed to record frog calls in conjunction with bat detectors deployed in January 2020. Weather conditions, as described in Section 4.2.6 below, were considered conducive to frog call activity on 16, 21, 23 January 2020. Song Meters were deployed for 10 days at two sites for a total of 20 detector nights:

1. St Kilda Botanical Gardens; 16–25 January 2020
2. Elwood Canal / Elster Creek; 16–25 January 2020.

Call analysis was undertaken using Kaleidoscope Vers. 4.3.2 sound analysis software.

Refer to Appendix A for photographs showing the detector placement and adjacent habitat, and Appendix B for field survey location maps.

2.2.2.3 Active reptile Search

A search was undertaken on both sides of the Elwood Canal. Areas targeted were where native and exotic vegetation, woody debris or leaf litter was present. The search was undertaken over a period of approximately 2 hours (1.10 PM–3.05 PM) covering a distance of approximately 3.5 km. Weather conditions were conducive to reptile activity, refer to Section 4.2.6.

Refer to Appendix A for an indicative representation of the habitat searched adjacent to the Elwood Canal, and Appendix B for field survey location maps.

2.2.2.4 Active Rakali survey

A standardised survey methodology was developed to undertake annual monitoring by Earthcare volunteers. The Rakali survey was undertaken on the 10 March 2020. The survey was undertaken at dusk by two fieldworkers over a period of 75 minutes. The survey method was non-invasive, trialling the use of binoculars and headlamp by one field worker as the primary method. The 2nd fieldworker used a near-infrared night scope to compare the effectiveness of the use of binoculars and headlamp. The survey was conducted on a night conducive to activity, i.e. calm water and little to no wind.

Refer to Appendix A for photographs showing Rakali habitat surveyed, and Appendix B for field survey location maps.

2.2.2.5 St Kilda Spit Shorebird / Wader survey

A shorebird survey was undertaken at St Kilda Spit on the 10 March 2020 at dusk. A Nikon 90 mm spotting scope was used to count the number of stint and identify other migratory species which occupy the St Kilda Spit.

Refer to Appendix A for photographs showing shorebird habitat surveyed, and Appendix B for field survey location maps.

2.2.2.6 Habitat Assessment

A habitat assessment was undertaken to gain a general overview of site conditions and suitability to support fauna. The assessment sheet records information on the vegetation, (i.e. canopy, understorey and ground cover), canopy health, recruitment, disturbance history, feeding and nesting resources, tree hollows, presence of leaf litter, woody debris and rocks. Habitat assessments were undertaken at the following sites on the given dates:

1. St Kilda Botanical Gardens – 1 February 2020
2. Canterbury Road Urban Forest – 1 February 2020
3. Elwood Canal / Elster Creek – 1 February 2020
4. Point Ormond Reserve – 1 February 2020
5. St Kilda Breakwater – 10 March 2020
6. St Kilda Spit – 10 March 2020.

2.3 Significant Trees - mapping potential occurrence

According to the City of Port Phillip (2020), a *Significant Tree* means a tree or palm on private land:

- With a trunk circumference of 150 centimetres or greater measured 1 metre from the base;
- A multi-stemmed tree where the circumference of its exterior stems equals or is greater than 1.5 metres when measured 1 metre from its base; or
- If the tree has been removed, a trunk circumference of 150 centimetres or greater measured at its base.

Using the Department of Transport aerial imagery taken on 13 of October 2018, provided by the City of Port Phillip, Arcadis visually analysed and mapped the potential occurrence of Significant Trees and

palms on private land. As the presence of Significant Trees on public land, including roads and parks, is thought to be relatively well understood, public land was not included in this analysis.

Each property parcel was assigned to one of the following likelihood categories:

- High likelihood – Contains one or more clearly visible larger tree canopies or palm trees that may fit the definition of a Significant Tree
- Moderate likelihood – Tree canopies difficult to distinguish but property contains treed or shrubby vegetation that may include Significant Trees
- Low likelihood – All other properties that don't appear to contain Significant Trees
- Other – Properties that have a Significant Tree registered on their property, however no potentially Significant Trees were visible during the assessment of the aerial imagery.

The list of addresses for existing registered Significant Trees, provided by the City of Port Phillip, was geocoded and used as a point of reference for the visual assessment of canopy sizes. As there is potential for existing Significant Trees to have been lopped or felled, these properties were also categorised into the High, Moderate or Other likelihood categories.

2.4 Nomenclature, taxonomy and conservation status

Plant taxonomy and the use of common names follow the online Victorian Biodiversity Atlas (DELWP 2020d), VicFlora (VicFlora 2020), or the Australian Plant Census (Council of Heads of Australasian Herbaria 2020). For fauna, common names are generally used in the text.

Where an asterisk (*) precedes a plant or animal name, it is used to indicate those which are not indigenous to Victoria. A hash (#) is used to denote a Victorian indigenous plant species that is generally accepted as not indigenous i.e. outside of its natural range where recorded within the study area.

The conservation status of species was determined using DELWP's advisory lists (DEPI 2014, DSE 2013, DSE 2009) and separately for listings under the Commonwealth EPBC Act and Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act).

The FFG Act has recently undergone an amendment that will result in revised conservation statuses and transfer of advisory listed species to the FFG Act. As such the current advisory lists are expected to be outdated by approximately June 2020.

2.5 Limitations

As with all flora surveys, the seasonality of some species can be a limitation for the field survey as they can be easily overlooked if inconspicuous during the survey period or identified to genus level only if fertile material is absent. One notable limitation of this nature was the ability to confidently identify Australian Salt-grass *Distichlis distichophylla*, Salt Couch *Sporobolus virginicus*, Prickly Couch *Zoysia macrantha* and to a lesser degree Couch **Cynodon dactylon* var *dactylon* in the absence of fertile material – all four of which are known to occur along the City of Port Phillip foreshore. However, these limitations are unlikely to alter the major findings regarding the quality and significance of the vegetation.

Whilst the fauna surveys were undertaken during known activity periods of the target species, presence is contingent on a range of factors including the availability of suitable habitat, detectability, climatic conditions and levels of disturbance (human and domestic animals) at the time of the surveys. For these reasons where an animal is observed, species presence can be confirmed.

The GIS analysis of properties for presence of Significant Trees was based on the size of tree canopies, so should be viewed as indicative only. Ground truthing of these trees will be required. In addition, large trees that were dead or lacked foliage in the aerial imagery were unlikely to have been detected. It should be noted that the October 2019 aerial imagery used did show foliage on deciduous trees so these should not have been overlooked, therefore the impact of this limitation is not expected to be significant.

3 FLORA VALUES

3.1 Vegetation descriptions

Nine Ecological Vegetation Classes (EVCs) were observed within the six sites. Remnant vegetation within the six sites exists in a highly modified landscape of roads, residential buildings, sports fields, industrial and other infrastructure. Furthermore, there has been significant modification and engineering of natural watercourses (e.g. Elwood Canal) and some sections of shoreline (e.g. construction of sea walls, breakwater groynes and concrete coastal walkways and bike paths). In many cases the native vegetation patches have probably re-colonised or been planted after areas have been cleared and modified for past or current uses.

Recent indigenous plantings were commonly observed. If such plantings were within (or fringing) an existing patch of mature vegetation they were included as part of the floristic diversity of that patch. Two additional non-EVC assigned categories of vegetation were mapped:

- Indigenous grassy and low shrub plantings
- Indigenous plantings and colonisers with a non-native canopy.

These two categories have some functional biodiversity values but cannot be meaningfully categorised into an EVC.

Each of the EVCs and planted vegetation types observed are described below in order of EVC number:

- EVC 2: Coast Banksia Woodland (Coast Banksia dominated foreshore woodland, inland of the Coastal Dune Scrub)
- EVC 3: Damp Sands Herb-rich Woodland (Eucalypt dominated woodland of inland areas with sandy-loamy soils)
- EVC 10: Estuarine Wetland (Sea Rush dominated plantings in drainage wetlands along the coast)
- EVC 160: Coastal Dune Scrub (Commonly salt-pruned and wind-swept scrub occurring on the primary dunes)
- EVC 175: Grassy Woodland (River Red-gum and Yellow Box dominated woodland of inland reserves)
- EVC 311: Berm Grassy Shrubland (Coast Saltbush dominated shrubland on breakwater groynes and berms)
- EVC 821: Tall Marsh (Common Reed dominated vegetation in an artificial wetland)
- EVC 879: Coastal Dune Grassland (Hairy Spinifex dominated grassland on the foredunes)
- EVC 914: Estuarine Flats Grassland (Grassland vegetation occupying moist depressions on primary dunes)
- Planted vegetation

The conservation status for the EVC within the Gippsland Plain Bioregion appears in the heading in brackets after the EVC name below. Italicised text under each heading is from the EVC Benchmark (DELWP 2020b).

3.1.1 EVC 2: Coast Banksia Woodland (Vulnerable)

Restricted to near coastal localities on secondary or tertiary dunes behind Coastal Dune Scrub. Usually dominated by a woodland overstorey of Coast Banksia Banksia integrifolia to 15 m tall over a medium shrub layer. The understorey consists of a number of herbs and sedges, including scramblers.

Coast Banksia Woodland would have formerly occurred in a mosaic with Coastal Dune Scrub (EVC 160) along the entire City of Port Phillip foreshore, associated with recent dune deposits (DELPW 2020a). At the time of the field surveys there was a very small patch at St Kilda West Beach and two almost contiguous larger patches at the Elwood Coastline. The structure was a variable woodland 5–15 m tall, with either a shrubby or grassy understorey (Plate 1).

Coast Banksia trees were common in the canopy of this EVC (Plate 1), generally in moderate to good health, with some trees showing limb decline, canopy decline or death. It is understood that many Coast Banksia trees along the foreshore have been planted over previous months, years and decades and the success of these plantings in more recent times has generally been poor.

In some areas of this EVC, Coast Banksias were absent or extremely sparse. These patches were distinguished from adjacent Coastal Dune Scrub on the basis of having taller canopy species (typically greater than c. 5 m) and occupying sites somewhat sheltered from strong coastal winds and saltspray. Where this was the case, canopy dominants were Drooping Sheoak *Allocasuarina verticillata* and/or (less often) Coast Tea-tree *Leptospermum laevigatum*. Emergent Coast Manna Gum *Eucalyptus viminalis* subsp. *pryoriana* and Swamp Gum *Eucalyptus ovata* were also occasionally present in the canopy (the later typically occurring in wetter swales).

Common shrubs in the mid-layer (1–5 m) included Sweet Bursaria *Bursaria spinosa*, Common Boobialla *Myoporum insulare* and Seaberry Saltbush *Rhagodia candolleana* subsp. *candolleana*. Indigenous grasses and other graminoids were more abundant where the shrub layer was sparse. Common species include Prickly Spear-grass *Austrostipa stipoides*, Coast Spear-grass *Austrostipa flavescens*, Sandhill Sword-sedge *Lepidosperma concavum* and Small-flower Flax-lily *Dianella brevicaulis*.

Almost all large old specimens of Coast Banksia *Banksia integrifolia* observed in this study were in Elwood Park, clustered around buildings and amenities (e.g. around Elwood Tennis Club, behind the Sailing Club). Highly fragmented examples of this EVC were seen in other parts of this parkland, including fringing recreation and carpark spaces (Plate 1). These generally narrow patches often had a planted understorey of indigenous shrubs and grasses.

The main weeds occurring in this vegetation type in the study area were Panic Veldt-grass * *Ehrharta erecta* var. *erecta* and a suite of common annual herbaceous weeds such as Common Sow Thistle *Sonchus oleraceus* and Fumatory *Fumaria* species.



Plate 1. Various representations of Coast Banksia Woodland at Elwood Coastline

3.1.2 EVC 3: Damp Sands Herb-rich Woodland (Vulnerable)

A low, grassy or bracken-dominated eucalypt forest or open woodland to 15 m tall with a large shrub layer and ground layer rich in herbs, grasses, and orchids. Occurs mainly on flat or undulating areas on moderately fertile, relatively well-drained, deep sandy or loamy topsoils over heavier subsoils (duplex soils).

Damp Sands Herb-rich Woodland would have formerly occurred extensively in City of Port Phillip, inland from the coastal dune systems. Patches of this vegetation type were observed in the Port Melbourne Light Rail Reserve and adjacent to the Elwood Canal (Plate 2).

Canopy dominants in this woodland were Coast Manna Gum *Eucalyptus viminalis* subsp. *pryoriana*, Yellow Box *Eucalyptus melliodora* and River Red Gum *Eucalyptus camaldulensis*, most of which have been planted. The tall shrubby and understorey tree mid-layer included Black Sheoak *Allocasuarina littoralis*, Drooping Sheoak *Allocasuarina verticillata*, Lightwood *Acacia implexa* and Sweet Bursaria *Bursaria spinosa*.

Very little remnant ground layer vegetation remained but in many places there have been indigenous plantings established that are consistent with this EVC. In some cases, such plantings have been made in park garden beds that have a largely exotic canopy (e.g. Port Melbourne Light Rail Reserves). Common understorey species (in most cases planted) were small-medium shrubs (e.g. Coastal Daisy Bush *Olearia axillaris*, Hop Goodenia *Goodenia ovata*, Common Correa *Correa reflexa* and Prickly Wattle *Acacia paradoxa*), and grasses and graminoids (e.g. Spiny Headed Mat-rush *Lomandra longifolia*, Black-anther Flax-lily *Dianella revoluta* and Coastal Spear-grass *Austrodanthonia flavescens*).

Revegetation and amenity plantings have increased the diversity of many patches of this EVC, with easily cultivated and robust plants being most commonly used. The notable lack of Bracken *Pteridium esculentum*, which is typically common in this EVC, is likely a result of historic clearing and difficulties surrounding its propagation. Some patches of this EVC have a mown exotic lawn understorey and/or mulched ground and lack any indigenous understorey.

Weeds are mainly annual grasses and herbs typical of disturbed areas.



Plate 2. Damp Sands Herb Rich Woodland at the Port Melbourne Light Rail and Elwood Canal sites.

3.1.3 EVC 10 Estuarine Wetland (Least Concern)

*Grows on anaerobic peat-rich muds on the edges of estuarine waterbodies such as creeks, rivers and lagoons with intermediate salinity conditions. Vegetation is determined by fluctuating salinity, which varies in time from occasionally fresh to brackish or occasionally saline according to river flood and marine tide events. Dominated by graminoids and halophytic herbs and often fringed by a tall scrub layer of Swamp Paperbark *Melaleuca ericifolia* at the landward edge.*

In the study area examples of Estuarine Wetland were seen in the Elwood Foreshore area (Plate 3). They occurred in water sensitive urban design drainage wetlands where the vegetation had been planted. The dominant species observed were Sea Rush *Juncus kraussii* and Knobby Club Rush *Ficinia nodosa* which are representative of this EVC. Both of these species had expanded their cover naturally since planting occurred.

Other species fringing the Rush-dominated vegetation were Swamp Paperbark *Melaleuca ericifolia*, Spiny-headed Mat-rush *Lomandra longifolia* subsp. *longifolia*, Coast Tussock-grass *Poa poiformis* and Black-anther Flax-lily *Dianella revoluta*.

Few weeds were seen in this vegetation type, and the ground layer commonly included a layer of rocks or river pebbles to minimise erosion and provide amenity value.



Plate 3. Estuarine Wetland planted into a constructed wetland at Elwood Foreshore.

3.1.4 EVC 160: Coastal Dune Scrub (Depleted)

Closed scrub to 5 m tall with occasional emergents occurring on secondary dunes along ocean and bay beaches and lake shores. Occupies siliceous and calcareous sands that are subject to high levels of saltspray and continuous disturbance from onshore winds.

The pre-1750 EVC mapping of the study area shows this EVC to have existed in a mosaic with Coast Banksia Woodland and this was supported by field observations. Coastal Dune Grassland was typically present where wind and salt-spray would stunt the shrubby canopy and limit Coast Banksia establishment. Due to salt-pruning of foliage from salt-laden winds, the Coastal Dune Scrub vegetation observed was commonly stunted, growing 1–3 m tall, or occasionally up to c. 5 m tall (Plate 4).

Coastal Dune Scrub is typically characterised by the dominance of Coast Tea-tree *Leptospermum laevigatum*, however within the study area other shrubs were frequently dominants, including Drooping Sheoak *Allocasuarina verticillata*, Black She-oak *Allocasuarina littoralis*, Coast Wattle *Acacia longifolia* var. *sophorae* and Common Boobialla *Myoporum insulare*. The understorey was dominated by the shrub Seaberry Saltbush *Rhagodia candolleana* and the scrambler/climber Bower Spinach *Tetragonia implexicoma*, with a sparse ground layer of sand-tolerant graminoids such as Prickly Spear-grass *Austrostipa stipoides* and Small-flower Flax-lily *Dianella brevicaulis*.

Many of these patches have been significantly modified by past plantings, including in some cases non-indigenous shrubs and trees in the canopy in the MO Moran Reserve and Point Ormond Reserve (e.g. Bushy Yate *Eucalyptus lehmannii*, Showy Honey-myrtle *Melaleuca nesophila* and Giant Honey-myrtle *Melaleuca armillaris* subsp. *armillaris*).

Recent plantings at the fringes of some patches include herbs, grasses and woody species. Plantings such as those extending native vegetation patches in the MO Moran Reserve had a high diversity, including species not typical of the Coastal Dune Scrub EVC but likely to have occurred in the area in other EVCs (such as Coast Banksia Woodland and Damp Sands Herb-rich Woodland). In other areas, such as near the toilet block on the Elwood foreshore, tussock-dominated plantings have been made, with woody species interspersed. The graminoids included Prickly Spear-grass *Austrostipa stipoides*,

Chaffy Saw-sedge *Gahnia filum*, Knobby Club-sedge *Ficinia nodosa* and Pale Flax-lily *Dianella longifolia*.

Weeds generally associated with disturbance were common (e.g. Prostrate Knotweed *Polygonum aviculare*, Mallow *Malva* species, Sweet Melilot *Melilotus indicus*), often associated with the prolific network of authorized and unauthorized tracks.



Plate 4. Coastal Dune Scrub in the Elwood Foreshore Reserve

3.1.5 EVC 175: Grassy Woodland (Endangered)

A variable open eucalypt woodland to 15 m tall or occasionally Sheoak woodland to 10 m tall over a diverse ground layer of grasses and herbs. The shrub component is usually sparse. It occurs on sites with moderate fertility on gentle slopes or undulating hills on a range of geologies.

Grassy Woodland was the former vegetation type of the Alma Park area (Plate 5). Numerous healthy remnant eucalypt trees were observed to persist in the northern part of the parkland, east of the railway line, including large old trees (River Red-gum *Eucalyptus camaldulensis* and Yellow Box *Eucalyptus melliodora*). Mostly these trees have a mown lawn of exotic-grasses underneath their canopy. Several of the canopy eucalypts occur within long-established garden beds with a planted indigenous understorey of shrubs and ground-layer species, along with other Australian native species that are not indigenous to the City of Port Phillip. Shrub and subcanopy tree species in this garden bed included Sweet Bursaria *Bursaria spinosa* and Lightwood *Acacia implexa*. The ground-layer was heavily mulched with commonly planted species including graminoids such as Spiny-Headed Mat-rush *Lomandra longifolia* subsp. *longifolia*, Kangaroo Grass *Themeda triandra* and Black-anther Flax-lily *Dianella revoluta*.

Along the railway easement, a more natural albeit modified representation of Grassy Woodland exists with more naturally recruiting indigenous species. Eucalypts were present in low numbers, with most of the vegetation consisting of patches of recruiting midstorey and understorey species. These include understorey trees and shrubs such as Black Wattle *Acacia mearnsii*, Lightwood *Acacia implexa*, Blackwood *Acacia melanoxylon*, Forest Burgan *Kunzea* sp. (Upright form), and ground layer graminoids such as Kangaroo Grass, Spear Grasses *Austrostipa* spp., Spiny-Headed Mat-rush, Common Wheat-grass *Anthosachne scabra*.

Weeds were uncommon in the garden bed areas that had been heavily mulched, and common in the more natural representations along the railway easement. They primarily consisted of perennial grasses such as Couch **Cynodon dactylon* var. *dactylon* and Prairie Grass **Bromus catharticus*.



Plate 5. Grassy Woodland at Alma Park dominated by River Red-gums *Eucalyptus camaldulensis* or regenerating Wattles *Acacia* sp. and other indigenous species.

3.1.6 EVC 311: Berm Grassy Shrubland (Endangered)

Low shrubland to 1.5 m tall occurring in sheltered coastal areas where sand deposits have formed as a result of low energy wave action. Contains a number of halophytic species over a ground layer of grasses and herbs.

Berm Grassy Shrubland was observed as small patches associated with breakwaters, groynes or sea walls where these structures trap sediments. There was also a narrow band of this EVC along rocky sections of the Elwood coastline (Plate 6).

Species diversity is generally low in the loose sandy and rocky environment that this EVC occupies. It is dominated by the shrub Coast Saltbush *Atriplex cinerea*, to approximately 1 m tall. Common though sparse species also included Prickly Spear-grass *Austrostipa stipoides*, Seaberry Saltbush *Rhagodia candolleana*, Rounded noon-flower *Disphyma crassifolium* subsp. *clavellatum* and Karkalla *Carpobrotus rossii*.

Where this EVC occurs along the walking and cycling paths in Elwood it has generally been enriched with plantings. Species especially prominent in planted areas are Prickly Spear-grass *Austrostipa stipoides*, Coast Tussock-grass *Poa poiformis*, Coast Daisy-bush *Olearia axillaris* and Cushion Bush *Leucophyta brownii*.

Some areas had a dense cover of the invasive Couch **Cynodon dactylon* var. *dactylon*. Other weeds observed with a patchy occurrence included Sow Thistle **Sonchus oleraceus*, Annual Yellow Sweetclover **Melilotus indicus*, Prairie Grass **Bromus catharticus* and Fleabane **Erigeron* sp.



Plate 6. Berm Grassy Shrubland on a rock groyne at Sandridge Foreshore Reserve and along the foreshore at Elwood Coastline.

3.1.7 EVC 821: Tall Marsh¹

Occurs on Quaternary sedimentary geology of mainly estuarine sands, soils are peaty, silty clays, and average annual rainfall is approximately 600 mm. It requires shallow water (to 1 m deep) and low current-scour, and can only tolerate very low levels of salinity. Closed to open grassland/sedgeland to 2-3 m tall, dominated by Common Reed and Cumbungi. Small aquatic and semi-aquatic species occur amongst the reeds.

A small planted wetland near the playground in Alma Park is dominated by wetland vegetation that resembles Tall Marsh (Plate 7). Dominant species included Common Reed *Phragmites australis* in the deepest parts of the wetland, Poong'ort *Carex tereticaulis*, Tall Sedge *Carex appressa* and Pale Rush *Juncus pallidus* around the wet margins and Spiny-headed Mat-rush *Lomandra longifolia* around the riparian perimeter. There was a small amount of water in this wetland at the time of the field visit, with the margins of the wetland revealing exposed mud.



Plate 7. Landscaped wetland at Alma Park resembling Tall Marsh

3.1.8 EVC 879: Coastal Dune Grassland (Depleted)

Consists of grasses and halophytes (succulents) that colonise the foredunes of ocean beaches. Soils are siliceous sands that have a very low humus content.

Coastal Dune Grassland was observed in the study area on sandy beach fringes that were not subjected to beach-cleaning or sand nourishment machinery. The largest patch of this EVC was observed at Sandridge Reserve, where it occupies a strip on the low foredunes adjacent the sandy beach (Plate 8). The dominant species was primarily Hairy Spinifex *Spinifex sericeus*, though a substantial area is dominated by Strand Sedge *Carex pumila*. These species send out horizontal runners (rhizomes and/or stolons) that bind the sand. Other species commonly observed (especially where the sand has stabilised) included Karkalla *Carpobrotus rossii*, Rounded noon-flower *Disphyma crassifolium* subsp. *clavellatum* and Knobby Club-sedge *Ficinia nodosa*.

Weed cover was generally low in this EVC in the study area. Annual grasses and Sea Rocket **Cakile maritima* were the more abundant weeds, though generally they were uncommon. The only documented Victorian occurrence of the herbaceous weed Cut-leaf Evening-primrose **Oenothera laciniata* subsp. *laciniata* occurs in this EVC at Sandridge Reserve.

¹ DELWP has not yet assigned a Bioregional Conservation Status (BCS) for Tall Marsh in the Gippsland Plain.



Plate 8. Coastal Dune Grassland dominated by Hairy Spinifex *Spinifex sericea* (left) and Strand Sedge *Carex pumila* (right), Port Melbourne Foreshore

3.1.9 EVC 914: Estuarine Flats Grassland (Endangered)

Closed to open grassland to 1.5 m tall with occasional shrubs occurring on estuarine flats often associated with current or old beach berms or sand sheets that are occasionally inundated by high tides. Occupies areas on marginally higher ground inland from Coastal Saltmarsh.

Estuarine Flats Grassland remnants were observed at Sandridge Foreshore in Port Melbourne and St Kilda West Beach (Plate 9). Small modified examples were also observed along the bike and pedestrian paths at MO Moran Reserve. It is associated with swale areas behind low foredunes (as seen at St Kilda West Beach) as well as lower areas behind Berm Grassy Shrubland (as in the aforementioned bike path area). This grassy/sedgy vegetation was dominated by Australian Salt-grass *Distichlis distichophylla*, Knobby Club-rush *Ficinia nodosa*, Sea Rush *Juncus kraussii* subsp. *australiensis*. Also common were Hairy Spinifex *Spinifex sericeus* and Small-flower Flax-lily *Dianella brevicaulis*. Species more typical of adjacent woody EVCs were also observed as young or stunted shrubs, including Common Boobialla *Myoporum insulare* and Coast Banksia *Banksia integrifolia*.

Grassy weeds were common in this EVC in the study area, especially the perennial Couch **Cynodon dactylon* var. *dactylon* and the annual Great Brome **Bromus diandrus*.



Plate 9. Estuarine Flats Grassland at Port Melbourne Foreshore (left) and St Kilda West beach (right).

3.1.10 Planted vegetation

Indigenous species have been planted extensively in many of the study sites. In most cases these plantings enrich or extend a patch of native vegetation that has been assigned to one of the EVCs already described. Small patches of planted vegetation that had garden-like appearance or otherwise lacked sufficient resemblance to an EVC were classified as (Plate 10):

- **Plantings – grassy and low shrubs:** Tufted grasses, sedges and lilies were generally dominant, sometimes interplanted with low shrubs such as Cushion Bush *Leucophyta brownii* and Coast Saltbush *Atriplex cinerea*.
- **Plantings – indigenous species under exotic canopy:** Generally these areas had a well-established exotic canopy (e.g. Norfolk Island Pine or Norfolk Island Hibiscus) with indigenous understorey amenity plantings including those from the 'grassy and low shrubs' category and/or hardy low shrubs such as Seaberry Salt Bush *Rhagodia candolleana* and Coast Saltbush *Atriplex cinerea*.



Plate 10. Planted vegetation – grassy and low shrubs at Port Melbourne Foreshore (left) and Elwood Coastline (middle), and Plantings – indigenous species under exotic canopy at Elwood Coastline (right).

3.2 Site vegetation values

During the vegetation field surveys, 214 plant species were recorded within the nine observed EVCs and 30 quality zones across the six study sites. This included 130 (60%) indigenous species, 79 exotic species and 5 native Victorian native species that are outside their natural range in the City of Port Phillip (Appendix A). Two of the indigenous species (Coast Wattle and Coast Tea-tree) are regarded as indigenous when in coastal environments, however, are considered outside their natural range when occurring further inland away from the coastal vegetation communities.

Thirty zones of vegetation were identified across the six flora surveys sites, comprising the EVCs and planted native vegetation described in Section 3.121. Most vegetation assessed as part of this study was determined to be between 30% and 50% of pre-European condition (Table 1). The results of the Vegetation Quality Assessments undertaken consider landscape components (i.e. how much native vegetation is within the surrounding landscape). It is worthy of note that these components consistently reduced the overall pre-European habitat quality score of all Zones assessed and this aspect is unlikely to change given the highly urbanised landscape within and adjoining the municipality.

Table 1. Total native vegetation area within each habitat score range across the six sites assessed as part of the flora surveys.

Note, three additional zones were assessed as native amenity plantings that did not adequately resemble an EVC to warrant a vegetation quality assessment.

Habitat Score Range	Number of zones (Zone IDs)	Area of Vegetation (ha)
10–19% pre-European condition	5	1.19
20–29% pre-European condition	2	0.63
30–39% pre-European condition	10	4.95
40–49% pre-European condition	8	10.42
50–59% pre-European condition	2	1.30
TOTAL	27	18.49

The following sections provide an overview for the indigenous vegetation identified at each site (presented in alphabetical order by site name). This includes brief description of each EVC, a table presenting the Vegetation Quality Assessment scores, a graph illustrating the proportion of native vegetation within each quality score range, and a figure illustrating the distribution and extent of indigenous vegetation.

3.2.1 Alma Park East

3.2.1.1 Vegetation values

Alma Park East is a recreation space predominately comprising amenity plantings, exotic trees, lawns and walking paths. Native vegetation comprises two EVCs presenting as patches of vegetation and a Scattered Tree.

Grassy Woodland (EVC 175): Two zones were recorded for this EVC. Within Alma Park the Grassy Woodland vegetation largely comprised a remnant River Red-gum *Eucalyptus camaldulensis* canopy over manicured lawns or garden beds (Zone ID 28, 26% pre-European condition). Over the fence in the adjoining escarpment of the railway easement the Grassy Woodland vegetation comprised a small suite of naturally recruiting tree and shrub species over a predominantly weedy ground layer with occasional patches of native grasses and graminoids (Zone 26, 18% pre-European condition). One Scattered Tree (River Red-gum) was also recorded.

Tall Marsh (EVC 821): The landscaped constructed wetland to the south of the park comprised indigenous species consistent with the Tall Marsh EVC, such as Common Reed *Phragmites australis*, Poong'ort *Carex tereticaulis* and Tall Sedge *Carex appressa*. This vegetation had a score of 17% pre-European condition.

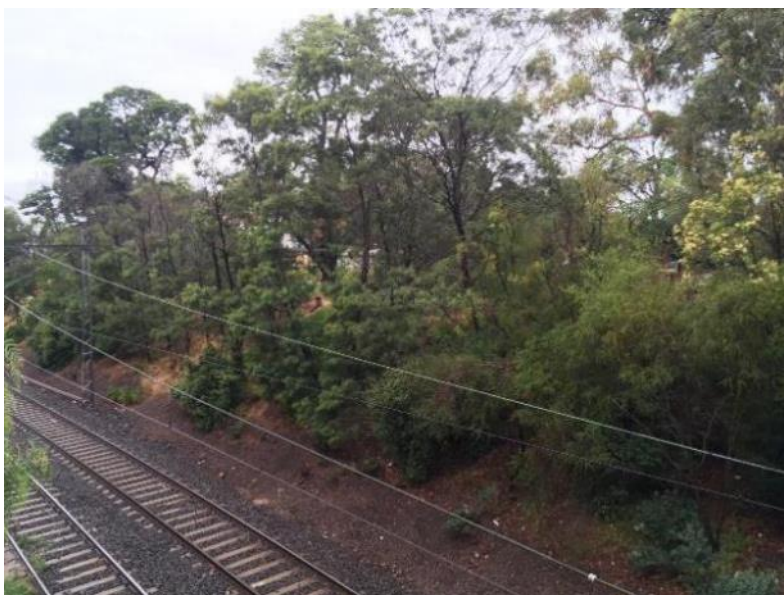


Plate 11. Grassy Woodland Vegetation at Alma Park, comprising remnant and planted River Red-gums over lawns and garden beds (above), and regenerating Wattles and other indigenous species along the adjoining railway line (below)

Table 2. Summary of the Vegetation Quality Assessment for the three quality zones identified at Alma Park East, St Kilda.

Key:

- EVC Ecological Vegetation Class
- GW Grassy Woodland
- TM Tall Marsh
- GP Gippsland Plain
- EN Classified as endangered in the Gippsland Plain Bioregion
- LC Classified as least concern in the Gippsland Plain Bioregion
- VQA Vegetation Quality Assessment, based on the Habitat Hectares condition method (DSE 2004)

Zone ID		26	27	28
Bioregion		GP	GP	GP
EVC Number: Name		175: GW	821: TM	175: GW
EVC Bioregional Conservation Status (BCS)		EN	LC	EN
Score	Max			
Site Condition	Large Trees	10	0	10
	Canopy Cover	5	3	3
	Lack of Weeds	15	0	2
	Understorey	25	5	5
	Recruitment	10	6	0
	Organic Matter	5	4	4
	Logs	5	0	2
Site Score	Total Site Score	75	18	26
	Max Site Score	75	55	75
	Adjusted Site Score	18	44	26
Landscape Context	Patch Size	10	1	1
	Neighbourhood	10	0	0
	Distance to Core	5	0	0
VQA Condition Score		100%	19%	17%
Number of Large Trees		0	-	7
Area (ha)		0.564	0.075	0.480

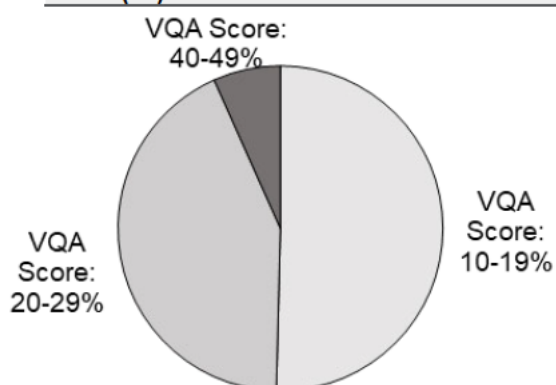


Figure 2. Proportional area of vegetation assessed within each habitat score (%) category, Alma Park East, St Kilda, January 2020. Note that the percentages represent **condition categories**, the graph is a visual representation of the contribution of each category to the **total area (hectares)** of mapped vegetation at this site.



Vegetation mapping

Date: 28/02/2020 Path: \\hco-aus-vc-fs-01\Jobs\100361631L-GIS\B_Workshop\200217_TaraLaptop_Ecology\Ecology\TT_working\A4_PortPhillip_AlmaPark_A4L_v1.mxd
Created by: RM
QA by: LH

Figure 3. Vegetation values within the Alma Park East site.

3.2.2 Elwood Canal Linear Reserve

3.2.2.1 Vegetation values

The vegetation along the Elwood Canal site included some mature indigenous eucalypts and other indigenous trees, over a predominantly planted indigenous ground layer. Some exotic canopy trees and plantings also existed, sometimes associated with encroaching gardens from adjoining residents.

All areas that resembled remnant indigenous vegetation resembled a single EVC but were assessed as four distinct condition zones.

Damp Sands Herb-rich Woodland (EVC 3): The highest quality zone (Zone ID 16) comprised an indigenous canopy, midstorey and moderately diverse groundlayer of robust species, most of which appeared to have been planted. The condition in this zone was 39% pre-European condition, which was the highest at this site. The main canopy species were Coast Manna-gum *Eucalyptus viminalis* subsp. *pryoriana* and River Red-gum, *Eucalyptus camaldulensis*. A sub-canopy of Lightwood *Acacia implexa*, Drooping Sheoak *Allocasuarina verticillata* and other shrubs was present in some areas.

One patch of vegetation (Zone ID 17) had moderate diversity of indigenous understorey species (both planted and colonised) under a canopy of exotic trees (primarily Desert Ash *Fraxinus angustifolia*). This patch achieved a condition score of 13% pre-European condition.

Near the eastern end of the reserve, on the northern side of the canal, there were several mature Silver-leaf Stringybark *Eucalyptus cephalocarpa* with a patchy understorey dominated by Spiny-headed Mat-rush *Lomandra longifolia* subsp. *longifolia* (Zone ID 18). This patch scored 20% pre-European condition notably due to poor understorey diversity and lack of recruitment. The trees were approaching the size to be considered Large Old Trees.

On the southern side of the canal a large proportion of the indigenous understorey vegetation had a non-indigenous canopy (e.g. Sugar Gum *Eucalyptus cladocalyx*). These patches were assessed as a different zone (Zone ID 19) and scored 13% for condition. Along the edge of the reserve where private properties have access to the reserve there were multiple incursions of exotic garden species into this zone.

There were also several young planted Scattered Trees that were not part of the above zones, but still represent a component of the Damp Sand Herb-rich Woodland EVC.

3.2.2.2 Significant flora

Two Victorian Rare species (DEPI 2014) were recorded at this site in Damp Sands Herb-rich Woodland: Marsh Saltbush *Atriplex paludosa* subsp. *paludosa* and Wirilda *Acacia unifolia*. It is expected that both were planted.



Plate 12. Restored Damp Sands Herb-rich Woodland at Elwood Canal

Table 3. Summary of the Vegetation Quality Assessment for the four quality zones identified at Elwood Canal Linear Reserve, Elwood.

Key:

- EVC Ecological Vegetation Class
- DSHRW Damp Sands Herb-rich Woodland
- GP Gippsland Plain
- EN Classified as endangered in the Gippsland Plain Bioregion
- VQA Vegetation Quality Assessment, based on the Habitat Hectares condition method (DSE 2004)

Zone ID			16	17	18	19
Bioregion			GP	GP	GP	GP
EVC Number: Name			3:DSHRW	3:DSHRW	3:DSHRW	3:DSHRW
EVC Bioregional Conservation Status (BCS)			EN	EN	EN	EN
Score			Max			
Site Condition	Large Trees	10	0	0	0	0
	Canopy Cover	5	5	0	5	0
	Lack of Weeds	15	9	0	4	2
	Understorey	25	15	5	5	5
	Recruitment	10	3	3	0	1
	Organic Matter	5	5	4	5	4
	Logs	5	0	0	0	0
Site Score	Total Site Score	75	37	12	19	12
	Max Site Score		75	75	75	75
	Adjusted Site Score		37	12	19	12
Landscape Context	Patch Size	10	2	1	1	1
	Neighbourhood	10	0	0	0	0
	Distance to Core	5	0	0	0	0
VQA Condition Score		100%	39%	13%	20%	13%
Number of Large Old Trees			0	0	0	0
Area (ha)			0.672	0.054	0.092	0.022

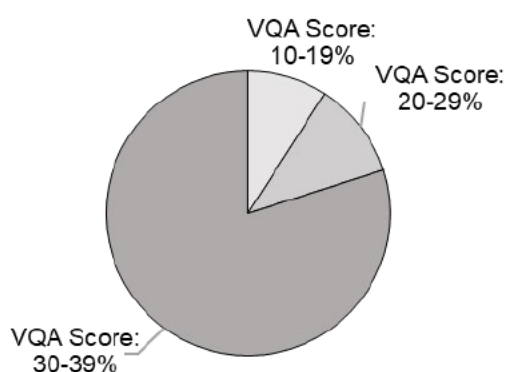


Figure 4. Proportional area of vegetation assessed within each habitat score (%) category, Elwood Canal Linear Reserve, Elwood. Note that the percentages represent **condition categories**, the graph is a visual representation of the contribution of each category to the **total area (hectares)** of mapped vegetation at this site.

Elwood Canal



Vegetation mapping

Date: 28/02/2020 Path: \\HC-AUS-VC-FS-01\jobs\10036183L-GIS\B_Workshop\200217_Tara\Laptop_Ecology\Ecology\TT_working\A4_PortPhillip_ElwoodCanal_A4L_v1_.msd
 Created by : RM
 QA by : LH

Figure 5. Vegetation values within the Elwood Canal Linear Reserve.

3.2.3 Elwood Coastline

3.2.3.1 Vegetation values

The stretch of coastline between the St Kilda Marina and the southern edge of the City of Port Phillip coastline contained five EVCs within reserves and recreation spaces.

Coast Banksia Woodland (EVC 2): Occupied sites generally somewhat sheltered from salt-spray and wind. The distribution of mature Coast Banksia *Banksia integrifolia* was uneven along the Elwood coastline. Most mature Coast Banksia trees occurred in or near Elwood Park (especially behind the Angling Club and Elwood Baths). All examples of Large Old Trees (i.e. Banksia greater than 50 cm diameter at breast height according to the EVC benchmark) were clustered around the Tennis Club area, sometimes very close to car parking areas. Coast Banksia was sparse from the canopy in the Elwood Teatree Reserve (near Point Ormond) however the canopy height is consistently taller than the adjacent areas of Coastal Dune Scrub. The EVC condition score was 45% pre-European levels.

Estuarine Wetland (EVC 10): There were three small examples of this vegetation type along the Elwood Coastline (Zone ID 25). Two are just south west of Lady Foster Kindergarten, around small constructed drainage area. The third was a somewhat larger landscaped drainage feature to the south of Wallie Watson Oval. These wetlands, which are dominated by Sea Rush *Juncus kraussii* subsp. *australiensis* and Knobby Club-sedge *Ficinia nodosa*, had moderate species diversity for the vegetation type but lacked recruitment beyond the planting that was done at the time of their creation. They scored 44% of pre-European condition.

Coastal Dune Scrub (EVC 160): This EVC was represented by two condition zones along the Elwood coastline. The first (Zone ID 22) comprised clumps of native shrubby vegetation in the MO Moran Reserve and Point Ormond where understorey species diversity was relatively high (due largely to enhancement plantings) but canopy shrubs were sometimes not indigenous. The second zone of this EVC (Zone ID 23) was the more-or-less contiguous stretch of vegetation between the Elwood Teatree and Elwood Foreshore Reserve. The vegetation graded into Coast Banksia Woodland at both ends of this stretch. There were many areas where the shrubby canopy (especially the Drooping Sheoak, which were generally taller than the rest of the shrubs present) appeared senescent, damaged or in poor health. Overall, both condition zones scored similarly: 45% and 46% of pre-European condition respectively.

Berm Grassy Shrubland (EVC 311): This EVC, dominated by Coast Saltbush *Atriplex cinerea* hugged the coastline, generally occupying a narrow band between the rocky shore or sea wall and the bike or pedestrian sealed path. There was also a small patch of this vegetation type on the rocky groyne next to the Elwood Boat Ramp. The condition was 46% pre-European levels.

Estuarine Flats Grassland (EVC 914): In the MO Moran Reserve a narrow band of vegetation adjacent the bike path (inland from the Berm Grassy Shrubland along the coastline) resembles this EVC. Dominant species include plantings of Knobby Club-sedge *Ficinia nodosa* and Cushion Bush *Leucophyta brownii*, and some naturally recruiting such as Australian Salt-grass *Distichlis distichophylla*. Although likely to be largely of planted origin, the species diversity and presence of colonising indigenous coastal grasses gave this zone resemblance to Estuarine Flats Grassland and scored 32% pre-European condition.

Plantings: Two planted vegetation zones (amenity plantings with indigenous species) were identified and mapped at this site. The first (Zone ID 30) included grassy plantings, typically dominated by tussock forming coastal grasses and lilies such as Prickly Spear-grass *Austrostipa stipoides* and Small-flower Flax-lily *Dianella brevicaulis*. Low shrubs such as Cushion Bush *Leucophyton brownii* and (when further from the coast) Hop Goodenia *Goodenia ovata* also occurred. The second type of plantings allocated a zone (Zone ID 29) comprised an exotic canopy, of Norfolk Island Hibiscus **Lagunaria patersonia* interspersed with indigenous Drooping Sheoak *Allocasuarina verticillata* trees over a predominantly Seaberry Saltbush *Rhagodia candolleana* understorey.

3.2.3.2 Significant flora

Marsh Saltbush *Atriplex paludosa* subsp. *paludosa* (rare in Victoria, DEPI 2014) was observed in four of the EVCs along the Elwood Coastline: Coast Banksia Woodland, Coastal Dune Scrub, Estuarine Flats Grassland and Berm Grassy Shrubland. It is expected that many of the observed plants were planted however some may have colonised or be remnant.



Plate 13. Darker green Coastal Dune Scrub and silvery Berm Grassy Shrubland vegetation at Elwood Coastline



Plate 14. Coastal Dune Scrub that has been salt-pruned at Elwood Coastline.

Table 4. Summary of the Vegetation Quality Assessment for the eight quality zones identified at the Elwood Coastline site, Elwood.

Key:

- EVC Ecological Vegetation Class
- BGS Berm Grassy Shrubland
- EFG Estuarine Flats Grassland
- CDS Coastal Dune Scrub
- CBW Coast Banksia Woodland
- EW Estuarine Wetland
- GP Gippsland Plain
- EN Classified as endangered in the Gippsland Plain Bioregion
- VU Classified as vulnerable in the Gippsland Plain Bioregion
- DP Classified as depleted in the Gippsland Plain Bioregion
- LC Classified as least concern in the Gippsland Plain Bioregion
- VQA Vegetation Quality Assessment, based on the Habitat Hectares condition method (DSE 2004)

Zone ID		20	21	22	23	24	25	29	30
Bioregion		GP	GP	GP	GP	GP	GP	GP	GP
EVC Number: Name		311: BGS	914: EFG	160: CDS	160: CDS	2: CBW	10: EW	Planting	Planting
EVC BCS		EN	EN	DP	DP	LC	VU	NA	NA
Score	Max								
Site Condition	Large Trees	10	-	-	-	-	6	-	-
	Canopy Cover	5	-	-	-	-	3	-	-
	Lack of Weeds	15	7	4	9	7	7	13	-
	Understorey	25	15	15	15	15	15	15	-
	Recruitment	10	6	0	5	5	5	0	-
	Organic Matter	5	5	4	3	5	5	3	-
	Logs	5	-	-	-	-	4	-	-
Site Score	Total Site Score	75	33	23	32	32	45	31	-
	Max Site Score		55	55	55	55	75	55	-
	Adjusted Site Score		45	31	44	44	45	42	-
Landscape Context	Patch Size	10	1	1	1	2	2	2	-
	Neighbourhood	10	0	0	0	0	0	0	-
	Distance to Core	5	0	0	0	0	0	0	-
VQA Condition Score	100%	46%	32%	45%	46%	47%	44%	NA	NA
Number of Large Trees		0	0	0	0	9	0	0	0
Area (ha)		1.189	0.175	1.567	2.013	3.231	0.080	0.406	0.153

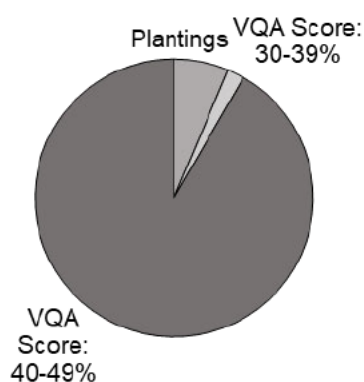


Figure 6. Proportional area of vegetation assessed within each habitat score (%) category, Elwood Coastline, Elwood. Note that the percentages represent **condition categories**, the graph is a visual representation of the contribution of each category to the **total area (hectares)** of mapped vegetation at this site.

City of Port Phillip City of Port Phillip Biodiversity Study
 Elwood Coastline



Vegetation mapping

Figure 7. Vegetation values within the Elwood Coastline site. Map 1/3

City of Port Phillip City of Port Phillip Biodiversity Study
 Elwood Coastline



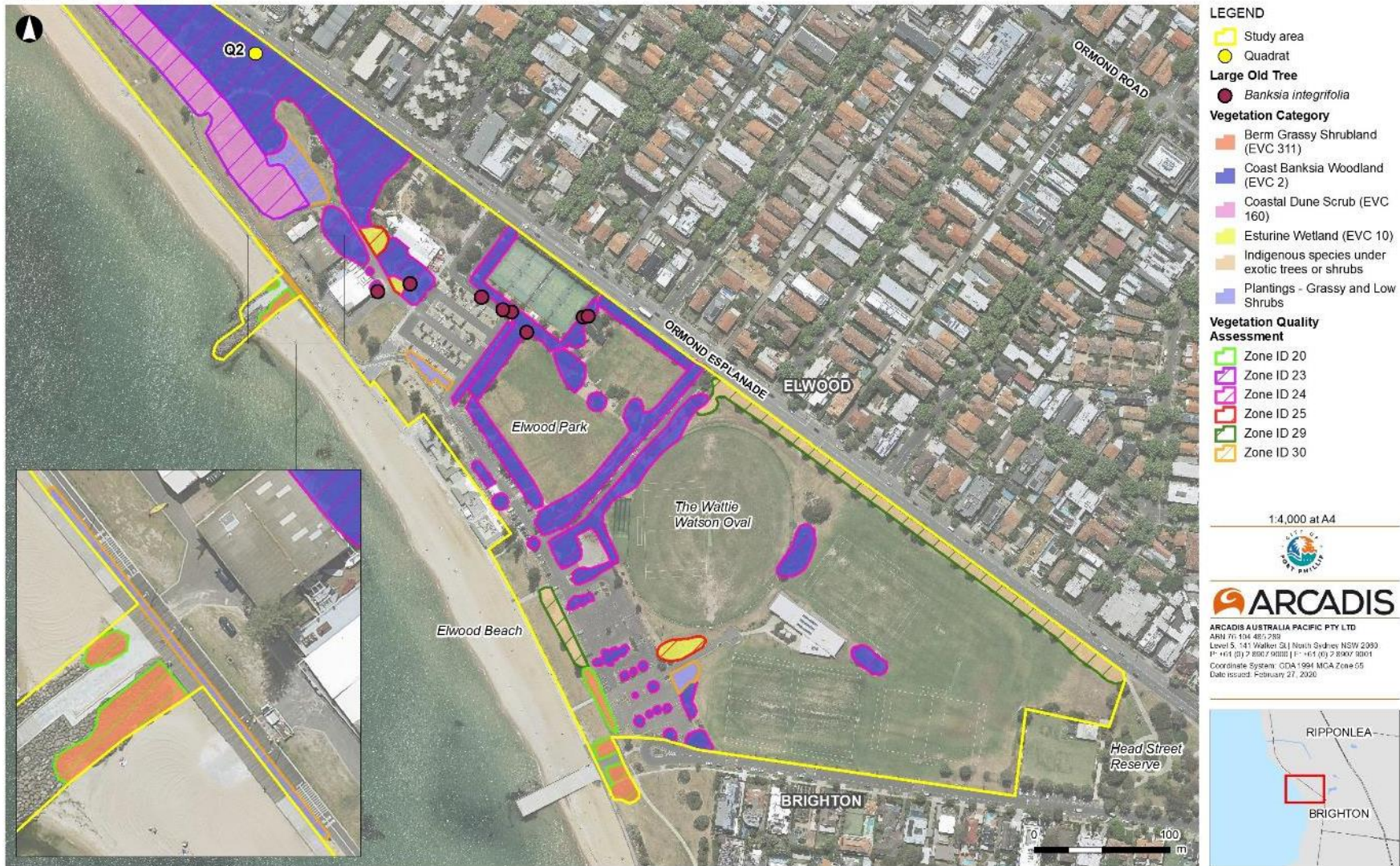
Vegetation mapping

Page 2 of 3

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 Created by: RM
 QA by: LH

Figure 8. Vegetation values within the Elwood Coastline site. Map 2/3

City of Port Phillip City of Port Phillip Biodiversity Study
 Elwood Coastline



Vegetation mapping

Figure 9. Vegetation values within the Elwood Coastline site. Map 3/3

3.2.4 Port Melbourne Foreshore

3.2.4.1 Vegetation values

Four EVCs comprising six quality zones were recorded within the Port Melbourne Foreshore site, along with some narrow strips of low-growing amenity plantings.

Coastal Dune Scrub (EVC 160): The vegetation classified as Coastal Dune Scrub appears to largely be planted with a combination of indigenous species and occasional exotic species. A small number of planted Coast Banksia *Banksia integrifolia* trees are present, giving resemblance to Coast Banksia Woodland EVC, however given their scarcity it was determined that Coastal Dune Scrub was the most appropriate EVC. Zone ID 5 resembled a more natural albeit modified vegetation structure achieving a quality score of 35% of pre-European condition, while Zone ID 7 was more representative of mulched planted garden beds with few weeds and scored 42% pre-European condition.

Berm Grassy Shrubland (EVC 311): Occurs on the breakwater groynes and primary dune where Coast Saltbush *Atriplex cinerea* has opportunistically colonised the sediments within and adjoining the basal boulders. Vegetation in this Zone scored 35% of pre-European condition.

Coastal Dune Grassland (EVC 879): Occurs on the foredune with two distinct zones of quality – some areas are moderately diverse (Zone ID 3; 55% of pre-European Condition) while others are very species poor (Zone ID 1; 34% of pre-European condition). Hairy Spinifex *Spinifex sericea* and Strand Sedge *Carex pumila* bind and stabilise the foredune sands, with the notably large Strand Sedge population being considered quite significant.

Estuarine Flats Grassland (EVC 914): At the western end of the site, this EVC was located in a swale accumulating additional moisture behind the primary dune. The small area contained a small suite of species and was quite weedy, scoring 29% of pre-European condition.

Plantings: Along some of the footpaths were narrow strips of indigenous amenity plantings, primarily consisting of low growing shrubs and graminoids such as Cushion Bush *Leucophyta brownii*, Prickly Spear-grass *Austrostipa stipoides*, Coast Tussock-grass *Poa poiformis*, Spiny-headed Mat-rush *Lomandra longifolia* and Small-flower Flax-lily *Dianella brevicaulis*.

3.2.4.2 Significant flora

The Victorian rare species Marsh Saltbush *Atriplex paludosa* subsp. *paludosa* (DEPI 2014) was observed in the Coastal Dune Scrub at Port Melbourne Foreshore. It is expected that these were planted.



Plate 15. Vegetation at Port Melbourne Foreshore comprising Coastal Dune Grassland dominated by Strand Sedge *Carex pumila* (foreground) and Hairy Spinifex *Spinifex sericea* (left) and Coast Dune Scrub (background left).

Table 5. Summary of the Vegetation Quality Assessment for the seven quality zones identified at Port Melbourne Foreshore, Port Melbourne.

Key:
 EVC Ecological Vegetation Class
 CDG Coastal Dune Grassland
 BGS Berm Grassy Shrubland
 EFG Estuarine Flats Grassland
 CDS Coastal Dune Scrub
 GP Gippsland Plain
 EN Classified as endangered in the Gippsland Plain Bioregion
 DP Classified as depleted in the Gippsland Plain Bioregion
 NA Not Applicable
 VQA Vegetation Quality Assessment, based on the Habitat Hectares condition method (DSE 2004)

Zone ID			1	2	3	4	5	6	7	
Bioregion			GP	GP	GP	GP	GP	GP	GP	
EVC Number: Name			879: CDG	311: BGS	879: CDG	914: EFG	160: CDS	Planting	160: CDS	
EVC Bioregional Conservation Status (BCS)			DP	EN	DP	EN	DP	NA	DP	
Score			Max							
Site Condition	Large Trees	10	-	-	-	-	-	-	-	
	Canopy Cover	5	-	-	-	-	-	-	-	
	Lack of Weeds	15	13	7	13	7	4	-	13	
	Understorey	25	5	10	15	5	15	-	15	
	Recruitment	10	1	3	6	3	3	-	0	
	Organic Matter	5	5	5	5	5	3	-	2	
	Logs	5	-	-	-	-	-	-	-	
Site Score	Total Site Score	75	24	25	39	20	25	-	30	
	Max Site Score		55	55	55	55	55	-	55	
	Adjusted Site Score		33	34	53	27	34	-	41	
Landscape Context	Patch Size	10	1	1	2	2	1	-	1	
	Neighbourhood	10	0	0	0	0	0	-	1	
	Distance to Core	5	0	0	0	0	0	-	0	
VQA Condition Score			100%	34%	35%	55%	29%	35%	NA	42%
Number of Large Trees			-	-	-	-	-	-	-	
Area (ha)			0.049	0.174	0.849	0.061	1.520	0.605	1.542	

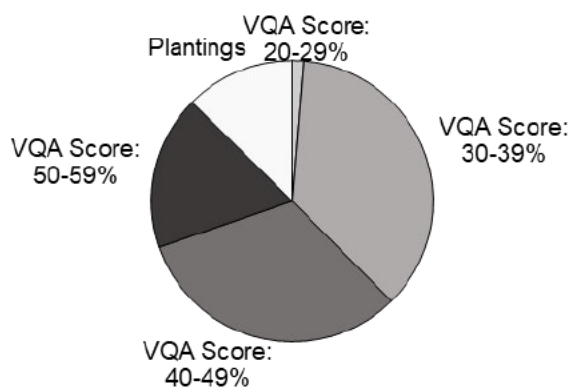


Figure 10. Proportional area of vegetation assessed within each habitat score (%) category, Port Melbourne Foreshore, Port Melbourne. Note that the percentages represent condition categories, the graph is a visual representation of the contribution of each category to the total area (hectares) of mapped vegetation at this site.



Vegetation mapping

Figure 11. Vegetation values within the Port Melbourne Foreshore site. Map 1/2



Vegetation mapping

Figure 12. Vegetation values within the Port Melbourne Foreshore site. Map 2/2

3.2.5 Port Melbourne Light Rail Corridor

3.2.5.1 Vegetation values

The parkland reserves along both sides of the Port Melbourne Light Rail contained a mix of exotic and indigenous vegetation, as well as mown grassy recreation areas, bike paths, walking tracks and children's playgrounds. Two Large Old Trees² were observed on the western side of the light rail, which was also the side where most mature indigenous plantings were seen. Although planted, these areas, as well as some more recent plantings on the eastern side, resembled native vegetation and were assessed as such. A single EVC was represented, however condition was variable.

Damp Sands Herb-rich Woodland (EVC 3): There were four condition zones identified.

The patch with the highest condition (43% pre-European condition), occupied the largest area of native vegetation at this site, which was a strip along the north western side of the light rail reserve (Zone ID 12). This zone had a healthy canopy and tall shrubby subcanopy of eucalypts, Drooping Sheoak *Allocasuarina verticillata*, Sweet Bursaria *Bursaria spinosa* and other tall shrubs, plus a range of graminoids and herbs (both planted and colonising) in the ground layer.

A zone which comprised mainly a canopy of mixed eucalypts over mown lawn of exotic grass or mulched areas suppressing grass around trees (Zone ID 13) scored 19% pre-European condition. The majority of trees were still quite young and had been planted.

A planted area on the eastern side of the light rail (Zone ID 14) had a predominately exotic canopy but a moderately species-rich indigenous understorey of recent plantings. This area had a condition score of 33% pre-European condition.

There was also indigenous vegetation within the fenced light rail easement (Zone ID 15). The indigenous species here (mostly large shrubs and small trees) are presumed to have naturally colonised. Species included young River Red-gum *Eucalyptus camaldulensis* and Lightwood *Acacia implexa*. This vegetation did not comprise the enrichment plantings and mulch of some of the other zones. It scored 30% of pre-European condition.



Plate 16. Restored Damp Sands Herb-rich Woodland along the Port Melbourne Light Rail

² A Large Old Tree (LOT) is an indigenous tree with a diameter at breast height (dbh) equal to or greater than that specified in the relevant EVC benchmark. For example, the benchmark for Damp Sands Herb-rich Woodland specifies a LOT is 70cm dbh or above (DELWP 2020b).

Table 6. Summary of the Vegetation Quality Assessment for the four quality zones identified at Port Melbourne Light Rail Corridor, Port Melbourne.

Key:

- EVC Ecological Vegetation Class
- DSHRW Damp Sands Herb-rich Woodland
- GP Gippsland Plain
- EN Classified as endangered in the Gippsland Plain Bioregion
- VQA Vegetation Quality Assessment, based on the Habitat Hectares condition method (DSE 2004)

Zone ID			12	13	14	15
Bioregion			GP	GP	GP	GP
EVC Number: Name			3:DSHRW	3:DSHRW	3:DSHRW	3:DSHRW
EVC Bioregional Conservation Status (BCS)			EN	EN	EN	EN
Score	Max					
Site Condition	Large Trees	10	3	3	0	0
	Canopy Cover	5	5	3	0	5
	Lack of Weeds	15	13	4	15	11
	Understorey	25	15	5	15	5
	Recruitment	10	3	0	0	1
	Organic Matter	5	3	3	2	5
	Logs	5	0	0	0	2
Site Score	Total Site Score	75	42	18	32	29
	Max Site Score		75	75	75	75
	Adjusted Site Score		42	18	32	29
Landscape Context	Patch Size	10	1	1	1	1
	Neighbourhood	10	0	0	0	0
	Distance to Core	5	0	0	0	0
VQA Condition Score		100%	43%	19%	33%	30%
Number of Large Trees			1	1	0	0
Area (ha)			0.722	0.552	0.515	0.161

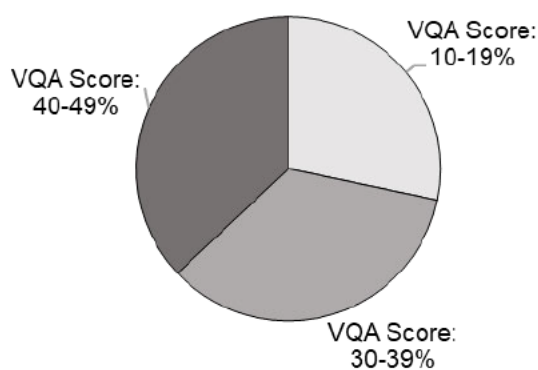


Figure 13. Proportional area of vegetation assessed within each habitat score (%) category, Port Melbourne Light Rail Corridor, Port Melbourne. Note that the percentages represent **condition categories**, the graph is a visual representation of the contribution of each category to the **total area (hectares)** of mapped vegetation at this site.

City of Port Phillip City of Port Phillip Biodiversity Study
 Port Melbourne Light Rail



Vegetation mapping

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 Created by: RM
 QA by: LH

Figure 14. Vegetation values within the Port Melbourne Light Rail Corridor.

3.2.6 St Kilda West Beach

3.2.6.1 Vegetation values

There were four EVC observed in the two patches of remnant native vegetation at St Kilda West Beach.

Coast Banksia Woodland (EVC 2): This occurred on the higher ground or more sheltered areas in both the eastern and western patch. Some remnant Coast Banksia *Banksia integrifolia* and other shrubs (e.g. Drooping Sheoak *Allocasuarina verticillata*, Coast Tea-tree *Leptospermum laevigatum*) were present. The predominately grassy understorey was mostly likely planted and had a relatively low species diversity. It scored 32% pre-European condition.

Berm Grassy Shrubland (EVC 311): This was confined to the area around the drainage line/canal to the east of this site. Coast Saltbush *Atriplex cinerea* dominated this EVC with a small amount of other native and exotic species on the groundlayer. Weeds and lack of recruitment resulted in a lower condition score of 38% of pre-European condition.

Coastal Dune Grassland (EVC 879): Occupies the foredunes and dominated by Hairy Spinifex *Spinifex sericea*, which was stabilising the loose sand at the perimeter of the vegetation patches. It was assessed as 54% the pre-European condition, which represented the highest condition score for this site.

Estuarine Flats Grassland (EVC 914): This vegetation occupied the swale area encircled by boardwalks in the eastern vegetation patch at this site. This area was waterlogged in places and supported a range of predominantly grasses and graminoids tolerant of both salinity and periodic inundation. The soil had a high proportion of broken shells in the surface layer and may be an Aboriginal midden (further investigation required). Species diversity was moderate for this vegetation type however the presence of high threat weeds including Spiny Rush **Juncus acutus* subsp. *acutus* and Couch **Cynodon dactylon* var. *dactylon* contributed to a low-moderate condition score of 35% of pre-European condition.



Plate 17. Estuarine Flats Grassland at St Kilda West Beach

Table 7. Summary of the Vegetation Quality Assessment for the four quality zones identified at St Kilda West Beach, St Kilda.

Key:

- EVC Ecological Vegetation Class
- BGS Berm Grassy Shrubland
- CBW Coast Banksia Woodland
- CDG Coastal Dune Grassland
- EFG Estuarine Flats Grassland
- GP Gippsland Plain
- EN Classified as endangered in the Gippsland Plain Bioregion
- DP Classified as depleted in the Gippsland Plain Bioregion
- LC Classified as least concern in the Gippsland Plain Bioregion
- VQA Vegetation Quality Assessment, based on the Habitat Hectares condition method (DSE 2004)

Zone ID			8	9	10	11
Bioregion			GP	GP	GP	GP
EVC Number: Name			2: CBW	311: BGS	879: CDG	914: EFG
EVC Bioregional Conservation Status (BCS)			LC	EN	DP	EN
Score			Max			
Site Condition	Large Trees	10	4	-	-	-
	Canopy Cover	5	0	-	-	-
	Lack of Weeds	15	7	7	11	4
	Understorey	25	10	15	15	10
	Recruitment	10	5	0	3	6
	Organic Matter	5	5	5	5	5
	Logs	5	0	-	-	-
Site Score	Total Site Score	75	31	27	34	25
	Max Site Score	75	75	55	55	55
	Adjusted Site Score		31	37	46	34
Landscape Context	Patch Size	10	1	1	1	1
	Neighbourhood	10	0	0	0	0
	Distance to Core	5	0	0	6	0
VQA Condition Score		100%	32%	38%	53%	35%
Number of Large Trees			1	-	-	-
Area (ha)			1.056	0.090	0.453	0.537

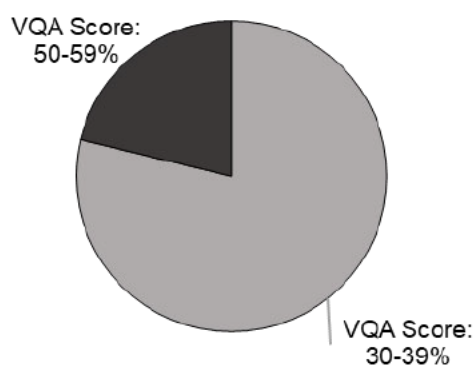


Figure 15. Proportional area of vegetation assessed within each habitat score (%) category, St Kilda West Beach, St Kilda. Note that the percentages represent **condition categories**, the graph is a visual representation of the contribution of each category to the **total area** (hectares) of mapped vegetation at this site.

City of Port Phillip City of Port Phillip Biodiversity Study
 St Kilda West Beach



Vegetation mapping

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 Created by: RM
 QA by: LH

Figure 16. Vegetation values within the St Kilda West Beach site.

3.3 Floristic quadrats

Six quadrats were completed for the project, all of which are located in larger remnants of native vegetation along the City of Port Phillip's foreshore. Due to the highly modified, narrow and planted nature of most areas of native vegetation within inland reserves, no locations were deemed suitable for floristic quadrats.

Table 8 summarises the EVC, number of species and dominant species (native or exotic) in each quadrat, with full details and photos provided in Appendix D.

Table 8. Summary of data collected from the six floristic quadrats completed in areas of remnant vegetation located along the City of Port Phillip coastline (refer to Appendix D for full details). An asterisk * before a species name indicates it is exotic. Dominant species are listed in alphabetical order, not order of dominance.

Quad. #	Site	EVC	No. Species			Dominant species	
			Total no.	No. Native (%)	No. Exotic (%)	Scientific name	Common name
1	Elwood Coastline	Coastal Dune Scrub	18	10 (56%)	8 (44%)	<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coast Wattle
						<i>Myoporum insulare</i>	Common Boobialla
						<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush
						<i>Tetragonia implexicoma</i>	Bower Spinach
2	Elwood Coastline	Coast Banksia Woodland	14	12 (86%)	2 (14%)	<i>Allocasuarina verticillata</i>	Drooping Sheoak
						<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Sweet Bursaria
						<i>Eucalyptus ovata</i>	Swamp Gum
						<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush
3	Elwood Coastline	Coast Banksia Woodland	11	10 (91%)	1 (9%)	<i>Allocasuarina verticillata</i>	Drooping Sheoak
						* <i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass
						<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush
						<i>Tetragonia implexicoma</i>	Bower Spinach
4	St Kilda West Beach	Estuarine Flats Grassland	13	9 (69%)	4 (31%)	<i>Ficinia nodosa</i>	Knobby Club-sedge
						<i>Distichlis distichophylla</i>	Australian Salt-grass
						<i>Austrostipa stipoides</i>	Prickly Spear-grass
						* <i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch
5	Port Melbourne Foreshore	Coastal Dune Grassland	11	6 (55%)	5 (45%)	* <i>Bromus diandrus</i>	Great Brome
						* <i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass
						<i>Spinifex sericeus</i>	Hairy Spinifex
6	Port Melbourne Foreshore	Coastal Dune Grassland	17	11 (65%)	6 (35%)	* <i>Bromus diandrus</i>	Great Brome
						* <i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch
						<i>Spinifex sericeus</i>	Hairy Spinifex

4 FAUNA HABITAT

4.1 Habitat descriptions

The study sites varied from coastal and freshwater habitat to modified terrestrial habitat. All the study areas have been modified to varying degrees. Modification can have beneficial outcomes, as is the case with the St Kilda Breakwater. Whilst the St Kilda Breakwater is not a natural feature it provides excellent habitat for Rakali (a native water-rat) and nesting for Little Penguins. Further to this the Breakwater has created the tidal sand bar on the St Kilda Spit where migratory shorebirds roost of an evening. Conversely the highly modified Elwood Canal has limited ability to improve water quality within the creek and entering Port Phillip Bay, and there is very little native vegetation that has not been revegetated.

Except for the St Kilda Botanical Gardens, the sites were linear with distances to the core varying from 5 m to 200 m. The distance to the core impacts on how fauna use a site due to the influence of 'edge effect' which is "the effect of an abrupt transition between two quite different adjoining ecological communities on the numbers and kinds of organisms in the marginal habitat" (Meriam Webster, 2020).

Edge effects influence how fauna interact within the landscape and whether the habitat provides the required resources for a species to persist. In an urban environment, the edge effect is not a transition of an adjoining ecological community, it is typically the result of infrastructure e.g. roads, housing, commercial building, open space and lighting. Edge effects have varying degrees of influence depending on the species. Other external influences include how humans interact with the area e.g. tree clearing, dogs off leads, etc.

An overview of the fauna habitat observed at each study area is provided below.

4.1.1 St Kilda Botanical Gardens

The St Kilda Botanical Gardens consists of a modified terrestrial and freshwater aquatic habitat approximately 7.6 ha in area. The garden has both mature introduced (e.g. Date Palm and Moreton Bay Fig) and native canopy trees and a diversity of introduced understorey and ground flora.

The native section consists of a range of introduced native canopy trees and, native midstorey (Blackwood *Acacia melanoxylon*, Black Wattle *Acacia mearnsii* and Coast Pomaderris *Pomaderris paniculosa* subsp. *paralia*) and ground flora (Tussock Grasses *Poa* species, Spiny-headed Mat-rush *Lomandra longifolia* and Berry Saltbush *Atriplex semibaccata*). There were many habitat trees (Lemon-scented Gum *Corymbia citriodora*, Spotted Gum *Corymbia maculata*, Sugar Gum *Eucalyptus cladocalyx* and Moreton Bay Fig *Ficus macrophylla*) providing food resources but only a few tree hollows were observed. Nest boxes have been placed throughout the gardens to supplement the lack of tree hollows. There is a scarcity of woody debris and / rocks in the garden beds.

The aquatic habitat is approximately 1000 m² and consists of a concrete pond with a fountain and small constructed wetland dominated by planted native aquatic species (Cumbungi *Typha* species, Sedges *Carex* species and Rushes *Juncus* species) and several introduced species.

4.1.2 Canterbury Road Urban Forest

The 'Urban Forest' is a linear revegetated area providing approximately 1.6 ha of terrestrial habitat. The site was established approximately 15-years ago. The forest consists of non-provenance native canopy trees, (Box and Ironbark eucalypts) and, native mid-storey (Gold-dust Wattle *Acacia acinacea*, Hedge Wattle *Acacia paradoxa* and Correa *Correa* species) and ground flora (Berry Saltbush *Atriplex semibaccata*). There was a lack of woody debris and rocks to provide habitat for insects and skinks. The *Urban Forest* is self-sustaining and relatively weed free. Whilst the forest provides food resources for insectivorous and nectivorous birds, it lacks roosts for hollow dependant species.

4.1.3 Elwood Canal / Elster Creek

The Elwood Canal and Elster Creek study area is approximately 4.5 ha. The revegetation at the mouth of Elwood Canal to Marine Parade, replicating the Estuarine Wetlands EVC, is well advanced and provides habitat for a range of birds and reptiles. The tidal zone of the canal supports habitat for a range of fish and foraging for herons and egrets.

It is highly modified with the creek being channelised from Glen Huntly Road to St Kilda Street. There is little in the way of remnant vegetation with the exception of several River Red Gums. Introduced Sugar Gums are the most prevalent canopy species confined to the eastern section.

Revegetation along the Elwood Canal and Elster Creek from Marine Parade to St Kilda Road is in the early stages of establishment (restored Damp Sands Herb-rich Woodland) and provides habitat for common bird species, skinks and microbats. There were few tree hollows observed however this has been supplemented by nest boxes. There was a lack of woody debris and rocks providing habitat for insects and skinks. Kikuyu grass was dominant on the escarpment and riparian zones.

There was a strong odour coming from the water in Elster Creek from above the tidal zone through to St Kilda Street, which suggests that it is of limited suitability for water dependant birds and frogs.

4.1.4 Point Ormond Reserve

The vegetation within Point Ormond Reserve is a linear remnant coastal vegetation community (Coast Banksia Woodland) linking with Elwood Foreshore creating an area of approximately 7 ha. It is one of the largest, if not the largest intact remnant vegetation community in the City of Port Phillip. With the exception of some illegal clearing of the canopy, the reserve is both floristically and structurally diverse (e.g. canopy trees and shrubs, understorey and ground flora). Unlike the other study areas, there is extensive ground cover and woody debris. The Melaleucas (e.g. Swamp Paperbark *Melaleuca ericifolia*; Moonah *Melaleuca lanceolata*) and Coast Banksia *Banksia integrifolia* trees provide habitat for a wide range of fauna species.

4.1.5 St Kilda Breakwater

Although the St Kilda Breakwater is human constructed infrastructure built from basalt rocks to provide safe mooring for boats, the breakwater provides important habitat for a variety of species including birds, mammals, reptiles, fish and crustaceans. The gaps between the boulders provides safe nesting from predators for Little Penguins and Rakali (native water-rat) and supports prey for the Rakali as well as cormorants and other waterbirds. The breakwater covers an area of approximately 2.5 ha.

4.1.6 St Kilda Spit

The St Kilda Spit is an artefact of the construction of the breakwater at St Kilda West Beach. It consists of a tidal sandbar and Coastal Dune Grassland on the shoreline. The Spit provides roosting habitat (Gio Fitzpatrick, pers comm, 25 February 2020) of an evening for migratory waders and feeding resources for other coastal waterbirds, e.g. Red-necked Stint, Pied Oyster Catcher *Haematopus longirostris*, Black-winged Stilt and Red-necked *Avocet Recurvirostra novaehollandiae*. The Spit covers an area of approximately 15 ha.

Refer to fauna habitat assessment sheets in Appendix E.

4.2 Fauna survey results

4.2.1 Bat detector surveys

Bat activity and diversity was greatest in the larger areas where there is a range vegetation, presence of understorey and trees of older age classes that provide natural roosts, or where roosts are supplemented by nest boxes.

St Kilda Botanical Gardens had the highest levels of bat activity and species diversity. This is attributed to the diversity of vegetation (both native and non-native), areas suitable for foraging, proximity to water and roost availability. The impacts of edge effects are likely to be less due to the size and shape of the gardens.

A total of five microbat species were identified from their call features and, three species call complexes. A species call complex is where the characteristic call features used for identification are not present and the call could be of more than one species. The species and call complexes identified were as follows:

1. Chocolate Wattled Bat – *Chalinolobus morio*
2. Gould’s Wattled Bat – *Chalinolobus gouldii*
3. Large Forest Bat – *Vespadelus darlingtoni*
4. Little Forest Bat – *Vespadelus vulturnus*
5. White-striped Freetail Bat – *Austronomus australis*

The three call complexes recorded were:

1. Forest bat complex – *Vespadelus* sp.
2. Long-eared bat complex – *Nyctophilus* sp.
3. Freetail / Gould’s wattled bat complex- *Ozimops* / *Chalinolobus* sp.

Refer to Appendix F for call images indicative of species identified.

St Kilda Botanical Gardens

The Gardens had second highest species diversity. Four species were identified from their distinctive call features along with one call complex. Call activity averaged 380 bat call files per night, the highest activity of any site.

Gould’s Wattled Bat was recorded on each of the five-nights the detectors were deployed, Large Forest Bat and White-striped Freetail Bat were recorded on four nights and Little Forest Bat on 1 night. The Long-eared bat call complex, most likely Lesser Long-eared Bat, was recorded on two nights (refer to Table 9 below).

Table 9. Bat call activity at St Kilda Botanical Gardens

Key: ✓ Present

Site Name: St Kilda Botanical Gardens	11/2/20	12/2/20	13/2/20	14/2/20	15/2/20	Total
Number of files	427	419	372	297	387	1902
Identified to species level	4	1	3	3	3	
Gould’s Wattled Bat	✓	✓	✓	✓	✓	
Large Forest Bat	✓		✓	✓	✓	
Little Forest Bat	✓					
White-striped Freetail Bat	✓		✓	✓	✓	
Identified to call complex		1	1			
Long-eared Bat		✓	✓			



Plate 18. Bat detector deployed on Spotted Gum directed to an area considered foraging habitat



Plate 19. Bat foraging habitat located adjacent to bat detector.

Canterbury Forest

Bat activity and species diversity at Canterbury Forest was the lowest of any of the sites, with only one bat call recorded. Gould's Wattled Bat was recorded at the site, this is the most common species recorded in urban areas.

The lack of bat activity is attributed to the small area of the reserve, its linear landscape structure, isolation from remnant vegetation and significant edge effects with light rail and a major road

immediately adjacent. The vegetation is also relatively young, and the canopy trees lack roosts. Of interest is electrical activity from the light rail which was recorded by the bat detectors. It is possible that the electrical activity interferes with echolocation and bats avoid the area. Refer to Table 10 for results.

Table 10. Bat call activity at Canterbury Forest

Key: ✓ Present

Species: Date	17/1/20	18/1/20	Total
Number of files	19	1	20
Identified to species level		1	
Gould's Wattled Bat		✓	

Elwood Canal / Elster Creek

Bat activity was confined to three of the five nights of deployment. Two species were recorded, Gould's Wattled Bat and Chocolate Wattled Bat and one call complex, Long-eared species. Chocolate Wattled Bat was not recorded at any of the other sites. Notwithstanding the linear shape of the study area and the majority of the vegetation having been re-established, the detectors were placed where bat activity was expected.

There was an average of 11.6 calls per night, which is lower than anticipated (refer to Table 11 for nightly results). In comparison, the St Kilda Botanical Gardens averaged 380 calls per night over the same survey period.

Table 11. Bat call activity at Elwood Canal / Elster Creek

Key: ✓ Present

Species: Date	11/2/20	12/2/20	13/2/20	Total
Number of files	5	19	11	35
Identified to species level	1	2	1	
Chocolate Wattled Bat		✓		
Gould's Wattled Bat	✓	✓	✓	
Identified to call complex	1			
Long-eared Bat	✓			



Plate 20. Elster Creek bat detector on River Red Gum



Plate 21. Elster Creek bat foraging habitat adjacent to detector.

Point Ormond Reserve

Bat activity was recorded on each of the eleven nights of detector deployment averaging nineteen calls per night. Three species were recorded, Gould's Wattled Bat, Little Forest Bat and White-striped Freetail Bat, all common in urban areas. One call complex was recorded, Gould's Wattled Bat / Freetail species complex. Refer to Table 12 for nightly activity results.

The nightly bat activity levels were as anticipated given the type of vegetation community present, i.e. Coast Banksia Woodland and Coastal Dune Scrub. Although linear in shape, the distance to the core is greater (40 m–80 m) than Canterbury Forest and Elwood Canal / Elster Creek (5 m–10 m) and forms one of the largest remnant patches of vegetation in the municipality.

Table 12. Bat call activity at Point Ormond Reserve

Key: ✓ Present

Site Name: Port Ormond	16/1/20	17/1/20	18/1/20	19/1/20	20/1/20	21/1/20	22/1/20	23/1/20	24/1/20	25/1/20	26/1/20	Total
Number of files	3	22	33	45	5	46	3	8	21	22	2	210
Identified to species level												
Gould's Wattled Bat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Little Forest Bat	✓	✓	✓	✓		✓			✓			
White-striped Freetail Bat		✓	✓			✓			✓			
Identified to call complex												
Gould's Wattled Bat / Ozimops sp						✓						



Plate 22. Point Ormond Reserve bat detector placed on Drooping Sheoak



Plate 23. Bat foraging habitat located adjacent to bat detector

4.2.2 Amphibian recorder surveys

St Kilda Botanical Gardens

The SongMeter SM4™ recorder was set up adjacent to the constructed wetland and pond at St Kilda Botanical Gardens. Two species were recorded, Peron’s Tree Frog and Southern Brown Tree Frog. Both species are not usually found in such a highly urbanised area close to the CBD.

Peron’s Tree Frog is a more recent occurrence believed to have been introduced during remedial works in the constructed wetland. Common Froglet and Marsh Frogs have been recorded in the past but have not been heard for a number of years (Gio Fitzpatrick, pers comm, 10 February 2020).

Table 13. St Kilda Botanical Gardens SongMeter SM4 frog survey

IN FILE	DURATION	Fmin Hz	Fmean Hz	Fmax Hz	DATE	TIME	MANUAL ID
S4A02566_20200126_220000.wav	2.024062	1,000.00	1,823.08	2,437.50	26/01/2020	22:00	Peron’s Tree Frog
S4A02566_20200126_000000.wav	1.917812	875.00	1,934.63	3,250.00	26/01/2020	0:00	Peron’s Tree Frog
S4A02566_20200123_000000.wav	2.44375	937.50	2,006.90	3,062.50	23/01/2020	0:00	Peron’s Tree Frog
S4A02566_20200119_220000.wav	2.125	1,500.00	2,113.94	3,000.00	19/01/2020	22:00	Peron’s Tree Frog
S4A02566_20200126_220000.wav	2.109062	1,375.00	2,048.55	2,875.00	26/01/2020	22:00	Peron’s Tree Frog
S4A02566_20200123_040000.wav	3.1875	2,062.50	2,347.48	2,812.50	23/01/2020	4:00	Southern Brown Tree Frog
S4A02566_20200122_030000.wav	2.523438	2,125.00	2,482.14	2,812.50	22/01/2020	3:00	Southern Brown Tree Frog



Plate 24. SongMeter placed on palm tree between pond and constructed wetland



Plate 25. Constructed wetland located adjacent to recorder

Elwood Canal / Elster Creek

The SongMeter SM4™ recorder was set up adjacent to the Elster Creek where riparian and aquatic vegetation was present. No frogs were recorded over the 11 days of deployment. This was an unexpected result given that Southern Brown Tree Frog and Striped Marsh Frog have been recorded

in Elster Creek in Elsternwick Park. However, as previously noted, the water quality appears to be compromised for much of the canal and creek above the tidal zone.



Plate 26. SongMeter placed on River Red Gum



Plate 27. Riparian and aquatic habitat located adjacent to recorder

4.2.3 Elwood Canal / Elster Creek active reptile search

The active reptile survey failed to record the presence of any reptiles although Weasel Skink and Garden Skink have previously been observed within the canal and adjacent houses (Gio, Fitzpatrick, pers comm, 10, February 2020). The revegetated areas would benefit by the placement of woody debris and rocks to provide ground layer protection for skinks and their prey.



Plate 28. Elwood Canal / Elster Creek indicative skink habitat

4.2.4 Active Rakali survey

The survey was completed during ideal weather conditions (refer to table 17). Twenty Rakali were observed, during the 75-minute survey period, two more Rakali were observed when leaving the study site. It is of interest that nineteen of the twenty observations were on the protected northern side of the *Breakwater*. The surface of the water was calmer, water depth is less (easier foraging), and there are natural sandy banks on the water's edge for exiting and feeding.

A literature search failed to find any studies that provide information regarding the current population densities at study sites in Victoria. A Rakali community study in Western Australia in 2014-2015 (Trocini, S. et al 2015), reported 234 sightings over a four-month period. The report notes that there was anecdotal evidence of localised declines and extinctions in the Perth Metropolitan Region. If a similar trend is occurring across Melbourne, the population of Rakali at the *Breakwater* are of significance. The *Breakwater* appears to be one of the only known strongholds for Rakali in Melbourne.



Plate 29. St Kilda Breakwater

4.2.5 St Kilda Spit Shorebird / wader survey

Dog activity was at its peak between 7pm and dusk and no shorebirds or waders were observed. Once dog activity ceased post dusk, two species of shorebirds were observed feeding at the Spit, namely Black-winged Stilt (3) and Red-necked Stint (7). Four Nankeen Night Heron, two of which were foraging, and two Chestnut Teals were also observed.

Up to two hundred Red-necked Stint have previously been observed feeding at the Spit. Other species regularly seen are Pied Oyster Catcher, Red-necked Avocet and Nankeen Night Heron (Gio Fitzpatrick, pers comm, 25 February 2020).

The Spit's suitability post dusk might not be only due to dog activity during daylight. A study by Dwyer et al (2013) found benefits with an overspill of lighting from an industrial area adjacent to a foraging area of the Common Redshank. Other studies referred to in their report support their conclusions that visual foraging is more productive than tactile foraging and provides a beneficial food intake for feeding intertidal birds. Dwyer et al (2013) are of the opinion that artificial lighting has a beneficial outcome for common redshank. It's possible that the overflow of lighting from Marine Parade provides similar benefits. Birds may be preferentially flying to the Spit post dusk to supplement their daytime feeding.



Plate 30. Low tide at St Kilda Spit

4.2.6 Weather Conditions

Surveys were conducted to coincide with the seasonal and weather conditions preferred by the target species. The tables below provide the weather conditions for each of the surveys.

Table 14. Canterbury Forest, Point Ormond bat survey, St Kilda Botanical Gardens and Elster Creek frog surveys

Date	Rainfall (mm)	3pm Temp (°C)	3pm Relative Humidity (%)	3pm cloud cover	3pm wind direction	3pm wind speed (km/h)	3pm Air Pressure (hPa)
16/01/2020	31.2	17.3	65	7	S	33	1012.3
17/01/2020	0.8	23.8	50	7	SSW	20	1009.6
18/01/2020	0	26.9	47	7	S	26	1005.7
19/01/2020	0	27.6	47	3	S	26	1002.4
20/01/2020	0.2	18.8	80	8	S	31	1003.5
21/01/2020	25.2	22.6	42	1	SSW	11	1007.9
22/01/2020	0	31	20	7	NNW	56	998.6
23/01/2020	18	20.2	47	7	W	43	998.9
24/01/2020	0.6	21.2	40	7	WNW	11	1012.1
25/01/2020	0	26.9	36	1	S	20	1012.2

Table 15. St Kilda Botanical Gardens and Elster Creek bat survey

Date	Rainfall (mm)	3pm Temp (°C)	3pm Relative Humidity (%)	3pm cloud cover	3pm Wind Direction	3pm Wind Speed (km/h)	3pm Air Pressure (hPa)
9/02/2020	0	26.5	44	7	E	35	1014.9
10/02/2020	0.8	25.8	58	7	SE	15	1008.2
11/02/2020	0	27.2	54	7	SSW	20	1008.1
12/02/2020	0.4	24	74	6	S	26	1013
13/02/2020	0.2	30.3	45	2	SE	9	1009.8
14/02/2020	0	22.1	86	7	WSW	39	1006.1
15/02/2020	11.2	17.3	98	8	SSW	22	1011.3

Table 16. Elwood Canal reptile survey

Date	Rainfall (mm)	9am Temp (°C)	3pm Temp (°C)	Cloud cover	Ave wind speed (km/h)	Air Pressure (hPa)
11/02/2020	0	20.5	27	7	14	1009.2

Table 17. St Kilda Breakwater Rakali and St Kilda Spit shorebird survey

Date	Rainfall (mm)	3pm Temp (°C)	3pm Relative Humidity (%)	3pm cloud cover (oktas)	3pm wind direction	3pm wind speed (km/h)	3pm Air Pressure (hPa)
10/03/2020	0	20.5	63	0	SW	17	1019.4

5 SIGNIFICANT TREES

5.1 Significant Tree mapping

According to the City of Port Phillip (2020), a *Significant Tree* means a tree or palm on private land:

- With a trunk circumference of 150 centimetres or greater measured 1 metre from the base;
- A multi-stemmed tree where the circumference of its exterior stems equals or is greater than 1.5 metres when measured 1 metre from its base; or
- If the tree has been removed, a trunk circumference of 150 centimetres or greater measured at its base.

Properties potentially containing Significant Trees were mapped using aerial photography for private property across the City of Port Phillip. The methods undertaken for this analysis are provided in Section 2.3.

The highest concentration of private properties with a high likelihood of containing Significant Trees were centred in Elwood (155 parcels) and St Kilda (115 parcels). St Kilda and St Kilda East contained the highest concentration of properties determined to have a Moderate likelihood, with 214 parcels and 147 parcels, respectively.

Potential Significant Trees were more commonly located in the southern portions of the municipality, compared to the north, primarily in residential areas compared to industrial areas. Of all 1265 private property parcels potentially containing Significant Trees:

- Approximately 94% fall within residential zones
 - 41% of those have a High likelihood
 - 59% of those have a Moderate likelihood
- Approximately 3.4% fall within the commercial zones
 - 59% of those have a High likelihood
 - 41% of those have a High likelihood
- 2.6% are within other zones.

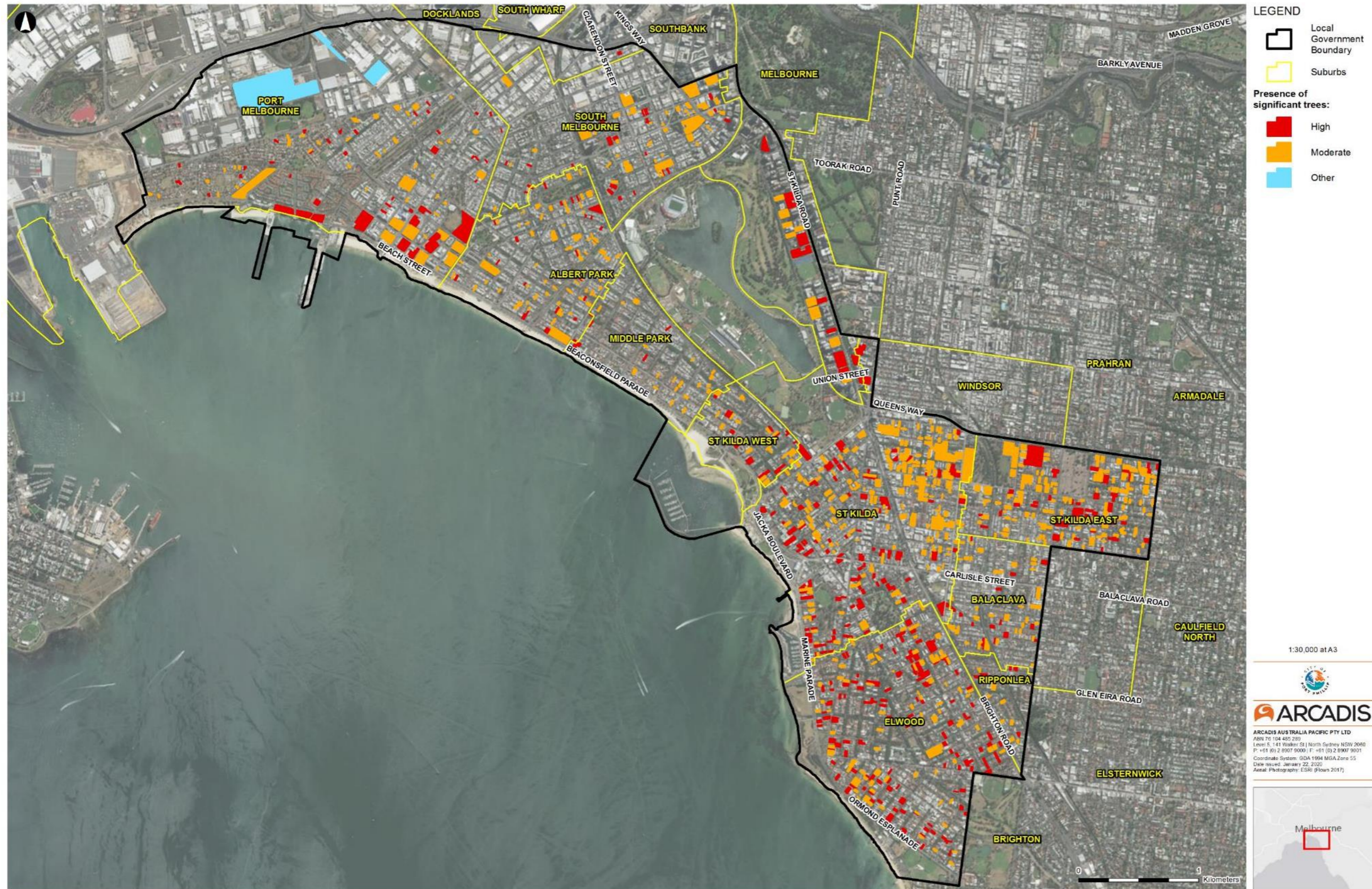
Three large industrial parcels in Port Melbourne that have registered Significant Trees were placed into the 'Other' category as potentially Significant Trees could not be seen in the aerial imagery.

Table 18 provides a suburb break down of the number of properties in the High, Moderate or Other likelihood categories, with all other properties falling in the Low likelihood category. The distributions of these are depicted in Figure 17.

Table 18. Suburb breakdown of the number of properties in the High, Moderate or Other likelihood of containing Significant Trees categories.

Suburb	High Likelihood	Moderate Likelihood	Other
Elwood	155	83	0
St Kilda	123	214	0
St Kilda East	49	147	0
Port Melbourne	48	54	3
South Melbourne	27	62	0
Balaclava	25	50	0
Albert Park	24	87	0
St Kilda West	16	19	0
Melbourne	18	9	0
Ripponlea	8	12	0
Middle Park	4	24	0
Windsor	3	0	0
Southbank	1	0	0
TOTAL	501	761	3

Port Phillip Tree Significance Assessment



Tree Significance

Figure 17. Likelihood of private properties to contain Significant Trees based on aerial photo interpretation.

5.2 Provisions for the protection of Significant Trees and environmental values

A comparison of the potential benefits and limitations of different Planning Scheme and Local Law mechanisms that could be used to protect Significant Trees and other environmental values is provided in Table 19

Table 19. Potential mechanisms available to increase the protection of Significant Trees and other environmental values within the Port Phillip municipality.

Mechanism	Potential benefits	Potential limitations	Comments
Planning scheme			
Vegetation Protection Overlay (VPO)	<p>Can apply to remnant and exotic/planted vegetation.</p> <p>Protection can be for biodiversity, amenity, landscape and heritage values – can be adapted to cover specific trees or areas of vegetation, or provide blanket coverage over wider areas.</p> <p>Protects vegetation that could otherwise be permitted for removal under exemptions of Clause 52.17 Native Vegetation.</p> <p>Can include offsets (e.g. compensation plantings) or application of additional mitigation measures (land management plans) if the vegetation is permitted to be removed.</p>	<p>Only triggers a planning permit for the removal or lopping of vegetation. Buildings and works that would not require a permit but may indirectly impact vegetation (e.g. a Tree Protection Zone), would not be controlled by the VPO. If used to protect Significant Trees – trees would need to be mapped which can be costly and incomplete for areas of private land that cannot be accessed. Alternatively, blanket application can be applied where sufficient justification can be provided (e.g. Banyule and Monash Planning Schemes).</p> <p>Introduction of new overlay schedules (or changes to the existing schedules) requires a planning scheme amendment, which can be lengthy process, including the preparation of amendment documents, and in some circumstances supporting documentation, public exhibition and a planning panel.</p>	<p>There is only one VPO schedule in Port Phillip planning scheme – it affects a significant English Oak tree on one property in St Kilda.</p> <p>Given the limitations of the VPO, the need for a VPO should be viewed in context of whether a VPO would be beneficial above the already existing Local Law relating to Significant Trees and other overlay options.</p> <p>Depending how a VPO is used to protect Significant Trees, the trees may need to be mapped or the VPO applied to extensive areas (as is the case in Banyule and Monash Planning Schemes, for example). Mapping trees is a cost to factor in but there are significant benefits to council decision-makers in having this data on hand.</p>
Environmental Significance Overlay (ESO)	<p>Protects areas supporting important biodiversity/environmental values and is the preferred overlay for achieving biodiversity outcomes (DELWP 2017).</p>	<p>Specifically applies to the protection of biodiversity and/or environmental values (e.g. waterways and coastal environs). Amenity values are not</p>	<p>Four ESO schedules currently in use for Port Phillip – Light Rail, Corroboee Tree, West Beach Natural History Reserve and Port Melbourne Environs. There may be additional opportunities to protect notable biodiversity and environmental values (e.g. habitat for</p>

Mechanism	Potential benefits	Potential limitations	Comments
	<p>Broader application than a VPO, including permit for development or other works, and impacts to significant habitat or other environmental values not associated with vegetation.</p> <p>Protects vegetation (including non-remnant vegetation) that could otherwise be permitted for removal under exemptions of Clause 52.17 Native Vegetation.</p> <p>Can include offsets (e.g. compensation plantings) and/or application of additional mitigation measures (land management plans) if the vegetation is permitted to be removed and/or works approved.</p>	<p>considered in this overlay.</p> <p>Introduction of new overlay schedules (or changes to the existing schedules) requires a planning scheme amendment, which can be lengthy process, including the preparation of amendment documents, and in some circumstances supporting documentation, public exhibition and a planning panel.</p>	<p>Rakali, areas of native vegetation, coastal areas and areas along waterways) outside of these areas through the use of additional ESO schedules. Much of these areas will be on public land and the benefits of this would need to be weighed up with the resources required for a planning scheme amendment.</p>
<p>Other overlays affecting trees and landscapes:</p> <ul style="list-style-type: none"> • Significant Landscape Overlay (SLO) • Neighbourhood Character Overlay (NCO) • Heritage Overlay (HO) 	<p>Can consider aesthetic, landscape, cultural and natural heritage values.</p> <p>Can include provisions for removal of vegetation and building and works.</p> <p>Protects vegetation (including non-remnant vegetation) that could otherwise be permitted for removal under exemptions of Clause 52.17 Native Vegetation.</p>	<p>Not to be used to protect biodiversity values only, although Significant Trees are not determined on their biodiversity values, rather their size.</p> <p>Introduction of new overlay schedules (or changes to the existing schedules) requires a planning scheme amendment, which can be lengthy process, including the preparation of amendment documents, and in some circumstances supporting documentation, public exhibition and a planning panel.</p>	<p>There is no Significant Landscape Overlay currently within the Port Phillip Planning Scheme. Inclusion of a new overlay requires a Planning Scheme Amendment and is an onerous process, as is developing new schedules or amendments to existing schedules to existing overlays. However an SLO may be useful along coastal areas to protect the landscape features.</p> <p>A NCO currently applies to properties within the Beacon Cove area. Additional NCOs could be developed to increase the coverage of this overlay for tree protection. However, given the extensive coverage of the Heritage Overlay in Port Phillip, inclusion of more NCO schedules to cover additional areas may not be necessary. Instead, there may be opportunities to include tree controls that would protect Significant Trees within alternative overlays, including for works proposed within the vicinity of the tree.</p> <p>The use of HOs has been effective for Significant Tree protection in other municipalities such as Banyule and Casey where individual properties that are recognised for heritage values are covered by a HO, and some individual trees outside the HO properties are also covered by a HO, or in some cases an ESO. The HO schedules include provision for tree controls for the majorities of properties covered, and apply to the entire property, not just the heritage place (e.g. building) listed. However, any additional controls would require a planning scheme amendment and heritage justification.</p>

Mechanism	Potential benefits	Potential limitations	Comments
Local Law			
Significant Trees	<p>Additional mechanism to planning scheme controls, that allows for the protection of Significant Trees within a municipality. A permit under the local law can be triggered if pruning, removal or works within the vicinity of a Significant Tree, is proposed.</p> <p>Can apply to native and non-native trees. Significance can be based on size (diameter or circumference of trunk) and/or other attributes. If based on size, then location of individual trees does not need to be mapped.</p> <p>Does not require a planning amendment.</p>	<p>Landowners are often not aware of local laws in relation to protection of trees and requirements for permits.</p> <p>Typically applies to trees and not other vegetation.</p> <p>May require amending Local Law.</p>	<p>Port Phillip already has Significant Trees (based on tree size) within its Local Law. There are opportunities to strengthen this policy to include a list and map of high priority trees for retention based on identified criteria, and also for the inclusion of a permit for works within the vicinity of Significant Trees. Local Laws expire after 10 years if they are not amended prior and this provides a good opportunity to review Local Laws and consider whether changes are required. Other example Local Laws include City of Bayside's Local Law No. 2 'Neighbourhood Amenity', City of Boroondara's "Tree Protection" Local Law and Brimbank City Council's proposed Municipal Tree Policy (in preparation).</p>

The best options for increasing protection of Significant Trees (regardless of their environmental values) needs to be viewed in the context of the values of the tree being protected, the location of the values (distribution and tenure of land), and the resources required to achieve the required outcome. For example, significant changes via a planning scheme amendment can be expensive, time consuming and onerous. This needs to be weighed up with the benefit of the changes and whether this will significantly improve the protection of the values being considered. Consideration should also be given to avoiding obtaining multiple provisions where the objective can be achieved with one provision (e.g. a Vegetation Protection Overlay (VPO) for Significant Trees and Local Law for Significant Trees). On this basis, the following are recommended for Port Phillip:

1. Review the Significant Tree requirements in the Port Phillip Local Law and consider increasing the protection measures associated with Significant Trees with new measures to be adopted once the current local law expires in August 2023. The current measures include all trees above a nominated size on private land. Consideration should be given to:
 - a. Protecting Significant Trees from impacts not associated with pruning or removal by including the requirement for a permit when works or development are undertaken within a nominated distance from the tree trunk.
 - b. Developing a registry and mapping the location of high retention value trees which are to be given a very high priority for retention when works or development are proposed (similar to Significant Trees within Boroondara's Local Law). Criteria would need to be developed to determine how the trees will be identified, and then assessed and mapped by an arborist. A system for nominating specific trees by the public could also be considered. Affected property owners would need to be notified. The registry could be reviewed every ten years when the Local Law is renewed. This would also allow additional trees to be included, and the health and condition of existing trees to be reassessed and removed from the registry if they no longer fulfilled the criteria.
2. Council to determine if additional planning controls are required in the planning scheme to protect Significant Trees (regardless of their environmental values) or vegetation / biodiversity values. The majority of the most significant vegetation (excluding Significant Trees) and biodiversity values for the municipality are located on public land and managed by public authorities. Implications of an overlay for future works or development on public land should be considered, as well as measures already in place

under existing planning provisions (zones and overlays, such as the Heritage Overlay). If additional planning controls are deemed necessary:

- a. Developing a new Environmental Significance Overlay or Vegetation Protection Overlay, or amending the existing Heritage Overlay to include more tree controls will be a costly and time-consuming exercise (some more than others). Significant Trees will need to be identified and assessed for their relevant value (e.g. heritage value, environmental or amenity value). Each of these overlay options have limitations in their effectiveness at protecting all Significant Trees. For example, ESOs are typically used for protecting the most significant biodiversity values of a municipality and do not consider amenity values and VPOs do not trigger permits for buildings and works that may indirectly impact a tree. A detailed investigation into these options would be required and Port Phillip would need to weight up the pros and cons of each option as outlined in Table 19.
- b. Based on the opportunities and limitations of the overlays considered above in Table 19 **Error! Reference source not found.**, the existing Heritage Overlay may provide an opportunity to include Significant Trees within the planning scheme. While some of the current schedules within the Port Phillip Heritage Overlay include tree controls, there is opportunity to include tree controls to more of the schedules (i.e. a planning permit required to remove, lop, or undertaken works within the vicinity of a Significant Trees). This would require the trees and vegetation within each property to be considered for their heritage value. There is quite an overlap between private properties that have a moderate to high likelihood of supporting a Significant Tree (Figure 17) and those affected by the Heritage Overlay. While there would be some duplication in permit requirements for works associated with Significant Trees, this would allow a planning permit to consider, (1) the implications of the proposed works on the heritage place, including Significant Trees (e.g. measures taken to protect Significant Trees during works), and (2) how the new development takes into account the health, appearance and setting of the tree.

As a priority, it will likely be most simple and quite effective (i.e. to cover general values in relation to Significant Trees such as landscape amenity and biodiversity) to include a Significant Trees requirement into Local Law. This will also provide a mechanism to address potential indirect impacts of works and development on the trees. So that the public are aware of the requirements of obtaining a Local Law permit before works are undertaken, a public consultation and awareness campaign is recommended.

Being a mapped planning mechanism, the application and implications of an overlays are more readily identified. A Vegetation Protection Overlay applied to large tracts of land would trigger a permit for direct impacts to Significant Trees (e.g. lopping, felling) and other vegetation, however indirect impacts to Tree Protection Zones during works would not. In such cases, the use of another planning overlay is recommended for Significant Trees when a specific objective is being achieved and/or when values are particularly significant (e.g. biodiversity, heritage). This would likely require the trees to be assessed and mapped as part of the Planning Scheme Amendment process. For example, Significant Trees could be protected in the existing Heritage Overlay if they are in the context of the heritage place being protected, such as trees that are very old and form part of the history of the property. Alternatively, large remnant indigenous trees could be protected for their biodiversity values under an Environmental Significance Overlay.

It is common in other Melbourne metropolitan municipalities (e.g. Banyule, Monash, Casey, Whitehorse to name a few) to protect Significant Trees via several different planning approaches including different areas of the landscape covered by Environmental Significance Overlay, Vegetation Protection Overlay, Significant Landscape Overlays and/or Heritage Overlays, while others only use a Local Law (e.g. Bayside). This would be more effective at protecting Significant Trees and other vegetation; however it will be a costly and time consuming process that must also be considered.

If it is determined that additional overlays on public land are not necessary, protocols could be developed to ensure adjoining significant vegetation on public land is protected, particularly when new development or other works are proposed.

The introduction of new planning controls will require consideration by City of Port Phillip to determine the most appropriate mechanism for protecting Significant Trees, vegetation and habitat (e.g. Rakali habitat at St Kilda Breakwater). Depending on the pathway(s) pursued, planning investigations and on-ground evaluation of identified values and species vegetation will be required. The Significant Tree mapping

undertaken as part of this study can provide a valuable contribution to refining investigation areas. Regardless of the planning mechanism chosen, community consultation and engagement will be essential.

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APPENDIX A – FAUNA EQUIPMENT DEPLOYMENT AND HABITAT CHARACTERISTICS




Bat Detectors

ID	Site Photographs – Bat Detectors	Comments
IMG_20200117_112528	 A photograph showing a close-up of a tree trunk with a small, dark bat detector attached to it. The tree has thick, textured bark and dense green foliage in the background.	Canterbury Forest bat detector
IMG_20200117_112226	 A photograph of a dirt path winding through a forest. The path is flanked by dense green bushes and trees. The sky is visible through the canopy.	Canterbury Forest bat flyway. Overstorey of non-provenance native species

ID	Site Photographs – Bat Detectors	Comments
IMG_1152		St Kilda Botanical Gardens bat detector
IMG_1150		St Kilda Botanical Gardens bat foraging habitat adjacent to detector
IMG_1154		Elster Creek bat detector

ID	Site Photographs – Bat Detectors	Comments
IMG_20200201_095542		<p>Elster Creek bat foraging habitat adjacent to detector.</p> <p>Mixture of River Red Gum and Sugar Gum overstorey with Typha within Elster Creek</p>
IMG_1084		<p>Point Ormond Reserve bat detector</p>
IMG_20200201_100715		<p>Point Ormond Reserve foraging bat habitat adjacent to detector.</p> <p>One of the few areas of relatively intact remnant vegetation.</p>

Song Meter Frog Recorders

ID	Site Photographs – Song Meters frog recorders	Comments
IMG_1079		St Kilda Botanical Gardens Song Meter frog recorder
IMG_20200201_093449		St Kilda Botanical Gardens frog habitat adjacent to recorder
IMG_1082		Elster Creek Song Meter frog recorder



ID	Site Photographs – Song Meters frog recorders	Comments
IMG_1156		Elster Creek frog habitat adjacent to recorder

Reptile Search Habitat

ID	Site Photographs – Reptile Search Habitat	Comments
IMG_20200211_132126		Elwood Canal indicative skink habitat

ID	Site Photographs – Reptile Search Habitat	Comments
IMG_20200211_132310		Elwood Canal indicative skink habitat
IMG_20200211_142029		Elwood Canal indicative skink habitat

Rakali Survey Habitat

ID	Site Photographs – Rakali Survey Habitat	Comments
IMG_20200211_145758	 A photograph showing a rocky breakwater along a coastline. In the background, there is a small, elevated structure that looks like a watchtower or a guard post. The sky is blue with some light clouds.	St Kilda Breakwater search area
IMG_20200211_145625	 A close-up photograph of large, dark grey basalt boulders stacked along a breakwater. A metal railing is visible in the foreground, and a fence runs along the top of the boulders in the background.	St Kilda Breakwater with basalt boulders providing roosting and feeding stations.

Shorebird survey

ID	Site Photographs – Shorebird Survey	Comments
IMG_1229		St Kilda Spit survey area

APPENDIX B – FAUNA SURVEY FIELD MAPS

City of Port Phillip City of Port Phillip Biodiversity Study
 Canterbury Forest



- LEGEND**
- Study area
 - ◆ Bat detector

1:2,000 at A4



ARCADIS AUSTRALIA PACIFIC PTY LTD
 ABN 76 104 486 289
 Level 5, 141 Walker St | North Sydney NSW 2060
 P +61 (0) 2 8907 0000 | F +61 (0) 2 8907 9001
 Coordinate System: GDA 1994 MGA Zone 55
 Date issued: February 26, 2020



Fauna surveying

Date: 26/02/2020 Path: \\hc-aus-rc-s-01\jobs\10036163\L-GIS\B_Workshop\200217_TaraLaptop_Ecology\Ecology\TT_working\A4_PortPhillip_CanterburyFauna_A4L_v1.mxd
 Created by: RM
 QA by: LH

City of Port Phillip City of Port Phillip Biodiversity Study
 Elster Creek



- LEGEND
- Study area
 - Waterbody
 - Survey transect

1:4,000 at A4



ARCADIS AUSTRALIA PACIFIC PTY LTD
 ABN 76 101 166 289
 Level 6, 141 Walker St, North Sydney NSW 2060
 P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001
 Coordinate System: GDA 1984 MGA Zone 55
 Date issued: February 29, 2020



Fauna surveying

Page 1 of 2



LEGEND

- Study area
- Waterbody
- Bat detector and Frog recorder
- Survey transect

1:4,000 at A4



ARCADIS AUSTRALIA PACIFIC PTY LTD
 ABN 76 104 465 209
 Level 5, 141 Walker St, North Sydney NSW 2060
 P. +61 (0) 2 8507 5000 | F. +61 (0) 2 8907 9001
 Coordinate System: GDA 1984 MGA Zone 56
 Data issued: February 26, 2020



City of Port Phillip City of Port Phillip Biodiversity Study
Point Ormond



- LEGEND**
- Study area
 - ◆ Bat detector

1:4,000 at A4



ARCADIS AUSTRALIA PACIFIC PTY LTD
 AUM 76 104 405 289
 Level 5, 145 Walker St | North Sydney NSW 2060
 P: +61 (0) 2 9907 9000 | F: +61 (0) 2 9907 9001
 Coordinate System: GDA 1994 MGA Zone 56
 Date issued: March 2, 2020



Fauna surveying

City of Port Phillip City of Port Phillip Biodiversity Study
St Kilda Botanical Gardens



- LEGEND**
- ▭ Study area
 - ▭ Waterbody
 - ◆ Bat and Frog Detectors
 - ◆ Frog Recorder

1:3,000 at A4



ARCADIS

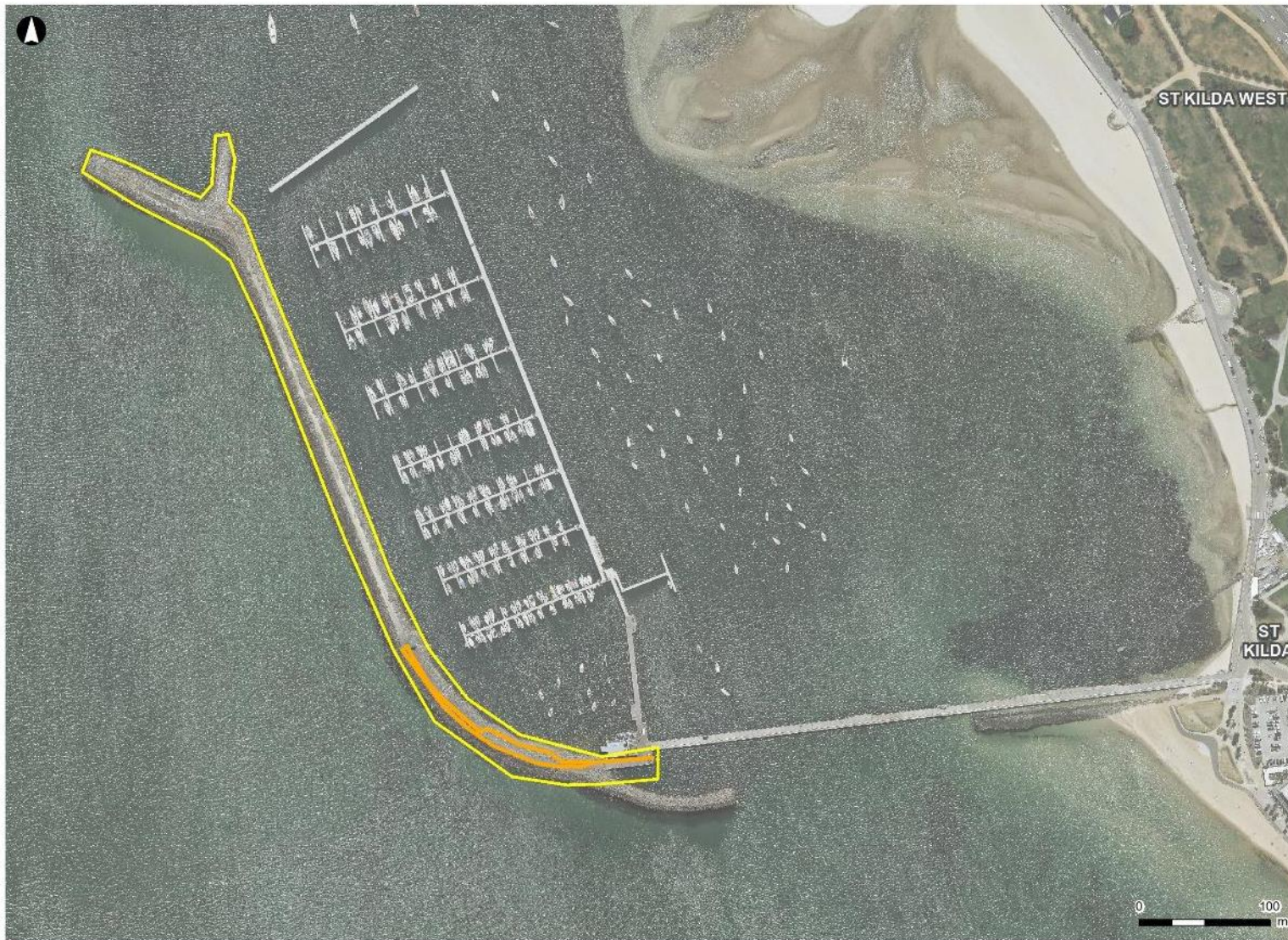
ARCADIS AUSTRALIA PACIFIC PTY LTD
 ABN 76 104 486 289
 Level 14, 141 Walker St | North Sydney NSW 2060
 P +61 (0) 2 8907 3000 | F +61 (0) 2 9887 3001
 Coordinate System: GDA 1994 MGA Zone 55
 Date issued: February 26, 2020





Fauna surveying

Date: 26/02/2020 Path: \\he-aus-vc-fs-01\Jobs\10036163\GIS\B_Workshop\200217_TaraLaptop_Ecology\Ecology\TT_working\A4_PortPhillip_StKildaBotanicalGardens_A4L_v1.mxd
 Created by : RM
 QA by : LH

City of Port Phillip City of Port Phillip Biodiversity Study
 St Kilda Breakwater



LEGEND

-  Study area
-  Survey transect

1:4,500 at A4



ARCADIS AUSTRALIA PACIFIC PTY LTD
 ABN 78 104 465 269
 Level 5, 141 Walker St | North Sydney NSW 2060
 P +61 (0) 2 9587 0000 | F +61 (0) 2 9587 0001
 Coordinate System: GDA 1994 MGA Zone 55
 Date issued: March 2, 2020



Fauna surveying

City of Port Phillip City of Port Phillip Biodiversity Study
 St Kilda Spit



LEGEND
 Study area

1:6,500 at A4



ARCADIS
 ARCADIS AUSTRALIA PACIFIC PTY LTD
 ADN 76 104 485 289
 Level 5, 141 Walker St | North Sydney NSW 2060
 P +61 (0) 2 8867 9000 | F +61 (0) 2 8907 9001
 Coordinate System: GDA 1994 MGA Zone 55
 Date issued: March 11, 2020



Fauna surveying

Date: 11/03/2020 Path: \\hpc-aus-vc-fs-01\Jobs\10036163\GIS\B_Workshop\200217_Tara\Laptop_Ecology\Ecology\TT_working\A4_PortPhillip_StKildaSpit_A4L_v1.mxd
 Created by: RM
 QA by: LH

APPENDIX C – PLANT SPECIES RECORDED DURING THE FIELD SURVEYS

Key:

*	Exotic species
#	Victorian native species that are non-indigenous to the City of Port Phillip
(#)	Indigenous species that can naturalise outside their natural range and are considered non-indigenous in areas away from the coast
EPBC	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FFG	Victorian <i>Flora and Fauna Guarantee Act 1988</i>
VROT	Victorian Rare or threatened species in Victoria (DEPI 2014)
cr	Classified as Critically Endangered in Victoria
en	Classified as Endangered in Victoria
vu	Classified as Vulnerable in Victoria
nt	Classified as Near Threatened in Victoria
dd	Classified as Data Deficient in Victoria

EPBC	FFG	VROT	Taxon Name	Taxon Common Name	Number of zones recorded
			<i>Acacia acinacea</i> s.l.	Gold-dust Wattle	1
		*	<i>Acacia baileyana</i>	Cootamundra Wattle	3
			<i>Acacia dealbata</i>	Silver Wattle	1
		#	<i>Acacia floribunda</i>	White Sallow-wattle	1
			<i>Acacia implexa</i>	Lightwood	6
		#	<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sallow Wattle	1
		(#)	<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coast Wattle	9
			<i>Acacia mearnsii</i>	Black Wattle	6
			<i>Acacia melanoxylon</i>	Blackwood	6
			<i>Acacia paradoxa</i>	Hedge Wattle	8
			<i>Acacia</i> spp.	Wattle	1
			<i>Acacia stricta</i>	Hop Wattle	1
			<i>Acacia suaveolens</i>	Sweet Wattle	1
		r	<i>Acacia uncifolia</i>	Coast Wirilda	1
			<i>Acaena novae-zelandiae</i>	Bidgee-widgee	1
			<i>Actites megalocarpus</i>	Dune Thistle	1
		*	<i>Allocasuarina diminuta</i> subsp. <i>diminuta</i>	Waxy Sheoak	2
			<i>Allocasuarina littoralis</i>	Black Sheoak	8
			<i>Allocasuarina paradoxa</i>	Green Sheoak	1
			<i>Allocasuarina verticillata</i>	Drooping Sheoak	12
		*	<i>Aloe maculata</i>	Common Soap Aloe	2
			<i>Alyxia buxifolia</i>	Sea Box	6
			<i>Anthosachne scabra</i> s.l.	Common Wheat-grass	2
		*	<i>Araujia sericifera</i>	White Bladder-flower	2
			<i>Atriplex cinerea</i>	Coast Saltbush	15
		r	<i>Atriplex paludosa</i> subsp. <i>paludosa</i>	Marsh Saltbush	6
			<i>Atriplex semibaccata</i>	Berry Saltbush	2
			<i>Austrostipa bigeniculata</i>	Kneed Spear-grass	3
			<i>Austrostipa flavescens</i>	Coast Spear-grass	9
			<i>Austrostipa scabra</i>	Rough Spear-grass	2
			<i>Austrostipa</i> spp.	Spear Grass	1
			<i>Austrostipa stipoides</i>	Prickly Spear-grass	14
		*	<i>Avena barbata</i>	Bearded Oat	1
		*	<i>Avena fatua</i>	Wild Oat	2
		*	<i>Avena</i> spp.	Oat	3

EPBC	FFG	VROT	Taxon Name	Taxon Common Name	Number of zones recorded
			<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>	Coast Banksia	13
			<i>Banksia marginata</i>	Silver Banksia	1
			<i>Banksia serrata</i>	Saw Banksia	1
			<i>Banksia</i> spp.	Banksia	1
		*	<i>Billardiera fusiformis</i>	Bluebell Creeper	1
			<i>Bossiaea cinerea</i>	Showy Bossiaea	1
		*	<i>Brassica fruticulosa</i>	Twiggy Turnip	2
		*	<i>Briza maxima</i>	Large Quaking-grass	1
		*	<i>Bromus catharticus</i>	Prairie Grass	8
		*	<i>Bromus diandrus</i>	Great Brome	11
		*	<i>Bromus hordeaceus</i>	Soft Brome	2
			<i>Bursaria spinosa</i>	Sweet Bursaria	8
		*	<i>Cakile maritima</i> subsp. <i>maritima</i>	Sea Rocket	5
			<i>Callistemon sieberi</i>	River Bottlebrush	1
			<i>Carex appressa</i>	Tall Sedge	2
			<i>Carex pumila</i>	Strand Sedge	2
			<i>Carex</i> spp.	Sedge	1
			<i>Carex tereticaulis</i>	Poong'ort	1
		*	<i>Carpobrotus edulis</i>	Hottentot Fig	1
			<i>Carpobrotus rossii</i>	Karkalla	8
			<i>Cassinia sifton</i>	Sifton Bush	3
			<i>Cassytha melantha</i>	Coarse Dodder-laurel	1
		*	<i>Cenchrus clandestinus</i>	Kikuyu	5
			<i>Chrysocephalum apiculatum</i> s.l.	Common Everlasting	3
			<i>Chrysocephalum apiculatum</i> subsp. <i>apiculatum</i>	Common Everlasting	1
			<i>Chrysocephalum semipapposum</i> subsp. <i>semipapposum</i>	Clustered Everlasting	1
			<i>Clematis microphylla</i> s.l.	Small-leaved Clematis	6
			<i>Coprosma quadrifida</i>	Prickly Currant-bush	1
		*	<i>Coprosma repens</i>	Mirror Bush	1
			<i>Correa alba</i> var. <i>alba</i>	White Correa	11
		*	<i>Correa baeuerlenii</i>	Chef's Cap Correa	1
			<i>Correa reflexa</i>	Common Correa	2
			<i>Correa reflexa</i> var. <i>reflexa</i>	Common Correa	2
	v	#	<i>Corymbia maculata</i>	Spotted Gum	1
			<i>Crassula</i> spp.	Crassula	1
		*	<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch	12
		*	<i>Cyperus eragrostis</i>	Drain Flat-sedge	1
		*	<i>Delairea odorata</i>	Cape Ivy	1
			<i>Dianella brevicaulis</i>	Small-flower Flax-lily	19
			<i>Dianella longifolia</i> s.l.	Pale Flax-lily	7
			<i>Dianella revoluta</i> s.l.	Black-anther Flax-lily	7
			<i>Dichelachne crinita</i>	Long-hair Plume-grass	2
			<i>Dichelachne</i> spp.	Plume Grass	1
			<i>Dichondra repens</i>	Kidney-weed	1
		*	<i>Dipogon lignosus</i>	Common Dipogon	1
			<i>Disphyma crassifolium</i> subsp. <i>clavellatum</i>	Rounded Noon-flower	9
			<i>Distichlis distichophylla</i>	Australian Salt-grass	6

EPBC	FFG	VROT	Taxon Name	Taxon Common Name	Number of zones recorded
			<i>Distichlis distichophylla</i> / <i>Sporobolus virginicus</i>	Australian Salt-grass/Salt Couch species aggregate	2
			<i>Duma florulenta</i>	Tangled Lignum	2
		*	<i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass	12
		*	<i>Ehrharta longiflora</i>	Annual Veldt-grass	5
			<i>Einadia nutans</i> subsp. <i>nutans</i> (s.s.)	Nodding Saltbush	3
			<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Ruby Saltbush	2
			<i>Enchylaena tomentosa</i> var. <i>tomentosa</i> (prostrate form)	Ruby Saltbush (prostrate southern form)	2
			<i>Epilobium hirtigerum</i>	Hairy Willow-herb	1
		*	<i>Erigeron</i> spp.	Fleabane	8
			<i>Eucalyptus camaldulensis</i>	River Red-gum	7
			<i>Eucalyptus cephalocarpa</i> s.l.	Silver-leaf Stringybark	2
		*	<i>Eucalyptus cladocalyx</i>	Sugar Gum	1
		*	<i>Eucalyptus lehmannii</i>	Bushy Yate	1
			<i>Eucalyptus leucoxylon</i>	Yellow Gum	1
			<i>Eucalyptus melliodora</i>	Yellow Box	5
			<i>Eucalyptus ovata</i>	Swamp Gum	4
			<i>Eucalyptus polyanthemos</i>	Red Box	1
		r	<i>Eucalyptus sideroxylon</i> subsp. <i>sideroxylon</i>	Mugga	2
			<i>Eucalyptus</i> spp.	Eucalypt	3
			<i>Eucalyptus viminalis</i>	Manna Gum	1
			<i>Eucalyptus viminalis</i> subsp. <i>pryoriana</i>	Coast Manna-gum	6
		*	<i>Euphorbia paralias</i>	Sea Spurge	1
			<i>Eutaxia microphylla</i>	Common Eutaxia	2
			<i>Ficinia nodosa</i>	Knobby Club-sedge	14
		*	<i>Fraxinus angustifolia</i>	Desert Ash	2
			<i>Gahnia filum</i>	Chaffy Saw-sedge	4
			<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge	2
		*	<i>Galenia pubescens</i> var. <i>pubescens</i>	Galenia	7
			<i>Geranium</i> spp.	Crane's Bill	1
			<i>Goodenia ovata</i>	Hop Goodenia	8
		*	<i>Hakea drupacea</i>	Sweet Hakea	2
			<i>Hardenbergia violacea</i>	Purple Coral-pea	3
		*	<i>Hedera helix</i>	English Ivy	2
			<i>Helichrysum luteoalbum</i>	Jersey Cudweed	7
		*	<i>Hordeum marinum</i>		4
		*	<i>Hypochaeris radicata</i>	Flatweed	4
			<i>Imperata cylindrica</i>	Blady Grass	1
			<i>Indigofera australis</i> subsp. <i>australis</i>	Austral Indigo	3
		*	<i>Juncus acutus</i> subsp. <i>acutus</i>	Spiny Rush	2
			<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Sea Rush	6
			<i>Juncus pallidus</i>	Pale Rush	2
			<i>Kennedia prostrata</i>	Running Postman	1
			<i>Kunzea</i> sp. (Upright form)	Forest Burgan	3
		*	<i>Lactuca serriola</i>	Prickly Lettuce	4
		*	<i>Lagunaria patersonia</i> subsp. <i>patersonia</i>	Pyramid Tree	1
		*	<i>Lagurus ovatus</i>	Hare's-tail Grass	3
			<i>Lasiopetalum baueri</i>	Slender Velvet-bush	7

EPBC	FFG	VROT	Taxon Name	Taxon Common Name	Number of zones recorded
		*	<i>Lepidium africanum</i>	Common Peppercross	2
			<i>Lepidosperma concavum</i>	Sandhill Sword-sedge	5
			<i>Leptospermum continentale</i>	Prickly Tea-tree	1
		(#)	<i>Leptospermum laevigatum</i>	Coast Tea-tree	8
			<i>Leptospermum lanigerum</i>	Woolly Tea-tree	1
			<i>Leucophyta brownii</i>	Cushion Bush	9
			<i>Leucopogon parviflorus</i>	Coast Beard-heath	1
			<i>Linum marginale</i>	Native Flax	2
		*	<i>Lolium rigidum</i>	Wimmera Rye-grass	2
			<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	4
			<i>Lomandra longifolia</i> subsp. <i>longifolia</i>	Spiny-headed Mat-rush	10
		*	<i>Lysimachia arvensis</i>	Pimpernel	2
			<i>Malva</i> spp.	Mallow	2
		*	<i>Medicago polymorpha</i>	Burr Medic	4
	r	#	<i>Melaleuca armillaris</i> subsp. <i>armillaris</i>	Giant Honey-myrtle	3
			<i>Melaleuca ericifolia</i>	Swamp Paperbark	4
			<i>Melaleuca lanceolata</i>	Moonah	3
		*	<i>Melaleuca nesophila</i>	Showy Honey-myrtle	1
		*	<i>Melilotus indicus</i>	Sweet Melilot	5
			<i>Muehlenbeckia australis</i>	Climbing Lignum	1
			<i>Myoporum insulare</i>	Common Boobialla	10
		*	<i>Myoporum laetum</i>	Ngaio	1
			<i>Myoporum parvifolium</i>	Creeping Myoporum	5
			<i>Myoporum petiolatum</i>	Sticky Boobialla	1
		*	<i>Oenothera laciniata</i> subsp. <i>laciniata</i>	Cut-leaf Evening-primrose	1
			<i>Olearia axillaris</i>	Coast Daisy-Bush	9
			<i>Olearia glutinosa</i>	Sticky Daisy-bush	4
			<i>Olearia lirata</i>	Snowy Daisy-bush	2
			<i>Olearia ramulosa</i>	Twiggy Daisy-bush	5
			<i>Ozothamnus ferrugineus</i>	Tree Everlasting	1
		*	<i>Parapholis incurva</i>	Coast Barb-grass	3
		*	<i>Paraserianthes lophantha</i> subsp. <i>lophantha</i>	Cape Wattle	1
			<i>Pelargonium australe</i>	Austral Stork's-bill	6
			<i>Phragmites australis</i>	Common Reed	3
		*	<i>Phytolacca octandra</i>	Red-ink Weed	1
		*	<i>Pinus radiata</i>	Radiata Pine	1
		*	<i>Pittosporum crassifolium</i>	Karo	1
		*	<i>Plantago coronopus</i>	Buck's-horn Plantain	3
		*	<i>Plantago lanceolata</i>	Ribwort	2
		*	<i>Poa annua</i>	Annual Meadow-grass	1
			<i>Poa labillardierei</i> var. <i>labillardierei</i>	Common Tussock-grass	4
			<i>Poa poiformis</i>	Coast Tussock-grass	9
			<i>Poa sieberiana</i>	Grey Tussock-grass	1
		*	<i>Polygonum aviculare</i> s.l.	Prostrate Knotweed	2
			<i>Pomaderris paniculosa</i> subsp. <i>paralia</i>	Coast Pomaderris	3
			<i>Portulaca oleracea</i>	Common Purslane	1
			<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush	16
			<i>Ricinocarpos pinifolius</i>	Wedding Bush	1

EPBC	FFG	VROT	Taxon Name	Taxon Common Name	Number of zones recorded
		*	<i>Romulea rosea</i>	Onion Grass	2
			<i>Rumex</i> spp.	Dock	1
			<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	4
			<i>Rytidosperma fulvum</i>	Copper-awned Wallaby-grass	1
			<i>Rytidosperma geniculatum</i>	Kneed Wallaby-grass	1
			<i>Rytidosperma pilosum</i>	Velvet Wallaby-grass	1
			<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	Slender Wallaby-grass	2
		*	<i>Schinus molle</i>	Pepper Tree	5
		*	<i>Scolymus hispanicus</i>	Golden Thistle	2
			<i>Senecio pinnatifolius</i> var. <i>lanceolatus</i>	Lance-leaf Groundsel	1
			<i>Senecio quadridentatus</i>	Cotton Fireweed	1
			<i>Solanum laciniatum</i>	Large Kangaroo Apple	4
		*	<i>Solanum nigrum</i> s.l.	Black Nightshade	1
		*	<i>Sonchus asper</i> s.l.	Rough Sow-thistle	1
		*	<i>Sonchus oleraceus</i>	Common Sow-thistle	20
			<i>Spinifex sericeus</i>	Hairy Spinifex	10
		*	<i>Stellaria media</i>	Chickweed	1
			<i>Selliera radicans</i>	Shiny Swamp-mat	1
		*	<i>Stenotaphrum secundatum</i>	Buffalo Grass	1
			<i>Suaeda australis</i>	Austral Seablite	3
		*	<i>Symphotrichum subulatum</i>	Aster-weed	1
			<i>Tetragonia implexicoma</i>	Bower Spinach	10
			<i>Tetragonia tetragonioides</i>	New Zealand Spinach	1
			<i>Themeda triandra</i>	Kangaroo Grass	2
		*	<i>Thinopyrum junceiforme</i>	Sea Wheat-grass	2
			<i>Tortula muralis</i>	Common Wall-moss	1
			<i>Trachymene composita</i>	Parsnip Trachymene	1
		*	<i>Trifolium arvense</i> var. <i>arvense</i>	Hare's-foot Clover	1
			<i>Triquetrella papillata</i>	Common Twine-moss	1
		*	<i>Vicia</i> spp.	Vetch	2
		*	<i>Viola odorata</i>	Common Violet	1
		*	<i>Vulpia fasciculata</i>	Dune Fescue	2
		*	<i>Vulpia</i> spp.	Fescue	6
			<i>Wahlenbergia communis</i> s.l.	Tufted Bluebell	3
			<i>Wahlenbergia multicaulis</i>	Branching Bluebell	1
		*	<i>Watsonia</i> spp.	Watsonia	1
			<i>Xerochrysum viscosum</i>	Shiny Everlasting	2

APPENDIX D – FLORISTIC QUADRAT DATA

Key:

EVC Ecological Vegetation Class
* Exotic taxon

Quadrat 1				
Ecological Vegetation Class	160: Coastal Dune Scrub			
Site	Elwood Coastline			
Coordinates	144.9809985, -37.8856016			
Date	23/01/2020			
Recorder	NR & FS			
Habitat Attribute Type	Cover			
Non-vascular plants and lichens	<1%			
Bare ground	1-5%			
Rock	0%			
Litter	55-60%			
Taxon name	Taxon common name	Cover	Distribution	Recruiting
<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coast Wattle	10–15%	Scattered	
<i>Acacia paradoxa</i>	Hedge Wattle	<1%	Localised	
<i>Allocasuarina verticillata</i>	Drooping Sheoak	<1%	Localised	✓
* <i>Bromus hordeaceus</i>	Soft Brome	1-5%	Scattered	
<i>Clematis microphylla</i> var. <i>microphylla</i> spp. agg.	Small-leaved Clematis	<1%	Localised	
<i>Dianella brevicaulis</i>	Small-flower Flax-lily	<1%	Localised	
* <i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass	1-5%	Scattered	
* <i>Galenia pubescens</i> var. <i>pubescens</i>	Galenia	<1%	Localised	
* <i>Hypochaeris radicata</i>	Flatweed	<1%	Localised	
* <i>Melilotus indicus</i>	Sweet Melilot	<1%	Localised	
<i>Muehlenbeckia australis</i>	Climbing Lignum	1–5%	Scattered	
<i>Myoporum insulare</i>	Common Boobialla	15–20%	Scattered	✓
* <i>Plantago coronopus</i>	Buck's-horn Plantain	1–5%	Scattered	
<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush	40–45%	Widespread	✓
* <i>Romulea rosea</i>	Onion Grass	<1%	Localised	
* <i>Sonchus oleraceus</i>	Common Sow-thistle	<1%	Localised	
<i>Tetragonia implexicoma</i>	Bower Spinach	15–20%	Scattered	
* <i>Vulpia fasciculata</i>	Dune Fescue	<1%	Localised	

Notes: Small track runs through the quadrat. Some Drooping Sheoak have snapped trunks and are dead or lying flat. Canopy 1.8m. Dominant species Seaberry Saltbush and Common Boobialla.



a.



b.



c.

Figure 18. Photo-points for Quadrat 1 (a) looking east-south-east along the northern boundary, (b) looking south-south-east along the western boundary, and (c) photo of the stake in situ.

Quadrat 2				
EVC	2: Coast Banksia Woodland			
Site	Elwood Coastline			
Coordinates	144.9825306, -37.8864296			
Date	23/01/2020			
Recorder	NR & FS			
Habitat Attribute Type	Cover			
Non-vascular and lichens	<1%			
Bare ground	1-5%			
Rock	0%			
Litter	75-80%			
Taxon name	Taxon common name	Cover	Distribution	Recruiting
<i>Acacia paradoxa</i>	Hedge Wattle	1–5%	Localised	✓
<i>Allocasuarina verticillata</i>	Drooping Sheoak	15–20%	Scattered	
<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Sweet Bursaria	10–15%	Localised	
* <i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass	1–5%	Scattered	
<i>Eucalyptus ovata</i>	Swamp Gum	5–10%	Scattered	
<i>Eucalyptus viminalis</i> subsp. <i>pryoriana</i>	Coast Manna-gum	<1%	Localised	
* <i>Fraxinus angustifolia</i>	Desert Ash	<1%	Localised	
<i>Goodenia ovata</i>	Hop Goodenia	5–10%	Scattered	
<i>Lasiopetalum baueri</i>	Slender Velvet-bush	<1%	Localised	
<i>Lomandra longifolia</i> subsp. <i>longifolia</i>	Spiny-headed Mat-rush	<1%	Localised	
<i>Muehlenbeckia australis</i>	Climbing Lignum	1–5%	Scattered	✓
<i>Olearia glutinosa</i>	Sticky Daisy-bush	<1%	Localised	
<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush	75–80%	Widespread	✓
<i>Tetragonia implexicoma</i>	Bower Spinach	10–15%	Widespread	

Notes: c. 7 m tall canopy of Drooping Sheoak, Swamp Gum and Coast Manna Gum. Dense shrub layer approx. 4 m tall (Sweet Bursaria and Hedge Wattle). Small track through the quadrat. Sheoaks in poor health.



a.



b.

Figure 19. Photo-points for Quadrat 2 (a) looking east-south-east along the northern boundary, (b) looking south-south-east along the western boundary.

Quadrat 3				
EVC	2: Coast Banksia Woodland			
Site	Elwood Coastline			
Coordinates	144.9772278, -37.8817861			
Date	23/01/2020			
Recorder	NR & FS			
Habitat Attribute Type	Cover			
Non-vascular and lichens	<1%			
Bare ground	1-5%			
Rock	<1%			
Litter	70-75%			
Litter	75-80%	Cover	Distribution	Recruiting
<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coast Wattle	1–5%	Localised	
<i>Allocasuarina verticillata</i>	Drooping Sheoak	20–25%	Widespread	
<i>Alyxia buxifolia</i>	Sea Box	1–5%	Localised	
<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>	Coast Banksia	1–5%	Localised	
<i>Clematis microphylla</i> var. <i>microphylla</i> spp. agg.	Small-leaved Clematis	<1%	Localised	
* <i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass	5–10%	Scattered	
<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	Coast Manna-gum	1–5%	Localised	
<i>Myoporum insulare</i>	Common Boobialla	1–5%	Localised	✓
<i>Pomaderris paniculosa</i> subsp. <i>paralia</i>	Coast Pomaderris	1–5%	Localised	
<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush	75–80%	Widespread	✓
<i>Tetragonia implexicoma</i>	Bower Spinach	5–10%	Scattered	



Figure 20. Photo-points for Quadrat 3 (a) looking east-south-east along the northern boundary, (b) looking south-south-east along the western boundary, and (c) photo of the stake in situ.

Quadrat 4				
EVC	10: Estuarine Flats Grassland			
Site	St Kilda West Beach			
Coordinates	144.968307, -37.8589115			
Date	23/01/2020			
Recorder	NR & FS			
Habitat Attribute Type	Cover			
Non-vascular and lichens	0%			
Bare ground	<1%			
Rock	0%			
Litter	5-10%			
Taxon name	Taxon common name	Cover	Distribution	Recruiting
<i>Actites megalocarpus</i>	Dune Thistle	<1%	Localised	
<i>Austrostipa stipoides</i>	Prickly Spear-grass	10–15%	Scattered	
<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>	Coast Banksia	<1%	Localised	✓
* <i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch	10–15%	Scattered	
<i>Dianella brevicaulis</i>	Small-flower Flax-lily	1–5%	Localised	
<i>Distichlis distichophylla</i> / <i>Sporobolus virginicus</i>	Australian Salt-grass/Salt Couch species aggregate	35–40%	Widespread	
<i>Ficinia nodosa</i>	Knobby Club-sedge	50–55%	Widespread	
<i>Helichrysum adenophorum</i>	Branched Everlasting	<1%	Localised	
* <i>Hypochaeris radicata</i>	Flatweed	<1%	Localised	
* <i>Juncus acutus</i> subsp. <i>acutus</i>	Spiny Rush	<1%	Localised	
<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Sea Rush	1–5%	Scattered	
<i>Selliera radicans</i>	Shiny Swamp-mat	1–5%	Scattered	
* <i>Sonchus oleraceus</i>	Common Sow-thistle	<1%	Scattered	



a.



b.



c.

Figure 21. Photo-points for Quadrat 4 (a) looking east-south-east along the northern boundary, (b) looking south-south-east along the western boundary, and (c) photo of the stake in situ.

Quadrat 5				
EVC	879:Coastal Dune Grassland			
Site	Port Melbourne Foreshore			
Coordinates	144.915366, -37.8404189			
Date	23/01/2020			
Recorder	NR & FS			
Habitat Attribute Type	Cover			
Non-vascular and lichens	0%			
Bare ground	0%			
Rock	1-5%			
Litter	25-30%			
Taxon name	Taxon common name	Cover	Distribution	Recruiting
<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coast Wattle	<1%	Localised	✓
<i>Austrostipa stipoides</i>	Prickly Spear-grass	<1%	Localised	
* <i>Bromus diandrus</i>	Great Brome	5–10%	Widespread	
<i>Dianella brevicaulis</i>	Small-flower Flax-lily	<1%	Localised	
<i>Distichlis distichophylla</i> / <i>Sporobolus virginicus</i>	Australian Salt-grass/Salt Couch species aggregate	<1%	Localised	
* <i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass	1–5%	Scattered	
* <i>Lagurus ovatus</i>	Hare's-tail Grass	<1%	Localised	
<i>Poa poiformis</i>	Coast Tussock-grass	<1%	Localised	
* <i>Sonchus oleraceus</i>	Common Sow-thistle	<1%	Localised	
<i>Spinifex sericeus</i>	Hairy Spinifex	85–90%	Widespread	
* <i>Vulpia muralis</i>	Wall Fescue	<1%	Localised	



Figure 22. Photo-points for Quadrat 5 (a) looking east-south-east along the northern boundary, (b) looking south-south-east along the western boundary, and (c) photo of the stake in situ.

Quadrat 6				
EVC	879: Coastal Dune Grassland			
Site	Port Melbourne Foreshore			
Coordinates	144.913693, -37.841432			
Date	23/01/2020			
Recorder	NR & FS			
Habitat Attribute Type	Cover			
Non-vascular and lichens	<1%			
Bare ground	<1%			
Rock	10-15%			
Litter	10-15%			
Taxon name	Taxon common name	Cover	Distribution	Recruiting
<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coast Wattle	<1%	Localised	✓
<i>Allocasuarina verticillata</i>	Drooping Sheoak	<1%	Localised	✓
<i>Atriplex cinerea</i>	Coast Saltbush	1–5%	Scattered	✓
* <i>Bromus diandrus</i>	Great Brome	10–15%	Widespread	
* <i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch	15–20%	Widespread	
<i>Distichlis distichophylla</i> / <i>Sporobolus virginicus</i>	Australian Salt-grass/Salt Couch species aggregate	1–5%	Scattered	
<i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass	<1%	Localised	
<i>Ficinia nodosa</i>	Knobby Club-sedge	<1%	Localised	
* <i>Hypochaeris radicata</i>	Flatweed	<1%	Localised	
* <i>Lactuca serriola</i>	Prickly Lettuce	<1%	Localised	
<i>Laphangium luteoalbum</i>	Jersey Cudweed	<1%	Localised	
<i>Lepidosperma gladiatum</i>	Coast Sword-sedge	1–5%	Localised	
* <i>Oenothera laciniata</i> subsp. <i>laciniata</i>	Cut-leaf Evening-primrose	1–5%	Scattered	
<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush	1–5%	Localised	
* <i>Sonchus oleraceus</i>	Common Sow-thistle	<1%	Scattered	
<i>Spinifex sericeus</i>	Hairy Spinifex	40–45%	Widespread	
<i>Wahlenbergia multicaulis</i>	Branching Bluebell	<1%	Localised	



a.



b.



c.

Figure 23. Photo-points for Quadrat 6 (a) looking east-south-east along the northern boundary, (b) looking south-south-east along the western boundary, and (c) photo of the stake in situ

APPENDIX E – FAUNA HABITAT ASSESSMENT SHEETS

SITE DETAILS: St Kilda Botanical Gardens	
LAND TENURE: Public	EVC: N/A
TOPOGRAPHIC POSITION: N/A	
SIZE OF AREA (ha): 7.6ha	DISTANCE TO CORE (m): 120-150

DATE:	1/02/2020	RECORDERS NAME:	Rob Gratton
DATUM	AGD66	GDA94	<input checked="" type="checkbox"/>
Photo	<input checked="" type="checkbox"/>	WPT	<input checked="" type="checkbox"/>
GPS	S:	E:	Alt:

DISTURBANCE HISTORY			
	Severity	Legend	Last event
Fire	0	0 = none	
Clearing / logging	0	1 = light	
Grazing	0	2 = mod	
Weeds	1	3 = severe	
Mistletoe	0	N/A = Not applic	
Other			
SOIL TYPE			
Clay	Loam	Sand	Organic

WEATHER CONDITIONS							
Day	Temp max / min	Air Pressure	Relative humidity	Wind velocity	Moon	Cloud / Lux	Rain
1							
2							
3							
4							
5							
6							
7							

VEGETATION (spechts) Trees 5 > 30 meters			
70 - 100 %	30 - 70 %	10 - 30 %	< 10 %
Closed Forest	Open Forest	Woodland	Open Woodland
Dominant Species Present		Canopy Health %	Ave Dia
Spotted Gum		95	100-120cm
Sugar Gum		95	70-80cm
Recruitment		Nil	Some
			Extensive

WEATHER LEGEND	
Wind	0 = calm. 1 = leaves rustle. 2 = branches moving. 3 = strong
Moon	0 = none. 1 = 1/4 moon. 2 = 1/2 moon. 3 = 3/4 moon. 4 = full moon
Cloud	0 = none. 1 = partial. 2 = complete
Rain	0 = none. 1 = drizzle. 2 = rain. 3 = heavy rain. 4 = thunder storms

PROXIMITY TO WATER (klm)							
< 0.1	0.1 - 0.5	0.5 - 1	1 - 2	2 - 5	5 - 10	> 10	
<input checked="" type="checkbox"/>							

VEGETATION (spetchts) Understory % Cover			
70 - 100 %	30 - 70 %	10 - 30 %	< 10 %
Dominant Species Present		Recruitment	Ave Height
Pomedaris			12-1.5cm
Black Wattle			3-4m
Balckwood			3-4m

Habitat trees (Alive)	Tree hollows	% Cover		Litter (cm)	No of Logs	Rocks Present	% Cover
		Ground Flora					
10	2	1-5		Nil	Nil	Yes	
		5~10		1~2	1~2	No	<input checked="" type="checkbox"/>
		10~20		3~5	3~5	Weed Cover %	
	Stags	Hollow (dia)	10~20	>5	5~10	1-5	<input checked="" type="checkbox"/>
		10cm	20~50	<input checked="" type="checkbox"/>	>10	6-10	
			>50		>10	>10	

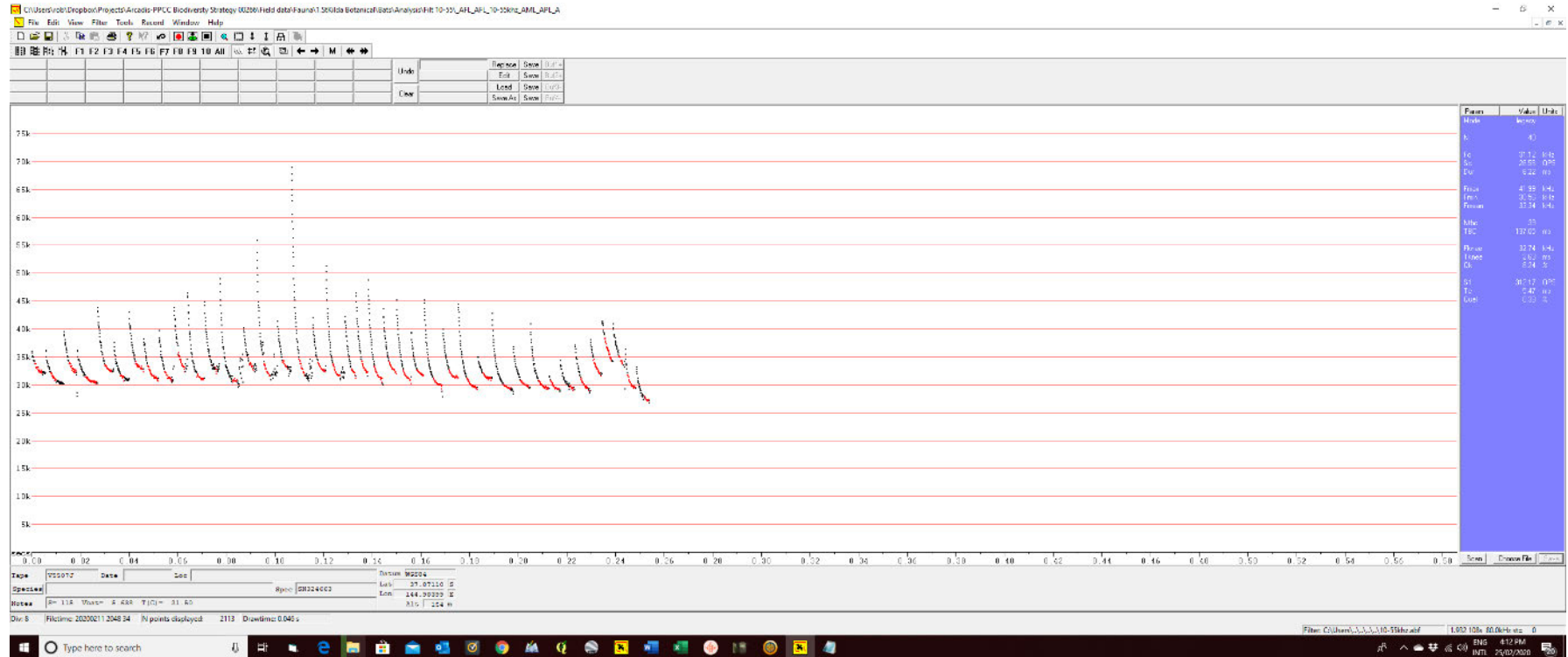
SITE DETAILS: Canterbury Forest				DATE: 1/02/2020		RECORDERS NAME: Rob Gratton	
LAND TENURE: Public		EVC: N/A		DATUM	AGD66	GDA94	<input checked="" type="checkbox"/>
TOPOGRAPHIC POSITION: N/A				Photo	<input checked="" type="checkbox"/>	WPT	<input checked="" type="checkbox"/>
SIZE OF AREA (ha): 1.6 approx.		DISTANCE TO CORE (m): 10		GPS	S:	E:	Alt:
DISTURBANCE HISTORY				WEATHER CONDITIONS			
	Severity	Legend	Last event	Day	Temp max / min	Air Pressure	Relative humidity
Fire	0	0 = none		1			
Clearing / logging	0	1 = light		2			
Grazing	0	2 = mod		3			
Weeds	1	3 = severe		4			
Mistletoe	0	N/A = Not applic		5			
Other				6			
				7			
SOIL TYPE				WEATHER LEGEND			
Clay	Loam	Sand	Organic	Wind	0 = calm. 1 = leaves rustle. 2 = branches moving. 3 = strong		
VEGETATION (spechts) Trees 5 > 30 meters				Moon	0 = none. 1 = 1/4 moon. 2 = 1/2 moon. 3 = 3/4 moon. 4 = full moon		
70 - 100 %	30 - 70 %	10 - 30 %	< 10 %	Cloud	0 = none. 1 = partial. 2 = complete		
Closed Forest	Open Forest	Woodland	Open Woodland	Rain	0 = none. 1 = drizzle. 2 = rain. 3 = heavy rain. 4 = thunder storms		
Dominant Species Present		Canopy Health %	Ave Dia	PROXIMITY TO WATER (klm)			
Box sp		95-100	60cm	< 0.1	0.1 - 0.5	0.5 - 1	1 - 2
Red Ironbark		95-101	20cm		<input checked="" type="checkbox"/>		
Recruitment	Nil	Some	Extensive	Habitat trees (Alive)			
VEGETATION (spetchts) Understory % Cover				Tree hollows	% Cover	Litter (cm)	No of Logs
70 - 100 %	30 - 70 %	10 - 30 %	< 10 %		Ground Flora		Rocks Present
	<input checked="" type="checkbox"/>			8	Nil	Nil	% Cover
Dominant Species Present	Recruitment	Ave Height			1-5	1~2	Yes
Gold-dust Wattle		120cm			<input checked="" type="checkbox"/>	1~2	< 5
Hedge Wattle		120cm			5~10	3~5	No
							Weed Cover %
				Stags	Hollow (dia)	10~20	1-5
							<input checked="" type="checkbox"/>
						20~50	6-10
						>50	>10

SITE DETAILS: Elwood Canal / Elster Creek				DATE: 1/02/2020				RECORDERS NAME: Rob Gratton					
LAND TENURE: Public				EVC: Damp Sands Herb-rich Woodland				DATUM AGD66		GDA94		<input checked="" type="checkbox"/>	
TOPOGRAPHIC POSITION: riparian / escarpment				Photo		<input checked="" type="checkbox"/>		WPT		<input checked="" type="checkbox"/>			
SIZE OF AREA (ha): 5 approx.				DISTANCE TO CORE (m): 5-10				GPS S:		E:		Alt:	
DISTURBANCE HISTORY				WEATHER CONDITIONS									
	Severity	Legend	Last event	Day	Temp max / min	Air Pressure	Relative humidity	Wind velocity	Moon	Cloud / Lux	Rain		
Fire		0 = none		1									
Clearing / logging		1 = light		2									
Grazing		2 = mod		3									
Weeds		3 = severe		4									
Mistletoe		N/A = Not applic		5									
Other	2	Urban disturbance	On-going	6									
SOIL TYPE				WEATHER LEGEND									
Clay	Loam	Sand	Organic	Wind	0 = calm. 1 = leaves rustle. 2 = branches moving. 3 = strong								
VEGETATION (spechts) Trees 5 > 30 meters				Moon	0 = none. 1 = 1/4 moon. 2 = 1/2 moon. 3 = 3/4 moon. 4 = full moon								
70 - 100 %	30 - 70 %	10 - 30 %	< 10 %	Cloud	0 = none. 1 = partial. 2 = complete								
Closed Forest	Open Forest	Woodland	Open Woodland	Rain	0 = none. 1 = drizzle. 2 = rain. 3 = heavy rain. 4 = thunder storms								
Dominant Species Present		Canopy Health %	Ave Dia	PROXIMITY TO WATER (klm)									
River Red Gum		95	60-80cm	< 0.1	0.1 - 0.5	0.5 - 1	1 - 2	2 - 5	5 - 10	> 10			
Sheok sp		95	20-30cm	<input checked="" type="checkbox"/>									
Sugar Gum		95	80-120cm										
Recruitment	Nil	Some	Extensive										
VEGETATION (spetchts) Understory % Cover				Habitat trees (Alive)									
70 - 100 %	30 - 70 %	10 - 30 %	< 10 %	Habitat trees (Alive)	Tree hollows	% Cover		Litter (cm)	No of Logs	Rocks Present	% Cover		
						Ground Flora							
				7		Nil		Nil	Nil	Yes			
Dominant Species Present		Recruitment	Ave Height			1-5		1~2	1~2	No	<input checked="" type="checkbox"/>		
Bansia			25-40cm			5~10	<input checked="" type="checkbox"/>	3~5	3~5	Weed Cover %			
Correa			80-150cm	Stags	Hollow (dia)	10~20		>5	5~10	1-5			
						20~50			>10	6-10			
						>50				>10	<input checked="" type="checkbox"/>		

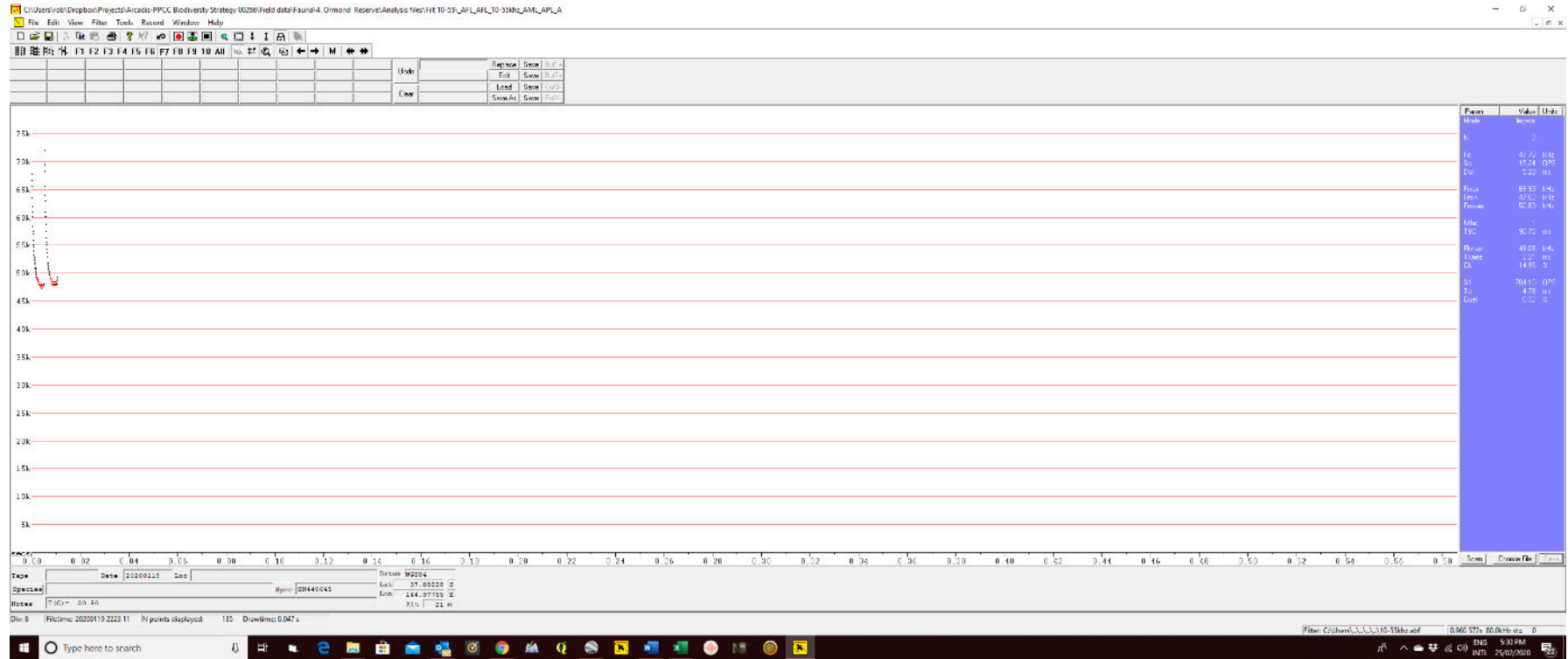
SITE DETAILS: Point Ormond				DATE: 1/02/2020				RECORDERS NAME: Rob Gratton							
LAND TENURE: Public				EVC: Coastal Dune Scrub				DATUM AGD66		GDA94 <input checked="" type="checkbox"/>					
TOPOGRAPHIC POSITION: Coastal Foreshore				Photo <input checked="" type="checkbox"/>		WPT <input checked="" type="checkbox"/>									
SIZE OF AREA (ha): 8 approx.				DISTANCE TO CORE (m): 40-80				GPS S:		E:		Alt:			
DISTURBANCE HISTORY				WEATHER CONDITIONS											
	Severity	Legend	Last event	Day	Temp max / min	Air Pressure	Relative humidity	Wind velocity	Moon	Cloud / Lux	Rain				
Fire	0	0 = none		1											
Clearing / logging	0	1 = light		2											
Grazing	0	2 = mod		3											
Weeds	1	3 = severe		4											
Mistletoe	0	N/A = Not applic		5											
Other	2	Human disturbance	On-going	6											
SOIL TYPE				WEATHER LEGEND											
Clay	Loam	Sand	Organic	Wind	0 = calm. 1 = leaves rustle. 2 = branches moving. 3 = strong										
VEGETATION (spechts) Trees 5 > 30 meters				Moon	0 = none. 1 = 1/4 moon. 2 = 1/2 moon. 3 = 3/4 moon. 4 = full moon										
70 - 100 %	30 - 70 %	10 - 30 %	< 10 %	Cloud	0 = none. 1 = partial. 2 = complete										
Closed Forest	Open Forest	Woodland	Open Woodland	Rain	0 = none. 1 = drizzle. 2 = rain. 3 = heavy rain. 4 = thunder storms										
Dominant Species Present				Canopy Health %				Ave Dia							
Coast Tea-tree				95				12-20cm							
Sheok sp				95				12-20cm							
Banksia				95				12-15cm							
Recruitment				Nil				Some				Extensive			
VEGETATION (spechts) Understory % Cover				PROXIMITY TO WATER (klm)											
70 - 100 %	30 - 70 %	10 - 30 %	< 10 %	< 0.1	0.1 - 0.5	0.5 - 1	1 - 2	2 - 5	5 - 10	> 10					
Dominant Species Present				Recruitment				Ave Height							
Coast wattle								1.2-1.5m							
Salt Bush								50cm							
Habitat trees (Alive)	Tree hollows	% Cover		Litter (cm)	No of Logs	Rocks Present	% Cover								
		Ground Flora													
		Nil		Nil	Nil	Yes									
>10		1-5		1~2	1~2	No	<input checked="" type="checkbox"/>								
		5~10	<input checked="" type="checkbox"/>	3~5	3~5	Weed Cover %									
Stags	Hollow (dia)	10~20		>5	5~10	1-5	<input checked="" type="checkbox"/>								
		20~50			>10	6-10									
		>50				>10									

APPENDIX F – BAT CALL IMAGES

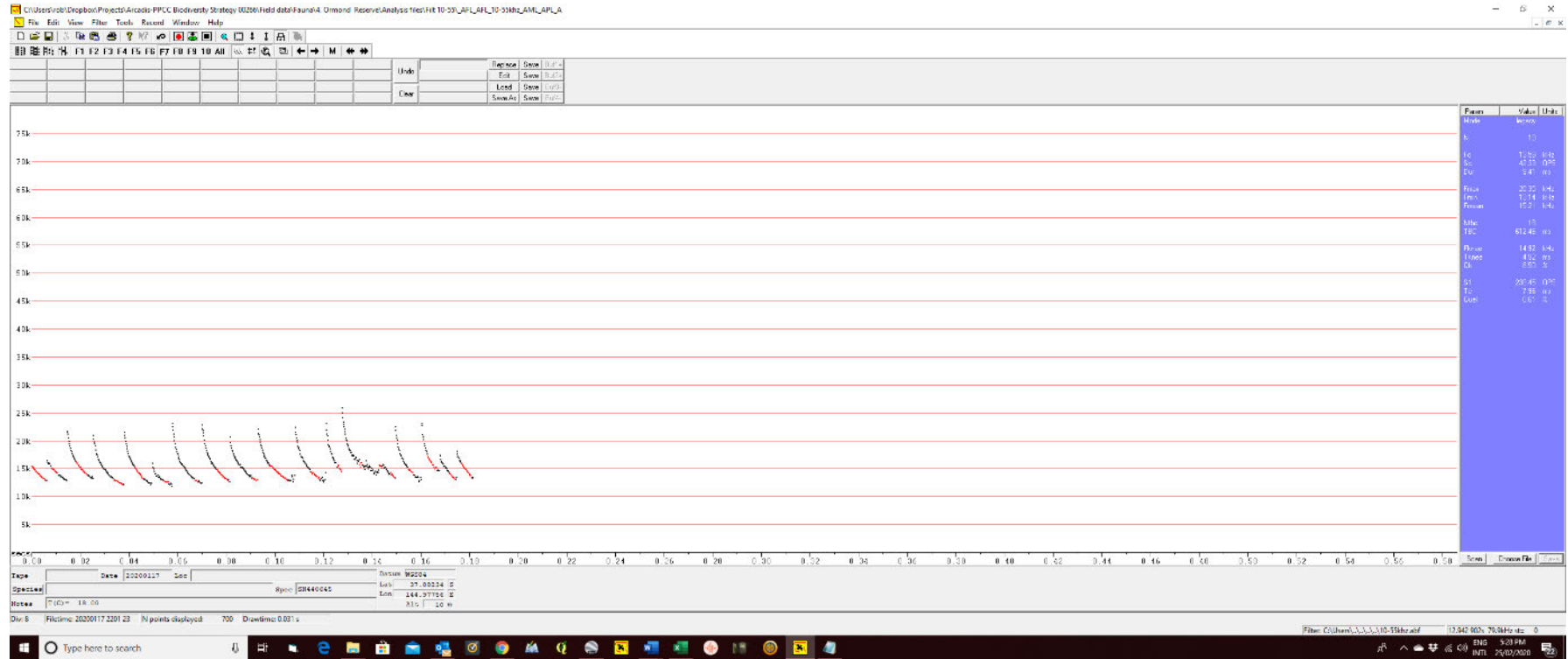
Gould's Wattled Bat



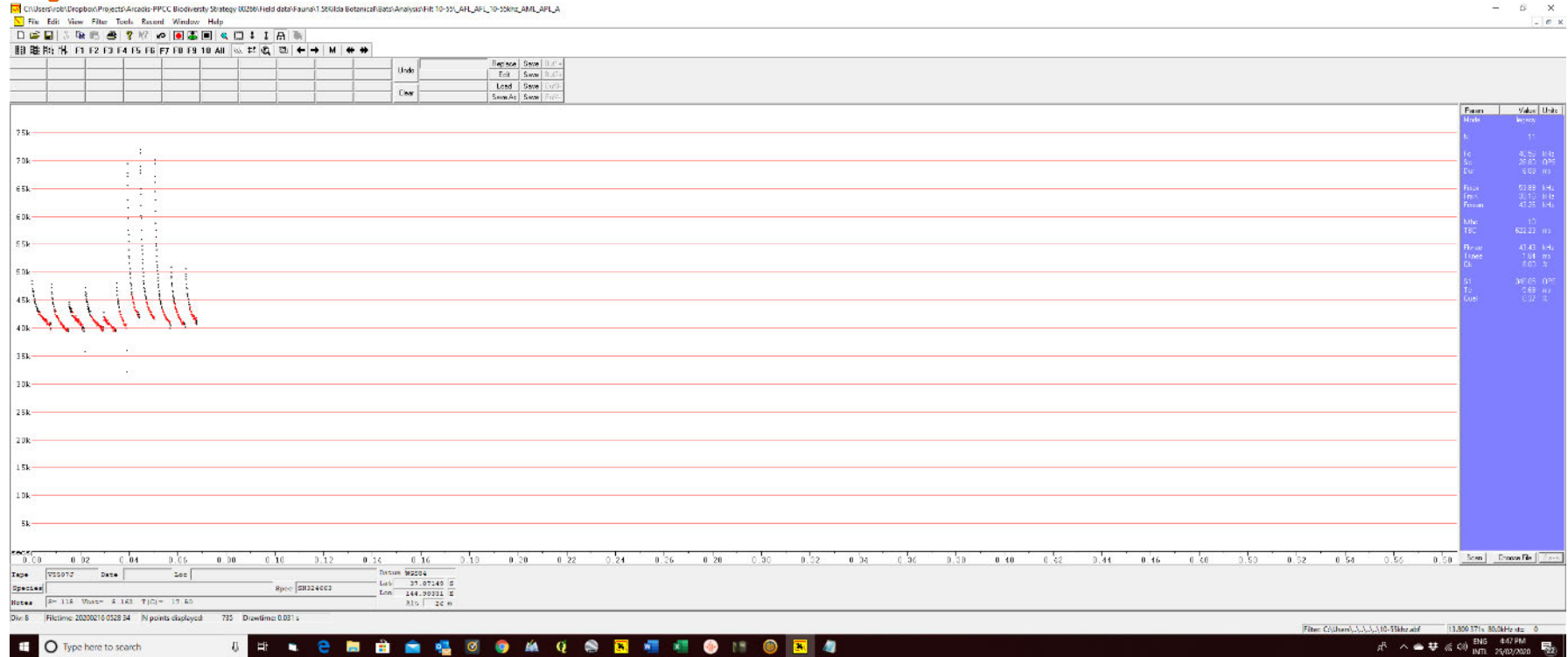
Little Forest Bat



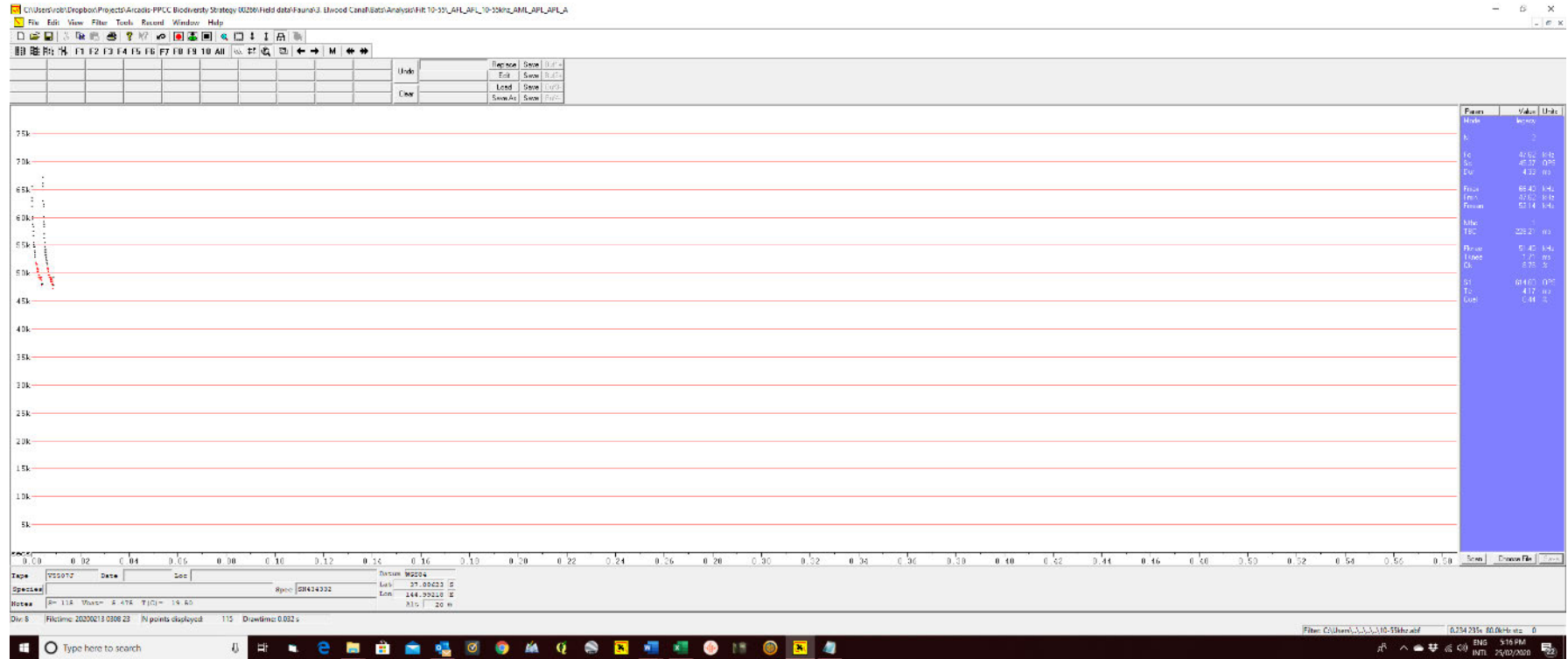
White-striped Freetail Bat



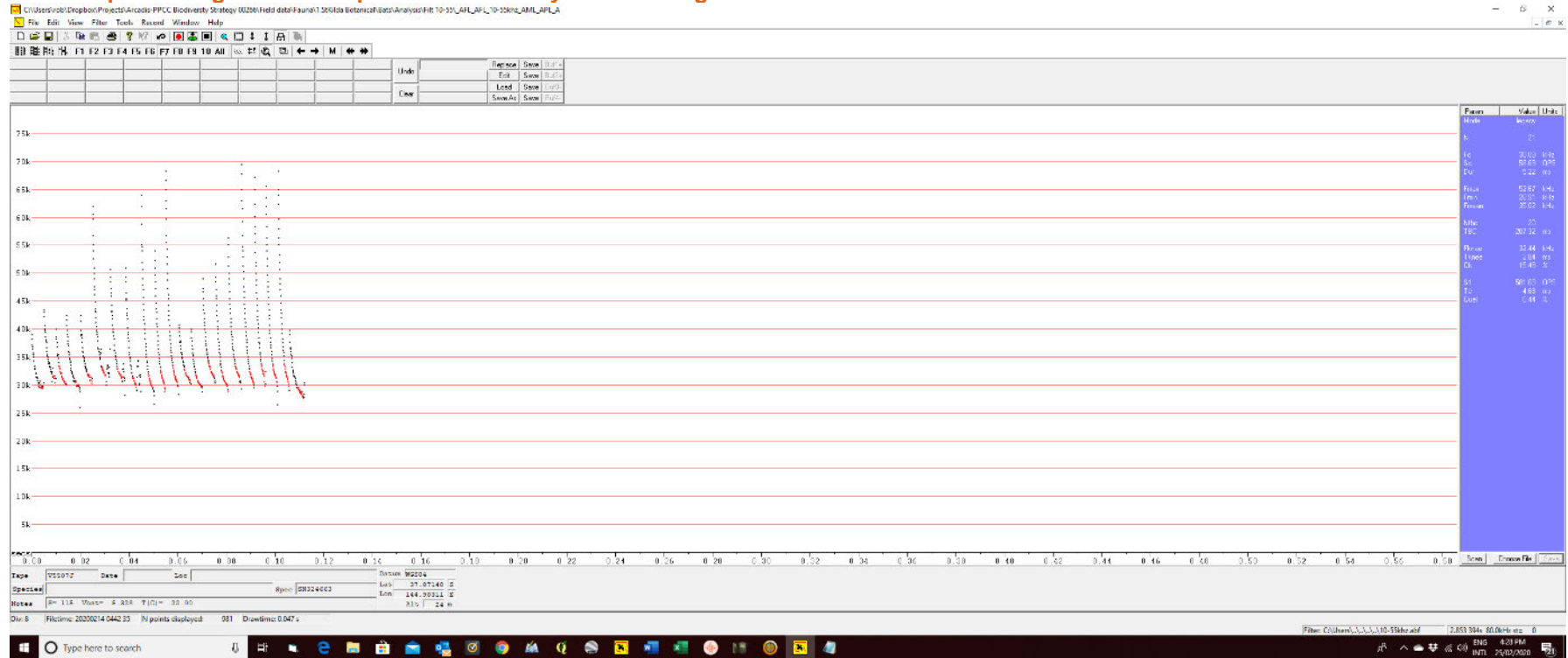
Large Forest Bat



Chocolate Wattle Bat



Call complex- Long-eared bat species- Most likely Lesser Long-eared bat



APPENDIX G – FROG CALL IMAGES

Peron's Tree Frog

Data\S4A02566_20200126_220000.wav @ 271.275012s (2.624062s)

Prefix: S4A02566 Model: SM4 S4A02566 2.1.1 Timestamp: 2020-01-26 22:00:00+11:00 GPS: 37.81000 N 144.88000 W

Notes

GIANTON Version: 1.0

Identification

cluster.02 Rename Noise

Auto next file

Fan-tailed cuckoo	Whipbird	Pied Currawong	Boobook Owl	Kookaburra	Common frog / verreauxii	Alpine complex / Common Froglet	Alpine complex
Crimson rosella	Thornbill sp	Spotted Pardalote	White-throat treecreeper	Banjo Frog	Common Froglet	Banjo	Banjo / verreauxii
Sth Brown / Banjo Frog	Southern Brown Tree Frog	Sth Brown / Banjo / Com frog	Sth Brown / Banjo / Strip Marsh	Com frog / Banjo	Verreauxii / Sth Brown Tree frog	Verreauxii / Banjo / sth brown	Verreauxii / Alpine tree frog
Banjo / common frog	Spotted Tree Frog	Common Froglet	Spotted Tree Frog Ref	Verreauxii tree Frog	Verreauxii / Sth brown / common frog	Verreauxii / common frog	Giant Burrowing Frog ref

Start a web search

6:07 PM 1/02/2020

Southern Brown Tree Frog

Data\S4A02566_20200123_040000.wav @234.114063s (3.787500s)

File Help

20000
10000
0
-10000
-20000
-30000

16.0kHz
15.0kHz
14.0kHz
13.0kHz
12.0kHz
11.0kHz
10.0kHz
9.0kHz
8.0kHz
7.0kHz
6.0kHz
5.0kHz
4.0kHz
3.0kHz
2.0kHz
1.0kHz
0.0kHz

0.0s 0.1s 0.2s 0.3s 0.4s 0.5s 0.6s 0.7s 0.8s 0.9s 1.0s 1.1s 1.2s 1.3s 1.4s 1.5s 1.6s 1.7s 1.8s 1.9s 2.0s 2.1s 2.2s 2.3s 2.4s 2.5s 2.6s 2.7s

Prefix: S4A02566 Model: SM4 S4A02566 2.1.1 Timestamp: 2020-01-23 04:00:00+11:00 GPS: 37.81000 N 144.88000 W

Notes

GIJIAN(N)Ver=inn:1.0

Identification

Southern Brown Tree Frog

cluster.07 Rename Noise

Auto next file

Perons Treefrog	Whipbird	Pied Currawong	Boobook Owl	Kookaburra	Common frog / verreauxii	Alpine complex / Common Froglet	Alpine complex
Crimson rosella	Thornbill sp	Spotted Pardalote	White-throat treecreeper	Banjo Frog	Common Froglet	Banjo	Banjo / verreauxii
Sth Brown / Banjo Frog	Southern Brown Tree Frog	Sth Brown / Banjo / Com frog	Sth Brown / Banjo / Strip Marsh	Com frog / Banjo	Verreuxii / Sth Brown Tree frog	Verreuxii/ Banjo/ sth brown	Verreuxii / Alpine tree frog
Banjo / common frog	Spotted Tree Frog	Common Froglet	Spotted Tree Frog Ref	Verreuxii tree Frog	Verreuxii / Sth brown / common frog	Verreuxii / common frog	Giant Burrowing Frog ref

Start a web search

6:50 PM
1/02/2020

