



## Extent of Tootgarook Wetland, Mornington Peninsula, Victoria

Prepared for Mornington Peninsula Shire

21 May 2019

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Cover photo: Tootgarook Wetland in flood, April 2001 (MPS)

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# 1. Introduction

Tootgarook Wetland (formerly Tootgarook Swamp and Boneo Swamp), located in Capel Sound, Boneo, Fingal and Tootgarook, is the largest wetland in the southeast Melbourne and Mornington Peninsula area. It is also the largest example of a shallow freshwater marsh in the Port Phillip and Western Port region.

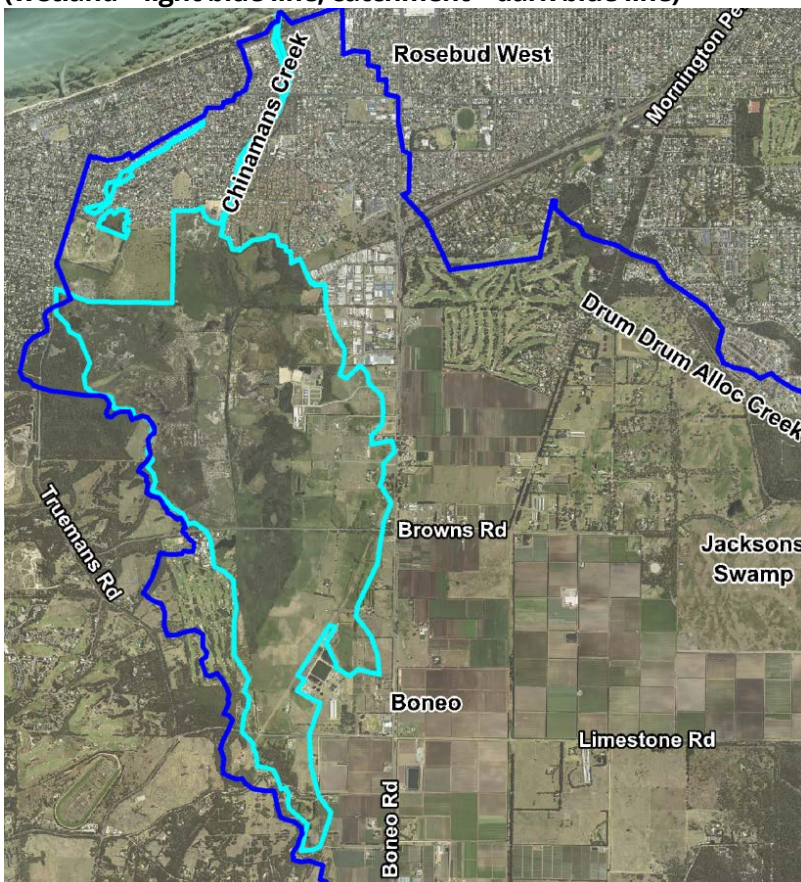
The diverse freshwater wetland has major ecological significance, supporting many wetland flora and fauna species including several of national significance. According to Melbourne Water (undated):

Tootgarook Wetland supports a wide array of cultural and ecological values. Aboriginal artefacts including formal digs remain on the swamp edges. The wetland retains at least 12 ecological vegetation classes, 248 plant species and over 160 bird species. It is also a site of significance for migratory birds and provides food and water for mammals.

Tootgarook Wetland is within the Chinamans Creek catchment and operates as a natural retarding basin providing important flood storage protecting downstream areas from severe flooding and reducing erosion by absorbing and slowly releasing floodwaters. The wetland also enhances water quality by acting as a sediment and nutrient filter before water enters Chinamans Creek and Port Phillip Bay.

The Tootgarook Wetland management plan (BMT 2018), describes a 590 hectare groundwater dependent wetland of which approximately 60% (340 hectares) is relatively undisturbed by human activity. It has high biodiversity values providing a range of ecosystem services (Figure 1).

**Figure 1. Tootgarook Wetland, as understood in May 2018 (BMT 2018)  
(wetland - light blue line, catchment - dark blue line)**



Biosis was commissioned by Mornington Peninsula Shire to produce an accurate and reliable extent map of the wetland which will be the basis for any revision of the current Environmental Significance Overlay 30 (ESO30) and related controls in the Mornington Peninsula Planning Scheme.

The objectives of this study are to:

- refine the current extent of Tootgarook Wetland
- define an appropriate buffer around the refined extent
- develop management guidelines for the wetland buffer
- review ESO30 and recommend amendments (additions, modifications and/or removal) to its provisions, and simplify the areas where it overlaps ESO18 and ESO19.

This report includes:

- the historical context
- a summary of relevant local, state and commonwealth legislation and policy
- a summary of the objectives, decision guidelines and provisions of ESO30
- a literature review including:
  - wetland hydrology and soils
  - available wetland mapping
  - wetland buffer zones
- the reasons underpinning the methodology applied in this study
- a reconstructed original wetland boundary
- the current wetland boundary
- a proposed wetland buffer zone boundary
- proposed buffer zone management guidelines
- proposed changes to Planning Scheme controls.

## 2. Historical context

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Tootgarook Wetland was formed during the Holocene geological epoch following a marine retreat to current sea level. The sea level in Port Phillip Bay some 5,500 years ago was approximately 1–2 metres higher than now during the mid-Holocene marine maximum (Holdgate et al. 2011). The area now occupied by the wetland was then a shallow inlet. During the marine retreat, a series of curved beach ridges built up to cut off the inlet. The low-lying area was subsequently inundated by surface inflow, largely from Drum Drum Alloc Creek which was the only major waterway to the swamp, and groundwater inflow to form the wetland.

The wetland formed during Aboriginal occupation of the area and was an extremely valuable resource for the Bun wurrung people. Several archaeological sites have been identified (Keble 1929, Heritage Insight 2007).

Existing topography, geology maps and historical surveys indicate that Tootgarook Wetland covered a larger area prior to European settlement. Condina (2011) estimates the pre-European area of the swamp as 484 ha with the remnant extent now being 381.5 ha, lower than the 590 ha of BMT (2018). The original outlet creek, named Tootgarook Creek here, formed on the northwest edge of the wetland (a bend in the former creek is the site of Tern Avenue Bushland Reserve which is an artificial excavated wetland), and ran northeast where it met Port Phillip Bay just west of the current artificial drain outlet, Chinamans Creek (Condina 2011).

Vegetation removal, market gardening and grazing by domestic stock were extensive in the 1800s and 1900s. Peat and marl/limestone were extracted in the north-west, leaving landscape scars. Attempts to drain the wetland commenced with a drain constructed in 1877 which was later realigned and enlarged to become Boneo drain and later Chinamans Creek. Works on the drain continued in stages to 1997. Areas on the wetland's northern margin were buried under landfill, causing major contraction in the wetland area.

The current Tootgarook Wetland is fed largely by direct rainfall, surface runoff events from its catchment and by lateral groundwater flow from its edges. The wetland may not be connected to the underlying regional groundwater aquifer which is used by adjacent market gardens by an impervious clay (or 'marl') layer on which a peat layer is developed (Keble 1950). Peat requires more or less permanent inundation to form.

Lateral groundwater inflow gives the Tootgarook Wetland natural resilience, sufficient for the core area to have survived Chinamans Creek drain and extensive utilisation for agriculture. However the wetland has contracted on the margins as evidenced by large areas of non-wetland vegetation on the geological swamp deposit which defines the extent of the original wetland. Swamp Paperbark *Melaleuca ericifolia*, once extensive on the margins, is resilient due to its deep root system accessing groundwater, but is mostly cleared and the scattered remnants are vulnerable to further clearing. The inundation level and flood regime of the wetland is set by the height and size of the Chinamans Creek culvert at Elizabeth Avenue, Capel Sound.

Tootgarook Wetland was modified before scientific recording so there is little information on its original ecology and vegetation. Tonkinson et al. (2003) postulate that originally it may have mostly supported grassy vegetation dominated by Common Tussock-grass *Poa labillardierei* with a wide range of smaller herbs, grasses and sedges adapted to seasonal waterlogging of soils. Small areas in the centre may have supported Swamp Scrub dominated by Swamp Paperbark *Melaleuca ericifolia* and/or Woolly Tea-tree *Leptospermum lanigerum*. Many of the wetland plants now present may have colonised since the wetland's modification.

However, prior to construction of Chinamans Creek drain wetter conditions would have prevailed in the swamp, therefore, while there were many *Poa* grasslands on islands on the eastern side, the deeper north-central area supported freshwater meadow with a range of non-woody ecological vegetation classes. Permanent inundation prevents shrub and tree growth and is required for peat formation. The extensive inner swamp was variably fringed by a zone of Swamp Scrub on less inundated land – the extensive outer swamp. Then as now, islands with *Poa* grassland were within both the inner and outer swamps.

Despite many disturbances and modifications, Tootgarook Wetland remains a significant area supporting a wide range of native wetland flora and fauna, with several significant at the national level (Legg 2014, Purnell and Wilson 2015). Condina (2011) considers the wetland to have potential international significance and points out that compared to other environmentally important wetlands, such as the Edithvale-Seaford Wetland, which is listed as a Wetland of International Importance under the Ramsar Convention, Tootgarook Wetland more than holds its own, even in its present partly unprotected state. Quite apart from its vital function as a natural retarding basin, it is larger than Edithvale-Seaford Wetland, supports more biodiversity, has a larger number of significant species, and has more diverse and significant vegetation communities.

Attempts to conserve Tootgarook Wetland commenced in the 1970s with the Western Port Regional Planning Authority. Most of the wetland is on private land including a large central area north of Browns Road which is under Trust for Nature covenant. Mornington Peninsula Shire has seven reserves within the wetland, the largest being Tootgarook Swamp Bushland Reserve south of Browns Road, with some recently acquired.

In 2015 a Planning Panel was appointed to consider a proposed Environmental Significance Overlay – ESO30 Tootgarook Wetland – to protect Tootgarook Wetland. The Panel supported the introduction of ESO30 on the basis that a further review of the controls affecting the wetland occurred (PPV 2015):

Accordingly, the Panel supports the application of the ESO30, but only on the basis that a comprehensive review is undertaken of all the planning controls affecting the Tootgarook Wetland area with a view to significantly simplify the planning controls (particularly the ESOs) that affect the area, as part of the next stage of the implementation of planning controls for the Tootgarook Wetland.

Mornington Peninsula Shire introduced ESO30 Tootgarook Wetland in order to protect the significant environmental values of the wetland in 2016. As per the ESO30 statement of significance:

Regulation of use and development within the wetland and its catchment is necessary to protect and maintain its ecological values and environmental services, including the provision of viable habitat linkages between the wetland components (inundated and dry land), waterways, buffer areas and the marine receiving environment of Port Phillip Bay.

This planning study informs the required review of planning controls affecting the Tootgarook Wetland area being undertaken by Mornington Peninsula Shire.

## 3. Legislation and government policy

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This section of the report provides a summary of the key legislation and policy that are relevant to protection and management of Tootgarook Wetland at Commonwealth, State and local levels.

### 3.1 Commonwealth

#### 3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to protect and manage matters of national environmental significance (MNES) (i.e. nationally and internationally important flora, fauna, ecological communities and heritage places).

MNES occur within the wetland area. Pursuant to the EPBC Act, a proposal that may result in a significant impact on a MNES will require an assessment and approval under the Act.

### 3.2 State

#### 3.2.1 Planning and Environment Act 1987

The *Planning and Environment Act 1987* (PE Act) controls the use and development of land across Victoria.

The wetland is subject to the Mornington Peninsula Planning Scheme (Planning Scheme). Relevant provisions and policies in Planning Scheme are summarised below.

#### 3.2.2 Mornington Peninsula Planning Scheme

##### **Planning Policy Framework**

The Planning Policy Framework (PPF) includes a number of policies at the state and regional levels. Those of particular relevance to the wetland are outlined in Table 1.

**Table 1. Relevant PPF policies**

Relevant clause	Description
<b>Clause 11.01-1R Green wedges – Metropolitan Melbourne</b>	<p>The objective is to protect the green wedges of Metropolitan Melbourne from inappropriate development. A number of strategies are provided to support the implementation of this objective. Of particular relevance to the wetland are the following:</p> <ul style="list-style-type: none"> <li>Promote and encourage the key features and related values of each green wedge area.</li> </ul> <p>Protect areas of environmental, landscape and scenic value such as biodiversity assets, national and state parks, Ramsar wetlands and coastal areas.</p>
<b>Clause 12.01-1S Protection of biodiversity</b>	<p>Aims to assist the protection and conservation of Victoria’s biodiversity. The strategies of this Clause are to ensure that the biodiversity values are identified, the impacts of any change in land use or development on those values have been considered and the impacts on important areas of biodiversity are avoided.</p>
<b>Clause 12.01-2S Native vegetation management</b>	<p>This state policy is to ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation.</p> <p>To implement this policy, decisions that involve, or will lead to, the removal, destruction or lopping of native vegetation, apply the three-step approach (i.e. avoid and minimise impacts on native vegetation and provide an offset to compensate for the biodiversity impacts) in accordance with the <i>Guidelines for the removal, destruction or lopping of native vegetation</i> (‘Guidelines’) (DELWP 2017).</p>
<b>Clause 12.02-1S Protection of coastal areas</b>	<p>The objective of this policy is to recognise the value of coastal areas to the community, conserve and enhance coastal areas and ensure sustainable use of natural coastal resources.</p> <p>Under this Clause, land use and planning need to comply with the requirements of <i>Coastal Management Act 1995</i> which as a priority requires the protection of significant environmental and cultural values.</p>
<b>Clause 12.03-11S River corridors, waterways, lakes and wetlands</b>	<p>Protecting and enhancing river corridors, waterways, lakes and wetlands is the objective of this Clause. In relation to the wetland, this objective will be achieved through protection of the environmental, cultural and landscape values of the wetland and ensuring that developments (and their design and siting) respect those identified values.</p>

<b>Clause 12.05-1S Environmentally sensitive areas</b>	<p>This is a policy for protection and conservation of environmentally sensitive areas.</p> <p>Under this policy, there is a strategy to protect environmentally sensitive areas with significant environmental value (including Mornington Peninsula) from development that would diminish their environmental, conservation or recreational values.</p>
<b>Clause 12.05-2S Landscape</b>	<p>The objective is to protect and enhance significant landscapes and open spaces that contribute to character, identity and sustainable environments.</p> <p>Under this policy, significant landscape areas (incl. coastlines) are to be protected and developments are required to not detract from the natural qualities of those areas.</p>
<b>Clause 14.02-1S Catchment planning and management</b>	<p>The objective of this state policy is to assist the protection and restoration of catchments, water bodies, groundwater, and the marine environment. This objective is achieved through a number of strategies such as ensuring that works at or near waterways provide for the protection and enhancement of the environmental qualities of waterways and their instream uses.</p>
<b>Clause 14.02-2S Water quality</b>	<p>This Clause encourages the protection of water quality by adopting a number of strategies such as using the mapped information available from the Department of Environment, Land, Water and Planning to identify the beneficial uses of groundwater resources and have regard to potential impacts on these resources from proposed land use or development.</p>

### **Local Planning Policy Framework**

The Local Planning Policy Framework (LPPF) contains policies that apply within the municipality. Relevant policies are listed below.

#### **Clause 21.08 Foreshores and coastal areas**

This policy has identified some key issues associated with the municipality such as environmental degradation, loss of natural and cultural values and declining community benefit as the result of the over use of the area by tourists and for recreational purposes. In order to tackle those issues, some objectives and associated strategies have been outlined under this Clause. Of relevance to the wetland is the following:

- **Objective 1:** To protect and enhance the natural ecosystems and landscapes of the coast for the benefit and enjoyment of present and future generations.

This objective is to be achieved through some strategies such as identify threatening processes including the spread of environmental weeds, introduced pest fauna, erosion and the pollution of water, ground water, air and land that may impact on the foreshore's natural systems and sites and applying appropriate management techniques.

### **Clause 21.09 Planning for rural areas**

This policy specifies that in the context of the Peninsula, 'rural' refers to land with a diverse range of values and includes areas that support the natural systems of the Peninsula, including among others wetlands and ground water recharge areas.

This policy contains three components:

- Conserving environmental values: This is a policy to maintain and enhance the natural values and ecological systems of Peninsula.
- Maintaining and enhancing landscape, cultural and recreational values: The relevant objective of this policy to maintain the recreational role of the Peninsula by protecting the qualities of its landscapes, natural environment and cultural heritage.
- Maintaining and enhancing landscape, cultural and recreational values: The relevant objective of this policy to maintain the recreational role of the Peninsula by protecting the qualities of its landscapes, natural environment and cultural heritage.

### **Clause 22.14 Mornington Peninsula land units**

This policy applies to all land within the Environmental Significant Overlay (Schedules 1–16 inclusive). According to this policy, Mornington Peninsula is described in terms of a number of distinct 'land units' that identify areas with reasonably consistent:

- Environmental characteristics including land form, soils and geology.
- Landscape and capacity to absorb further development without detriment to landscape qualities.
- Land use patterns.

This policy contains a number of objectives. Particularly relevant to the wetland are the following:

- To promote sustainable use and development of rural land, sustainable land use practices and integrated land management, including the retention and enhancement of habitat corridors along streamlines and the protection of wetlands.
- To maintain and conserve the environmental systems, habitat areas, soil stability, drainage patterns and stream quality of the Mornington Peninsula.
- To conserve areas of native vegetation, including native grasses and ground flora.
- To support effective catchment and land protection, including the management of salinity.
- To promote the siting and design of buildings, including the choice of building materials that is responsive to landscape character.
- To promote use and development which is compatible with the maintenance of long term natural, agricultural, landscape and recreational values of the Mornington Peninsula.

## **Zone controls**

Several zoning controls apply to the wetland and surrounding area (as currently identified within ESO30) (Map 1, Appendix B).

A summary of the most relevant zone controls and their permit requirements follows.

**Table 2. Summary of zone controls**

<b>Zone</b>	<b>Description</b>
<p><b>Green Wedge Zone (GWZ2 and GWZ4)</b></p>	<p>The GWZ includes a number of purposes such as protection and conservation of green wedge land for its agricultural, environmental and landscape opportunities.</p> <p>A summary of permit requirements under the GWZ is as follows:</p> <ul style="list-style-type: none"> <li>- Permit is required for specified land uses, buildings and works and subdivision.</li> <li>- A number of land uses and their associated buildings and works are exempt from permit requirements (i.e. poultry farm).</li> <li>- A number of land uses are prohibited (i.e. accommodation other than camping and caravan park, dependent person's unit, dwelling, group accommodation, host farm and residential building).</li> <li>- The minimum subdivision area for all land within the current extent of Wetland is 40 hectares except the areas covered by Schedule 28 to the Environmental Significant Overlay (ESO28) that meet some certain requirements (as specified in GWZ4).</li> </ul>
<p><b>Public Park and Recreation (PPRZ)</b></p>	<p>The purpose of the PPRZ is generally to recognise areas for open space, protect areas of significance and provide for commercial uses when appropriate.</p> <p>A summary of permit requirements under the PPRZ is as follows:</p> <ul style="list-style-type: none"> <li>- Permit is required for land specified uses, buildings and works and subdivision.</li> <li>- Under the application requirements of the PPRZ, an application for a permit by a person other than the relevant public land manager must be accompanied by the written consent from the public land manager is required.</li> </ul>

<b>Public Conservation and Recreational Zone (PCRZ)</b>	<p>The purpose of the PCRZ is to conserve the natural environment and natural processes and provide e facilities which assist in public education and interpretation of the natural environment.</p> <p>A summary of permit requirements under the PCRZ is as follows:</p> <ul style="list-style-type: none"> <li>- Permit is required for specified land uses, buildings and works and subdivision.</li> <li>- If permit is not required for a certain use or buildings and works, they have to be either undertaken by or on behalf of the public land manager in accordance with some certain pieces of legislation or be specified in an incorporated document.</li> </ul>
<b>Special Use Zone – Schedule 4 (SUZ4)</b>	<p>The purpose of the SUZ4 is to provide for integrated recreational and residential development in appropriate locations.</p> <p>A summary of permit requirements under the SUZ4 is as follows:</p> <ul style="list-style-type: none"> <li>- Permit is required for specified land uses, buildings and works and subdivision.</li> </ul>
<b>General Residential Zone – Schedule 1 (GRZ1)</b>	<p>The purpose of GRZ is generally to respect the neighborhood character of the area, encourage diversity of housing type and housing growth and allow for a range of different uses such as educational and recreational.</p> <p>A summary of permit requirements under the GRZ1 is as follows:</p> <ul style="list-style-type: none"> <li>- Permit is required for some uses and buildings and works.</li> </ul> <p>A permit is required to subdivide land.</p>
<b>Industrial 3 Zone (IN3Z)</b>	<p>The purpose of IN3Z is in summary to provide for industries and associated uses in specific areas, allow for industries and associated uses compatible with the nearby community and ensure that uses do not affect the safety and amenity of adjacent, more sensitive land uses.</p> <p>A summary of permit requirements under the IN3Z is as follows:</p> <ul style="list-style-type: none"> <li>- Permit is required for some uses and buildings and works.</li> </ul> <p>A permit is required to subdivide land.</p>

## **Overlay controls**

Several planning overlays apply to the wetland and surrounding area (Maps 2.1, 2.2, Appendix B).

Overlays which apply to the current ESO30 area are as follows:

- Environment Significance Overlays (ESOs):
  - ESO 14 – Tootgarook Swamp – Boneo Flats
  - ESO 17 – Streamlines
  - ESO 18 – Wetlands
  - ESO 19 – Fluvial Deposits
  - ESO 23 – Semi-Stabilised Dunes
  - ESO 28 – Mornington Peninsula Bushland
- Environmental Audit Overlay (EAO)
- Land Subject to Inundation Overlay (LSIO)
- Significant Landscape Overlay (SLO) (freeway reserve)
- Public Acquisition Overlay (PAO)
- Heritage Overlay (HO)
- Bushfire Management Overlay (BMO)

ESO30 (Tootgarook Wetland) is the most relevant overlay control as it was introduced for the purpose of protecting the wetland.

### **Clause 42.01 Environmental Significant Overlay – Schedule 30 (Tootgarook Wetland)**

The environmental objectives of the ESO30 to be achieved are as follows:

- To protect the integrity of the Tootgarook wetland groundwater dependent ecosystem including its ecological significance, environmental diversity and the flora and fauna habitat values of all wetland components.
- To implement the Australasian Bittern *Botaurus poiciloptilus* and all other EPBC Recovery Plans and FFG Action Plans applicable to recorded species and communities.
- To maintain and improve the biological, physical and chemical quality of water within the watercourse, water body, wetland and associated soil profile.
- To restore and maintain the natural hydrological regime and associated ability of streams, watercourses and wetland to carry environmental flows.
- To avoid adverse impacts on the ecological character and values of the Tootgarook wetland including small incremental impacts and other reduction or degradation of significant habitat areas except where these will be offset elsewhere within the Tootgarook wetland.
- To encourage use or development that can secure conservation of significant Tootgarook wetland environmental values particularly through Trust for Nature covenants or similar agreements.
- To avoid disturbing potential acid sulphate soils.

## **Particular provisions**

### **Clause 52.12 (Bushfire protection: exemptions)**

Clause 52.12 contains a number of exemptions which allow vegetation to be removed for the purpose of creating defendable space for properties within the BMO. Given part of the wetland and surrounding area is within the BMO these exemptions affect the extent of vegetation which can be removed without a permit.

### **Clause 52.17 (Native vegetation)**

A planning permit is required to remove native vegetation pursuant to Clause 52.17 of the Planning Scheme. Several exemptions (subject to conditions) apply including the following:

- Conservation work
- Crown land
- Dead native vegetation
- Emergency works
- Existing buildings
- Existing buildings and works in the Farming Zone and Rural Activity Zone
- Fences
- Fire protection
- Geothermal energy exploration and extraction
- Grasses
- Grazing (on freehold land or Crown land)
- Greenhouse gas sequestration and exploration
- Harvesting for timber production – naturally established native vegetation
- Land management or directions notice
- Land use conditions
- Lopping and pruning for maintenance
- Mineral exploration and extraction
- New buildings and works in the Farming Zone and Rural Activity Zone
- New dwellings in the Farming Zone and Rural Activity Zone
- Personal use
- Pest animal burrows
- Planted vegetation
- Railways
- Regrowth
- Road safety
- Site area

- Stock movements on roads
- Stone exploration
- Stone extraction
- Surveying
- Traditional owners
- Utility installations
- Vehicle access from public roads
- Weeds

Applications are assessed using the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017) (Native Vegetation Guidelines).

### **3.2.3 Water Act 1989**

The *Water Act 1989* (Water Act) provides the legal framework for managing Victoria's water resources. The Water Act sets out a number of licences for works on waterways for managing actions on freehold land.

Under the Water Act, 'waterway' includes 'swamp or marsh' and therefore the wetland is considered as a waterway. The Water Act also outlines specific requirements for water managers, in this case Melbourne Water, to manage Designated Waterways and their adjacent 20 metres.

The Water Act is also of relevance as it also gives Melbourne Water powers and obligations related to Improving health and amenity of waterways, conserving and improving biodiversity and ecosystems, protecting water quality and meeting State environment protection targets, and identifying and managing existing regional flood problems.

### **3.2.4 Catchment and Land Protection Act 1994**

The *Catchment and Land Protection Act 1994* (CaLP Act) establishes a framework for integrated and co-ordinated management of catchments across Victoria which aims to achieve a number of objectives including maintaining and enhancing the land productivity and ensuring the quality of the State's land and water resources.

The Mornington Peninsula municipality is within the Port Philip and Western Port Catchment Management Authority area. In the Port Philip and Western Port region, Melbourne Water acts as the waterway manager and the Port Philip and Western Port Catchment Management Authority acts as the land manager.

The CaLP Act sets out duties for land owners and the Secretary (the body corporate established under Part 2 of the *Conservation, Forests and Lands Act 1987*) including but not limited to avoiding land degradation, soil conservation, protecting water resources and preventing the growth and spread of regionally controlled weeds.

### **3.2.5 Environment Protection Act 1970**

The *Environment Protection Act 1970* (EP Act) establishes a legislative framework for the protection of the environment in Victoria having regard to the principles of environment protection. The EP Act has established the Environment Protection Authority Victoria (EPA Victoria) and set out Authority's powers, duties and functions related to improving the air, land and water environments by managing waters, control of noise and control of pollution. The EP Act also regulates industrial development and activities through a permit and licensing framework with associated enforceable offences.

The EP Act also requires the establishment of State Environment Protection Policies (SEPPs). SEPPs are subordinate legislation developed to provide more detailed requirements and guidance for the application of the Act to Victoria. The most relevant SEPPs to the wetland is the Waters SEPP.

#### **Waters State Environment Protection policy**

The Waters SEPP formally commenced recently. The purpose of this SEPP is to provide a framework to protect and improve the quality of Victoria's waters having regard to the principles of environment protection set out in the EPA Act.

### **3.2.6 Environmental Effects Act 1978**

The *Environment Effects Act 1978* (EE Act) establishes a framework for the assessment of environmental impacts of state significance. If a proposal that could have a significant effect on the environment, it should be referred to the Minister for Planning for a decision as to whether an Environment Effects Statement (EES) needs to be prepared before other statutory authorisations are granted.

### **3.2.7 Flora and Fauna Guarantee Act 1988**

The *Flora and Fauna Guarantee Act 1988* (FFG Act) is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. Under the FFG Act a permit is required to 'take' protected flora species from public land. A permit is generally not required for removal of protected flora from private land. Authorisation under the FFG Act is required to collect, kill, injure or disturb listed fish.

### **3.2.8 Aboriginal Heritage Act 2006**

The *Aboriginal Heritage Act 2006* (AH Act) and Aboriginal Heritage Regulations 2018 (AH Regulations) provides for the protection and management of Victoria's aboriginal heritage through processes linked to the planning system. The AH Act established the framework for the preparation of Cultural Heritage Management Plans (CHMP) and Cultural Heritage Permits.

Given parts of the wetland are identified as an area of cultural heritage sensitivity aboriginal heritage value, the provisions of the AH Act must be taken into consideration during the planning process.

## 4. Literature review

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Detail on Tootgarook Wetland can be found in numerous reports, publications and plans, including key documents listed in the References and Bibliography of this report. The Southern Peninsula Indigenous Flora and Fauna Association is also a source of information: [www.spiffa.org/tootgarook-swamp.html](http://www.spiffa.org/tootgarook-swamp.html).

The wetland has been subject to numerous hydrological and ecological studies (see *References* and *Bibliography*). This large body of literature has been reviewed in various reports, in particular:

- Condina P 2011. *Tootgarook Swamp, Rosebud: literature review and directions report*. Report prepared for Melbourne Water, Pat Condina & Associates, Devon Meadows, Victoria.
- Jacobs 2014. *Ecological strategic directions framework for Tootgarook Wetland, Rosebud: ecological values and knowledge gaps report*. Report prepared for Melbourne Water, Jacobs Engineering Group Inc., Melbourne.
- BMT WBM 2015. *Tootgarook Wetland Ramsar nomination feasibility study*. Report prepared for Mornington Peninsula Shire, BMT WBM Pty Ltd, Melbourne.
- BMT 2018. *Tootgarook Wetland management plan*. Plan prepared for Mornington Peninsula Shire, BMT.

This literature review explores critical issues relating to the present project.

### 4.1 Wetland hydrology and soils

A conceptual model of the hydrology of Tootgarook Wetland was developed for Melbourne Water by SKM (2012). Investigations completed by GHD (2014) resulted in some updates. The current conceptual model is described by Jacobs (2017).

Tootgarook Wetland receives its water from several sources:

- direct rainfall
- groundwater seepage from adjacent higher land (making the system groundwater dependent)
- surface flow from adjacent land, primarily Drum Drum Alloc Creek drain and Browns Road drain.

Water loss is through evapotranspiration and subsurface outflow via Chinamans Creek drain.

The relative contribution from each source varies in time and is not well understood. 'The data indicates that the wetland is a highly groundwater dependent system in terms of saturation of sediments and surface water ponding. Surface water contribution to the wetland appears to be less important than groundwater contribution.' (Jacobs 2017). However infrequent flooding and seasonal surface water contribution may now be the factors that increasingly control the hydrology of the wetland given local groundwater extraction.

Being groundwater dependent, Tootgarook Wetland is highly sensitive to local groundwater extraction (Jacobs 2017):

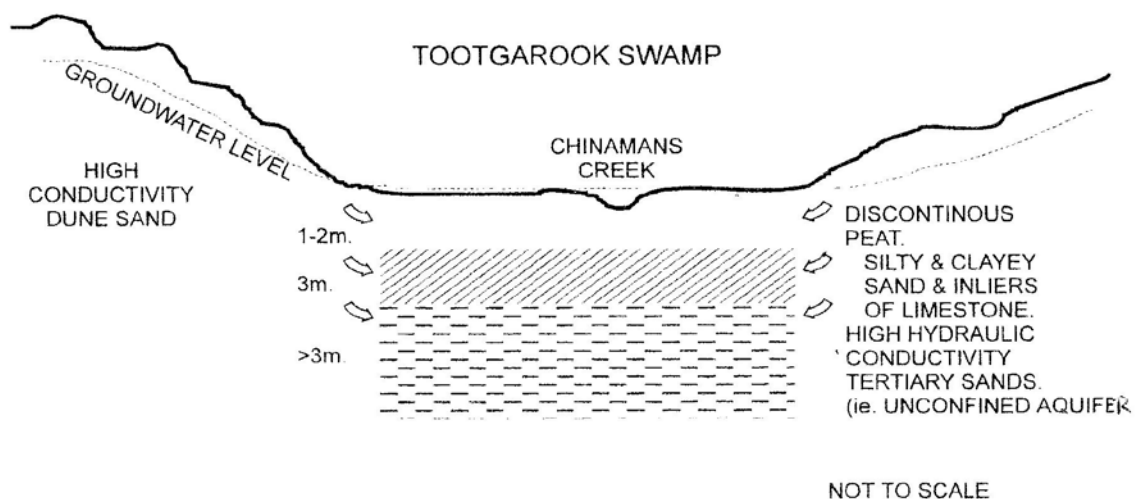
The highly seasonal nature of groundwater levels is likely to be due to a combination of climatic effects and pumping in the area. A large number of stock and domestic bores are registered to the north of the site and irrigation bores to the east and southwest. The declines in groundwater levels in the bores occur from August to March each year, which coincides with reduced rainfall (and hence higher pumping).

The central area of Tootgarook Wetland north of Browns Road has a discontinuous surface layer of peat (fibric organosol, see VRO 2018) to 1–2+ metres deep. Below the peat is a basal layer of impermeable or semi-permeable swamp and lagoonal sediments extending from approximately 1–2 metres down to 3 metres below the surface, consisting of clayey and silty sands with occasional limestone inliers (Condina 2011). This is the geological swamp deposit that defines the extent of the wetland. This clay-rich liner impedes water infiltration (it is an aquitard) and may at times perch at least some of the wetland above the regional Quaternary (Bridgewater Formation) aquifer water table below.

The extent and in particular the continuity of the near surface clay-rich peat and clay rich layers is not well understood. Consequently the degree to which Tootgarook Wetland has a perched aquifer is not clear, but some amount of perching of local water tables appears likely. This impeding layer was encountered during construction of the water supply pipeline across the central area in 1992, which provides the only available geological cross section across the wetland (Coffey Partners International 1992). It is a reasonable conjecture that the aquitard occurs throughout and that it consists of the geological swamp deposit itself.

The swamp soil itself is a major controlling factor in the overall movement and balances of surface and subsurface waters. Figure 2 (Condina 1997) shows a typical profile of the soils of the swamp along the water supply alignment. The occurrence of peat, clayey and silty sands with occasional limestone inliers would all serve to lower the vertical permeability of swamp water and lead to some perching of local water tables.

**Figure 2. Cross section of catchment and swamp (Condina 2011)**



Keble (1950) thought the swamp is underlain by impervious clay which holds or previously held water sufficiently for the peat to have formed:

The clay or marl... in the Tootgarook Swamp near Rosebud that held the water is impervious. The peat there was formed in shallow water, the level and composition of which influenced the decay of the vegetable matter.

SKM (2012) reported:

The evidence of a perched watertable or near surface impermeable stratum, remains open to conjecture. There is some evidence of low permeability palaeosol horizons in the sequence which may cause localised perched watertables or groundwater confinement. Groundwater may also be perched above near surface peat and clay beneath the swamp. These aquitards are leaky but may confine groundwater in the underlying Bridgewater Formation aquifer. The permeability of semi-confining peat layers may be in the order of 0.41m/day.

Jacobs (2017) found the 'swamp is in connection with the shallow unconfined Quaternary alluvium aquifer, although discontinuous clay and peat layers may result in small semi confined areas of the shallow aquifer'; these would cause localised perching of water tables.

Jacobs (2017) noted that a key data gap in conceptualisation of the wetland included the seasonal variation of groundwater levels due to local extraction in dry periods. A need to understand and quantify links between the saturation within the wetland caused by shallow watertable, variations in seasonal drawdown and potential impacts on ecosystem health was recognised. Specifically, it was unclear whether 'saturation of the wetland' relates to saturation of shallow soils or whether it means groundwater actually discharges at the surface across the wetland (e.g. providing permanent pools). The current conceptualisation implies that saturation relates to soils rather than discharge, with the exception of the creek and potentially other lower lying areas where groundwater discharge does occur. In addition, the seasonal and long term variability of this soil saturation and groundwater discharge is unclear, including the role of stormwater runoff and the temporal variability of recharge and discharge across the site.

Prior to development and drainage works the original outlet from the swamp (Tootgarook Creek) is likely to have often been blocked by the coastal dunes, and so large areas of the swamp must have been under water for long periods, thus explaining the formation of swamp and overlying peat deposits.

Given generally accepted peat formation rates of about 1 mm/year then the 400 mm thick, near surface 'true peat' layer, identified by Coffey Partners international (1992) would have taken 400 years to form. It should be noted that this true peat layer was not found in all test pits and therefore apparently is not a continuous layer across the wetland. Earlier studies by Melbourne Water (Geological Services Section, November 1991) had identified a far thicker layer containing peat up to 3.8 metres in thickness, which in addition to organic matter also contained calcareous clayey silt and shells. Sand occurred in all boreholes underlying the peat.

Peat requires permanent standing water to form, slowly oxidising when it dries out, and thus only builds up below herbaceous reed and rush vegetation growing on permanently inundated or waterlogged substrates (the inner swamp). Tootgarook Wetland has not held water continuously since recent observations began in 2012, drying out each summer (C. Brown, pers. comm.) including during years of above average rainfall (2013 and 2017). Regular drying out is not consistent with peat formation, indicating that something drastic has happened to the wetland hydrology. The wetland appears to have undergone major drying out due to Chinamans Creek drain and possibly rupture of the aquitard by historical marl extraction in the north-west (Figure 17). Dry peat is flammable and major peat fires could potentially occur in future.

It is unlikely that peat occurred on the fringes of the wetland including the long southern tail where inundation was intermittent. Here the soils are more mineral clay swamp deposit where woody paperbark and tea-tree scrub was and is able to grow with increased drainage (the outer swamp).

Apart from Drum Drum Alloc Creek, the catchment has a notable absence of continuous, natural waterways due to its well-drained sandy nature. Prior to development the catchment was able to accommodate rainfall from all but the most extreme storm events through infiltration into sandy soils and local storage in depressions, with subsequent transfer to the groundwater system and then laterally into swamp.

Groundwater recharge occurs during and after rainfall events and is aided by the hummocky nature of the dunes especially in the Cups area to the south-west of the swamp. Groundwater contained in the dunes is the Bridgewater Formation aquifer. It is predominantly unconfined, however localised perched water tables occur (e.g. in Tootgarook Swamp) as a result of previous deposition of lower permeability material such as peat, limestone or clays, and the interaction of these with subsurface inflow from the adjacent dunes.

Other surface water features apart from Tootgarook Swamp itself are almost absent to the west of Selwyn Fault due to the highly permeable nature of the sandy soils. Tootgarook Wetland is only one of a few natural depressions on the Nepean Peninsula with surface groundwater, another being Portsea lagoon.

The only essentially natural existing waterway in the Chinamans Creek catchment is Drum Drum Alloc Creek however within Tootgarook Wetland it is a channelised drain. Chinamans Creek is a completely artificial constructed drain but at 0.4–0.7 metres deep it was not deep enough to rupture the peat and clay-rich lining of the wetland which could have drained any perched water table and potentially destroyed the swamp.

Development of agricultural, commercial and residential areas and land use changes within the catchment have led to an alteration of the natural hydrologic regime of both the catchment and the swamp. In particular they have changed the hydrologic characteristics and response of the catchment during rainfall events:

- Significantly greater volumes of surface water are generated as a result of loss of natural storage in the catchment, catchment vegetation clearance, and increase in the area of impervious surfaces.
- The amount of rainfall infiltration of groundwater per unit rainfall has decreased as a result of loss of natural storage and drainage works.

Under normal catchment conditions low rainfall, low intensity storms do not result in appreciable surface runoff in rural parts of the catchment due to the highly pervious nature of the soil. However in wet years such as 1995, 1996, 2001, 2012 and 2013, when the subsoil remained saturated, even low intensity storms resulted in surface runoff. High rainfall, high intensity storms result in appreciable surface runoff which is conveyed by a variety of overland flow paths to Chinamans Creek and Drum Drum Alloc Creek and into the swamp. High rainfall events are important: the last major flood was in April 2001 when 207 mm of rainfall was received in one month, over three times the April average (BOM 2018b).

Drainage and runoff studies provide estimates of 1 in 100 year peak inflows and outflows from the swamp (Table 3). These illustrate the important flood retardation and flood mitigation function of the wetland.

**Table 3. Peak levels, inflows and outflows, Tootgarook Wetland**

<b>100 year ARI event</b>	<b>Level (m AHD)</b>	<b>Inflow (m<sup>3</sup>/sec)</b>	<b>Outflow (m<sup>3</sup>/sec)</b>
Goh (1994)	2.75	73.0	6.0
Craigie (1996)	2.81	86.0	5.4
MWH Australia (2005)	2.36	45.0	3.7
Melbourne Water (in Condina 2011)	2.87	104.9	3.7

Observations by Melbourne Water from 1992 to 1996 (Condina 1997) show that even in prolonged low rainfall periods the creek continues to have a small flow sufficient to at least maintain creek pools. Water levels of the swamp during drier periods are consistently 0.2 to 0.3 m above the height of water in Chinamans Creek. Thus there is normal inflow of swamp groundwater to the creek, however this may be temporarily reversed after rain periods where the creek level is higher than groundwater levels. Groundwater inflows to the swamp provide a buffer to drying out of the swamp, however in prolonged periods of dry weather little or no surface water remains except in artificial excavations into the surface.

The Melbourne Water monitoring found that groundwater levels fluctuated from year to year but generally winter/spring levels at about 1.9 m to 2.1 m AHD were above the natural surface level of 1.88 m AHD. In the summer/autumn period levels in the bores dropped to about 1.2 to 1.4 m AHD. Jacobs (2017) undertook further groundwater level studies and confirmed similar vertical variation. The central area of the wetland north of Browns Road has been subject to groundwater bore monitoring since 2014. The groundwater across the swamp in this area is very shallow, ranging from at ground surface to approximately 1.6 metres below the ground in the bores, and undergoes seasonal fluctuations of less than one metre (Jacobs 2017).

The level of the swamp is only marginally above sea level. Its average natural surface level of 1.88 m AHD at the lower end and the invert level of 0.69 m of its central drain (at the water pipeline), and 0.40 m AHD at Elizabeth Avenue, can be compared with a level of 1.52 m for the highest recorded tide (December 1984). At a flood level of 2 m about two-thirds of the swamp flats are under water. This proportion increases to about nine tenths when water levels rise to 2.5 m AHD (Goh 1994).

## 4.2 Mapping of Tootgarook Wetland

The extent, geology and vegetation of Tootgarook Wetland have been mapped many times with increasing detail (Table 4). The early maps were made before construction of Chinamans Creek drain in 1877 and therefore represent the original swamp.

**Table 4. Mapping of Tootgarook Wetland**

Date	Mapped by	Comments
<b>Extent</b>		
1804	JH Tuckey	Indicative oval shape labelled 'brackish swamp'
1841	GD Smythe	Intricate boundary, Drum Drum Alloc Creek not in correct position (Figure 3)
1863	M Callanan	Not accurate, shows land parcel boundaries enabling accurate registration of the mapping on a modern base map
2012	DSE	Not accurate, appears in DELWP (2019b) (Figure 6)
2014	Jacobs	Not accurate, reproduction of DSE (2012)
2018	BMT	Small scale, overestimates extent on eastern edge (Figure 1)
<b>Geology</b>		
1856	ARC Selwyn	Geology map of Port Phillip region, not detailed
1950	RA Keble	Shows land parcel boundaries, enabling accurate registration of 'Tootgarook Swamp' described as peat with small inliers of dune limestone
1951	RA Keble	Shows entire 'Tootgarook Swamp' described as Recent swamp deposit, includes southern extremity, small scale
1967	JJ Jenkin	Geology map (Sorrento sheet), small scale, reproduction of Keble (1951), shown as 'Tootgarook Swamp' lagoonal deposits: sandy and concretionary limestone, calcareous and ligneous clay
<b>Vegetation</b>		
2001	A Oates, M Taranto DNRE	Mapped as Wetland Formation in mosaic with EVC Swamp Scrub, currently on NatureKit vegetation map (DELWP 2019a)
2003	D Tonkinson et al. DSE	EVC mapping
2003	A Picone, G Walker	Detailed vegetation quality mapping
2006	S Sinclair et al. DSE	EVC mapping
2011	S Gannon	EVC mapping of major section of wetland (property north of Browns Road), detailed and not fully consistent with above

The geological and historical wetland boundaries appear to broadly correspond, subject to scale of mapping and some mapping inconsistencies. Callanan (1863) doesn't map the south-eastern arm of the wetland (Figure 4) which is mapped by Smythe (1841), Keble (1950) and BMT (2018). This arm has a narrow connection to the larger area that was apparently missed by Callanan. Another discrepancy is the extent of the northern arm: Smythe has it truncated, Callanan broken into sections, and Keble almost reaching Port Phillip Bay. Examination of 1939 aerial photography indicates that Smythe and Callanan may be correct, which suggests that the Keble's northern area had been cut-off by prehistoric sand drift to form an associated wetland not topographically connected to Tootgarook Wetland.

Figure 3. Tootgarook Wetland (Smythe 1841)

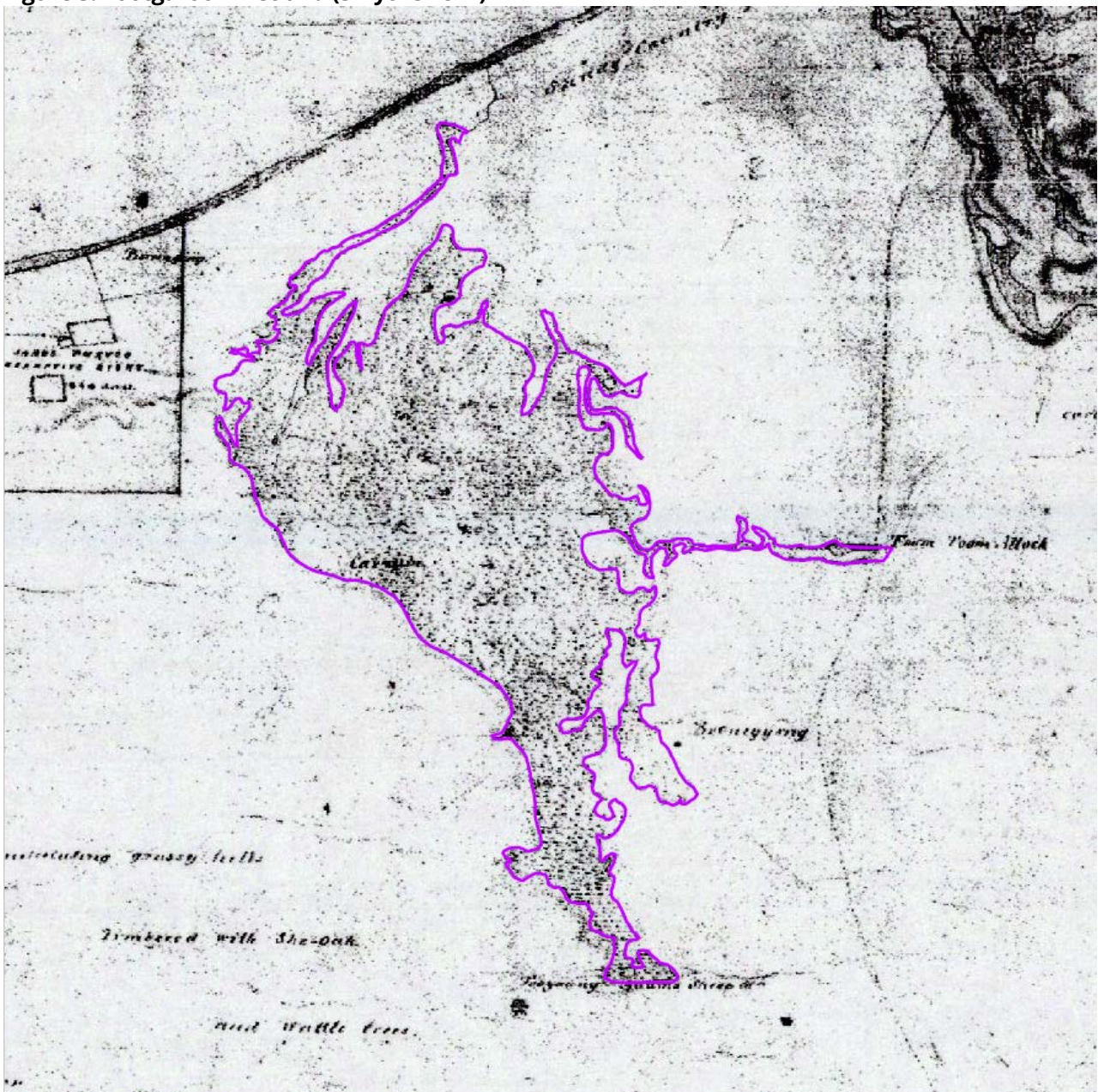




Figure 5. Tootgarook Wetland (Keble 1950)

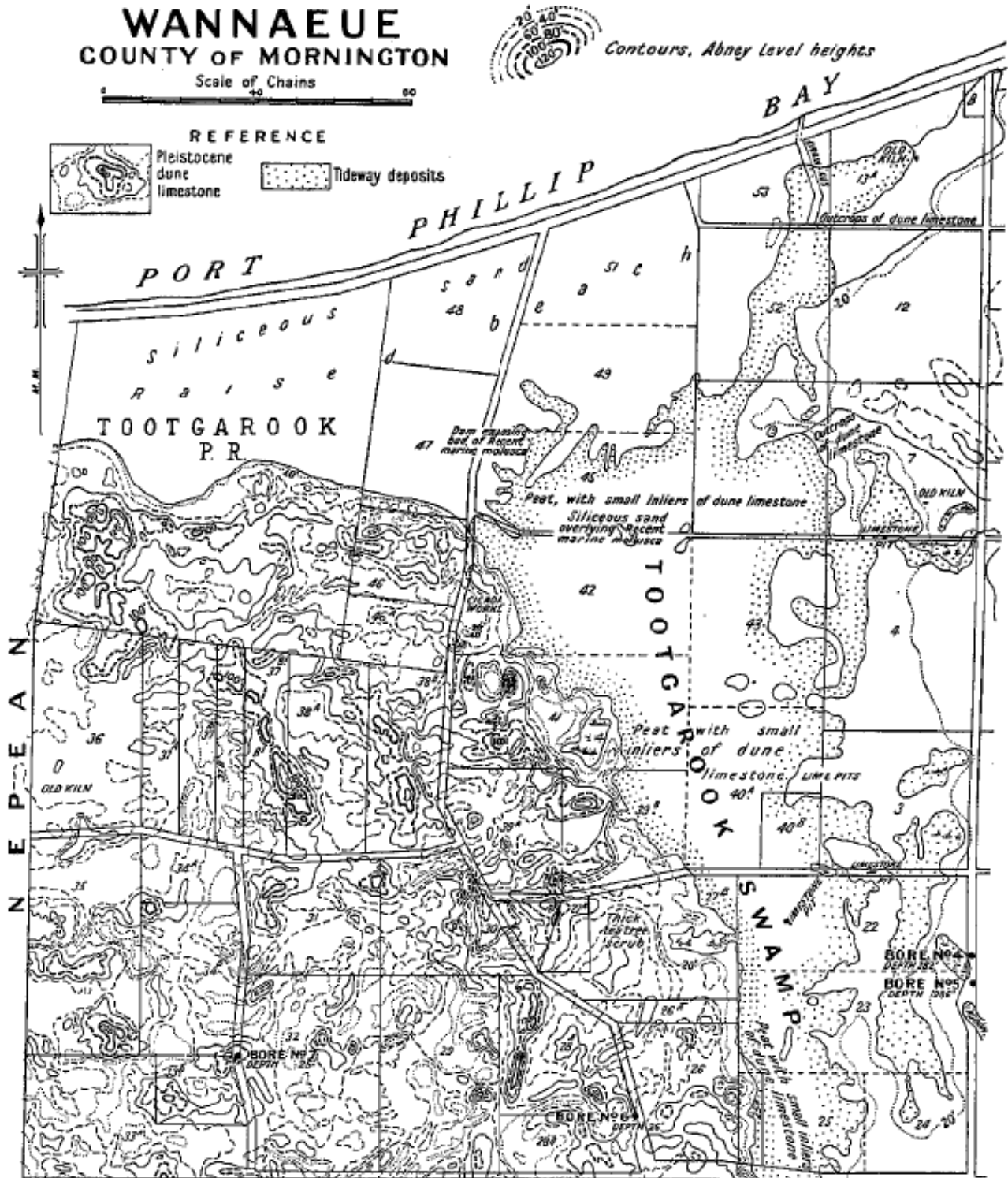
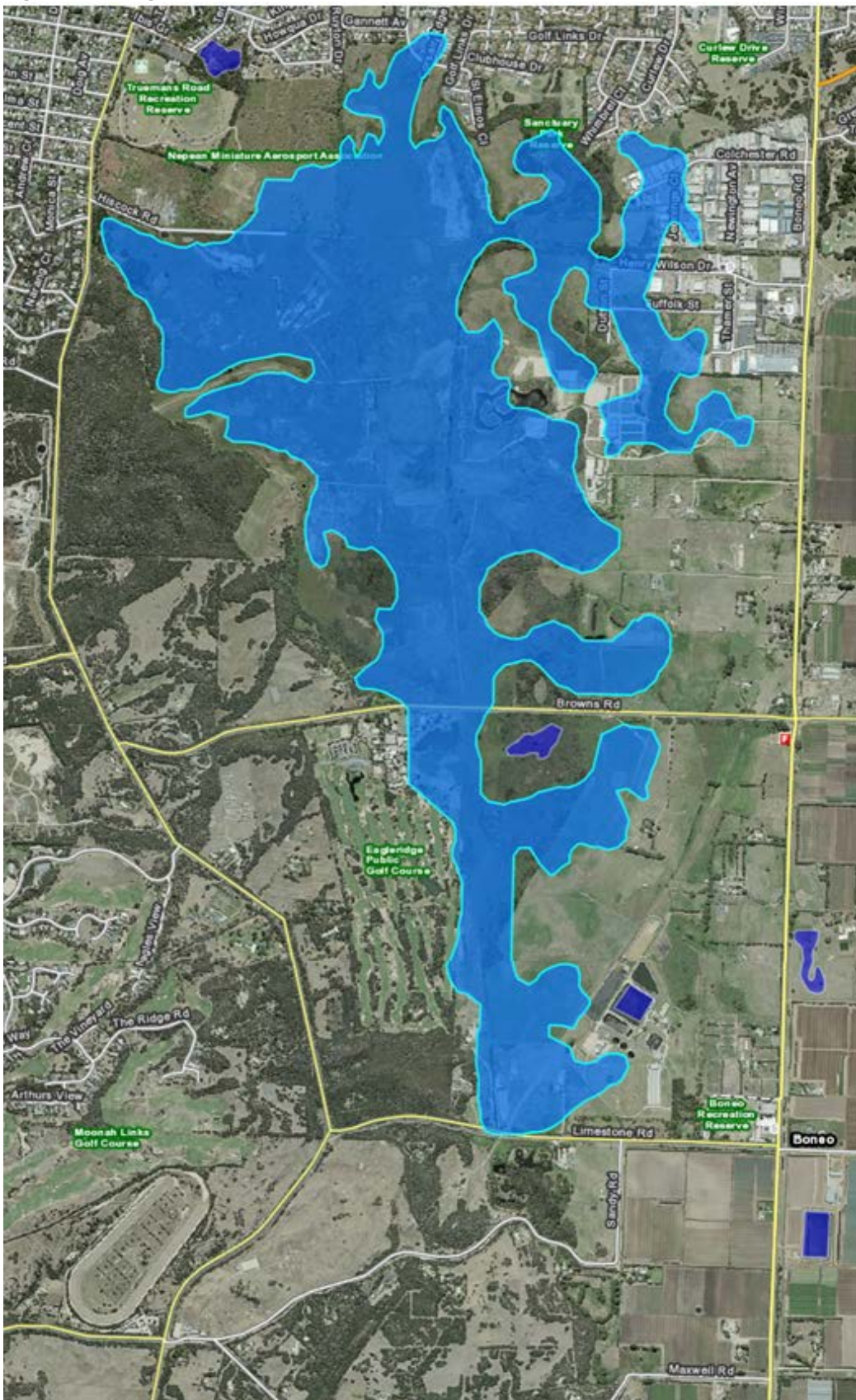


Fig. 59. Contour survey of part of the Nepean Peninsula.

Figure 6. Tootgarook Wetland (DELWP 2019b)



Vegetation mapping is mostly of native vegetation and has been undertaken this century only. It was too late to map the original outer and inner swamp boundaries. The inner swamp supported herbaceous vegetation too wet for shrubs and trees. The outer swamp was on higher ground at the edges and extremities and was frequently flooded rather than permanently wet, resulting in woody scrub of Swamp Paperbark *Melaleuca ericifolia*, Woolly Tea-tree *Leptospermum lanigerum* and, rarely, Scented Paperbark *Melaleuca squarrosa*. Remnants of both the inner and outer swamp are widespread.

The vegetation mapping is not fully consistent, indicating mapping discrepancies and also complexity in the distribution of the 12 recognised ecological vegetation classes (EVCs). Due to the complexity of wetland zones and transitions, driven by variable microtopography in relation to flood regime, maps of wetland vegetation are often simplifications of intricate and convolute on-ground boundaries and transitions between EVCs.

With predominantly introduced vegetation largely left out of the vegetation mapping, the available mapping is not of the entire wetland. It was produced for particular purposes such as setting management priorities and determining quantities of available native vegetation offsets. Many native flora and fauna can occur outside mappable DELWP 'patch' native vegetation in what is functional ecological wetland despite floristic modification. These include significant species such as Australasian Bittern *Botaurus poiciloptilus* and Latham's Snipe *Gallinago harwickii*. Maps of the McNaught property includes such vegetation as 'poor quality vegetation' (Picone and Walker 2003) and 'degraded treeless vegetation' (Gannon 2011), the latter a technical term used by DSE at the time.

Whilst broadly comparable, none of the geology, survey or modern vegetation maps are fully consistent due to mapping error, differences in scale, and differences in interpretation as to where the geological, wetland or EVC boundary is situated. While there is clearly a core area of wetland and wetland substrate, its boundary and the outer wetland boundary are not consistently mapped in the various studies.

DELWP (2016) has a wetland monitoring system for Victoria based on the following indicators that describe changes in the extent and type of wetlands over an eight year reporting cycle.

- Extent index:  
maximum inundation, i.e. maximum inundated area over the assessment period, expressed relative to the historical maximum inundation extent
- Water regime index:
  - water regime category/subcategory
  - frequency of inundation
  - duration of inundation
  - duration between inundation
- Vegetation index:  
vegetation 'cover trends' i.e. assessment of the vegetation cover of wetlands

This systems takes a remote sensing approach using Landsat Thematic Mapper imagery to classify standing water, which informs the extent index and water regime index, and to assess vegetation cover and character, which informs the vegetation index (DELWP 2016). Landsat having a course 25 metre pixel means that this method has no application in determining the precise extent of Tootgarook Wetland. Also, the historical maximum inundation extent is considered to be the ultimate extent of a wetland, but entire floodplains are inundated during extreme 100 ARI flood events as discussed in *Methodology*.

In summary:

- There are modern maps of native vegetation which are not fully consistent.
- There is no detailed, accurate and comprehensive map of the Tootgarook Wetland boundary.

### 4.3 Wetland buffer zones

Buffer zones are:

Areas peripheral to a specific protected area, where restrictions on resource use and special development measures are undertaken in order to enhance the conservation value of the protected area...

The term buffer zone gained international prominence through UNESCO's Man and the Biosphere Programme in 1971' (UNEP-WCMC 2014).

Buffer zones, where they exist, protect geophysical and ecological core natural areas by absorbing or moderating human impacts along the edges. Human-induced edge pressures include hydrological disturbance, invasive species, visitor pressure, sight, noise and light disturbance, toxic contamination and landscape intrusion. Wetlands in particular benefit from having a buffer zone as they are receiving basins for runoff from surrounding land. Wetland buffer zones are variously identified in Australia (Price et al. 2005).

It is widely recognised that terrestrial habitat adjacent to wetlands is important in maintaining wetland biodiversity and thus to the integrity of wetland ecosystems. Consequently, protecting isolated wetlands requires the extension of some protection to surrounding terrestrial habitat. However, 'balancing human land use and habitat conservation is challenging, and well-informed land use policy is hindered by a lack of knowledge of the specific risks of varying amounts of habitat loss' (Harper et al. 2008).

While the value of buffer zones for wetlands is widely understood, quantitative relationships have been difficult to establish. Furthermore the limited research and investigation into waterway buffers in Australia focusses on streams, which differ to wetlands in several respects, particularly in having fewer waterbirds.

A study of the flight initiation distance (FID) of various shorebirds in Victoria resulting from human disturbance found that species with higher body masses have longer FIDs (Glover et al. 2011). The mean distance ranged from 19 metres (Latham's Snipe, range 9–45 metres) to 126 metres (Eastern Curlew *Numenius madagascariensis*, range 81–196 metres). Both occur in Tootgarook Wetland. These distances should be accommodated within any designated wetland buffer zone. However, the recreational use of buffer zones reduces their effectiveness, causing 'buffer creep' whereby the effective separation distance between people and birds is reduced (Weston et al. 2009).

A study of the role and effectiveness of buffers in wetlands around Melbourne, including the Edithvale-Seaford Wetland found that wetland birds are sensitive to human and other activities around wetland habitats, even in areas where the frequency of disturbance is such that some habituation may be expected to occur (Biosis Research 1993). The study recommends that wetlands should have a buffer zone 100 metres wide where possible, with a minimum width of 60 metres, and wetlands that support sensitive species may require buffers of 150 metres or more (Biosis Research 1993).

Land and Water Australia has reviewed buffer controls around Australia (Price et al. 2005). All states and territories have regulatory controls that apply to a distance of between 20 and over 200 metres from streams and wetlands. These controls essentially create buffer zones of variable effectiveness. For example for wetlands of significant value on the Swan Coastal Plain the Western Australian government recommends an ecological buffer of 200+ m, and a groundwater buffer of 2 km in the direction of groundwater flow.

Le Feuvre et al. (2018) investigate setback widths for streams in the Port Phillip and Western Port region and recommend a minimum setback of 100+ metres for terrestrial fauna and 50+ metres for riparian fauna. Appropriate setback widths for wetlands need to be determined on a site basis due to unique habitat features and sensitivities, based on the species present or likely to be present:

To ensure wetlands and floodplains function well they need significantly wider setback widths to protect against disturbance and habitat degradation (e.g. using data from Hansen et al. 2015, wetlands need a setback of approximately 250 m to preserve terrestrial fauna). For floodplains, extending the setback to include the entire floodplain (1 in 100 year flood level) is one way to achieve this, while for wetlands along waterways the setback should start on the upslope bank of the wetland (in line with recommendations from Wenger 1999).

Wetland buffer zone width recommendations in Australia may be summarised as follows.

**Table 5. Buffer zones recommended around wetlands**

Wetland	Buffer zone	Reference
Australia	Varies with State or Territory, e.g. Swan Coastal Plain: ecological buffer 200+ m, groundwater buffer 2 km in direction of groundwater flow	Price et al. (2005)
Victoria	Minimum 120 m to improve water quality	Hansen et al. (2010)
Victoria	250 m for terrestrial (non-aquatic) fauna (birds, frogs etc.)	Hansen et al. (2015)
Port Phillip region	100 m wide where possible, minimum of 60 m, wetlands supporting sensitive species may require buffers of 150+ m	Biosis Research (1993)
Port Phillip and Western Port region	'Significantly wider' than 50 m for riparian (wetland) fauna	Le Feuvre et al. (2018)

While there is general agreement that any buffer zone is better than none, the limited knowledge base and differing scientific recommendations on buffer widths tend to make the determination of optimal or useful buffer zone widths for Tootgarook Wetland imprecise. Nonetheless minimal recommendations can be adopted. Recommendations for a Tootgarook Wetland buffer zone are in *Wetland buffer zone*.

### 4.3.1 Regional wetland buffer zones

Experience with wetland buffer zones in the region are discussed here, and implications for the present study are considered.

#### ***Edithvale-Seafood Wetland***

The Edithvale-Seafood Wetlands, managed by Melbourne Water, have a management plan that does not designate a buffer zone but has the following recommendations (Lane et al. 2000):

Disturbance to wildlife:

Locate infrastructure for human activities at least 60 metres from the edge of wetlands or, where unavoidable, provide dense screening vegetation at least 20 metres from the edge of wetland vegetation.

Locate infrastructure likely to concentrate human activities (e.g. car parks, entry points, picnic areas) at least 120 metres from the edge of wetland vegetation.

Restrict recreational activities at or near (within 200 metres) the wetlands to passive or nature-based activities.

Control disturbing influences such as noise, inappropriate levels of use on nearby reserves and limit lighting to low lux strength within 500 metres of the wetlands.

The Edithvale-Seafood Wetland at Austin Road, Seafood has a 30 metre buffer resulting from a VCAT decision regarding a proposed residential development (VCAT 2004). Melbourne Water recommended a 60 metre buffer in order to minimise bird disturbance, which was considered to be a useful rather than optimal buffer. There was debate over whether the buffer should extend from the edge of the mean water level versus the edge of the vegetated wetland (W. Steele, Melbourne Water, pers. comm.).

#### ***Western Treatment Plant***

Wetlands at the Western Treatment Plant at Werribee, managed by Melbourne Water, have 350 metre buffers which are designated to protect and manage birdlife and are not available for lease. These buffers are a condition of an EPBC Act approval in 2010 for land to be transferred from irrigation to cropping (EPBC Act approval 4221). The most susceptible wetland element in need of buffering was considered to be waterbirds, with flight initiation distance (FID), which differs between various species, taken into account. There was debate as to whether the buffers are 'terrestrial margins' or an integral part of the wetlands due to their local catchment groundwater connection (W. Steele, Melbourne Water, pers. comm.).

## 5. Methodology

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Based on the literature review and experience obtained from other similar wetland management planning projects, the following methodology was applied to achieve the project aim and objectives.

### 5.1 Original wetland extent

The original wetland extent was inferred using a range of evidence:

- geology maps (Keble 1950, 1951, reproduced in GSV 1967)
- historical survey plans (Smythe 1841, Callanan 1863)
- historical aerial photography (1939, c. 1940, 1957, 1992)
- Lidar digital elevation model (Dahlhaus 2012)

Keble's geology maps of the swamp deposit are reference maps for the original wetland. However, due to scale and interpretation issues, this mapping is indicative rather than precise or accurate.

Defining the original extent of Tootgarook Wetland is made difficult by a lack of accurate and detailed geology mapping of the geological swamp deposit, compounded by extensive vegetation clearance and general drying out of the wetland due to construction of major drains.

### 5.2 Current wetland extent

Wetland extent is defined here as *ecological wetland*, which is land currently supporting characteristic (typical) wetland vegetation, including both native and predominantly introduced vegetation.

A considerable proportion of the wetland is modified and does not support native 'patch' vegetation as defined by the state government (DELWP 2017). This predominantly introduced vegetation remains functional wetland vegetation as it supports wetland flora and fauna including significant species such as Australasian Bittern and Latham's Snipe.

The Land Subject to Inundation Overlay (LSIO) represents a Melbourne Water modelled 100 year ARI flood level. The model is useful though perhaps not accurate as floods have extended beyond the overlay boundary (G. Walker pers. comm.). Regardless of accuracy, obligate wetland flora cannot survive for 99 years without a flood. It can be assumed that a 100 year ARI flood would go beyond the normal limit of the wetland and temporarily flood adjacent non-wetland vegetation. However this is not a typical floodplain wetland. Tootgarook Wetland has a relatively large contributing catchment and is well confined by higher land on either side and by downstream coastal dunes. The LSIO is useful in checking the current wetland boundary.

While 1 in 100 year events do not necessarily define wetland extent, smaller events up to 1 in 5 year certainly do. The 1 in 100 year level is about 2.9 m AHD in Tootgarook Swamp. The one in two year level could be at around 2.0 m AHD and at such times 66% of the LSIO area would be inundated and the rest of the LSIO area may have soil at near saturation for a long period so emergent aquatic plants would thrive. At 2.5 m some 90% of wetland is inundated. This zone is 'ephemeral marsh' which is subject to occasional inundation, capillary rise or groundwater flow. Accordingly the extent of the wetland is the extent of the ephemeral marsh and this may approximate the LSIO boundary.

The wetland boundary was mapped using GPS Collector as indicated by characteristic (typical) wetland vegetation comprising characteristic wetland flora species (Table 6) with at least 25% of perennial plant cover. Characteristic wetland species are obligate wetland flora: species that require frequent or permanent flooding (hydrophytes). Wetland fauna are not useful in this mapping exercise as they are mobile and not present or evident all of the time.

**Table 6. Characteristic wetland flora of Tootgarook Wetland (source: G Walker, data)**

\* Introduced species

? Identity of species or status of species as native uncertain

Species	Common name
<i>Agrostis</i> sp.	Bent
* <i>Agrostis stolonifera</i>	Creeping Bent
<i>Alisma plantago-aquatica</i>	Water Plantain
* <i>Allium vineale</i>	Crow Garlic
<i>Apium prostratum</i>	Sea Celery
* <i>Atriplex prostrata</i>	Hastate Orache
<i>Azolla rubra</i>	Pacific Azolla
<i>Baumea arthrophylla</i>	Fine Twig-sedge
<i>Baumea articulata</i>	Jointed Twig-sedge
<i>Baumea juncea</i>	Bare Twig-sedge
<i>Baumea rubiginosa</i> s.l.	Soft Twig-rush
<i>Baumea tetragona</i>	Square Twig-Sedge
? <i>Berula erecta</i>	Water Parsnip
<i>Blechnum minus</i>	Soft Water-fern
<i>Blechnum patersonii</i>	Strap Water-fern
<i>Bolboschoenus caldwellii</i>	Salt Club-sedge
<i>Bolboschoenus medianus</i>	Marsh Club-sedge
<i>Calystegia sepium</i>	Large Bindweed
<i>Carex appressa</i>	Tall Sedge
* <i>Carex distans</i>	Distant Sedge
<i>Carex fascicularis</i>	Tassel Sedge
<i>Carex gunniana</i>	Mountain Sedge
<i>Centella cordifolia</i>	Centella
<i>Chenopodium glaucum</i>	Glaucous Goosefoot
<i>Cladium procerum</i>	Leafy Twig-sedge
* <i>Cotula coronopifolia</i>	Water Buttons
<i>Crassula helmsii</i>	Swamp Crassula
<i>Cyathea australis</i>	Rough Tree-fern
<i>Cyanogeton alcockiae</i>	Southern Water-ribbons

<b>Species</b>	<b>Common name</b>
<i>Cyanogeton procerum</i>	Common Water Ribbons
* <i>Cyperus congestus</i>	Dense Flat-sedge
* <i>Cyperus eragrostis</i>	Drain Flat-sedge
<i>Dicksonia antarctica</i>	Soft Tree-fern
<i>Eleocharis acuta</i>	Common Spike-sedge
<i>Eleocharis sphacelata</i>	Tall Spike-sedge
<i>Euchiton involucratus</i> s.l.	Common Cudweed
<i>Gahnia filum</i>	Chaffy Saw-sedge
<i>Gahnia trifida</i>	Coast Saw-sedge
<i>Glyceria australis</i>	Australian Sweet-grass
* <i>Glyceria declinata</i>	Manna Grass
* <i>Glyceria maxima</i>	Sweet Grass
<i>Haloragis brownii</i>	Swamp Raspwort
<i>Hemarthria uncinata</i>	Mat Grass
<i>Hydrocotyle hirta</i>	Hairy Pennywort
<i>Hydrocotyle pterocarpa</i>	Wing Pennywort
<i>Hydrocotyle sibthorpioides</i>	Shining Pennywort
<i>Hydrocotyle tripartita</i>	Slender Pennywort
<i>Hydrocotyle verticillata</i>	Shield Pennywort
<i>Isolepis cernua</i> var. <i>cernua</i>	Nodding Club-sedge
<i>Isolepis cernua</i> var. <i>platycarpa</i>	Broad-fruit Club-sedge
<i>Isolepis inundata</i>	Swamp Club-sedge
* <i>Juncus acutus</i>	Spiny Rush
* <i>Juncus articulatus</i>	Jointed Rush
<i>Juncus caespiticus</i>	Grassy Rush
<i>Juncus holoschoenus</i>	Joint-leaf Rush
<i>Juncus pauciflorus</i>	Loose-flower Rush
<i>Juncus planifolius</i>	Broad-leaf Rush
<i>Lachnagrostis scabra</i>	Ruddy Blown-grass
* <i>Leersia oryzoides</i>	Cut Grass
<i>Lemna disperma</i>	Common Duckweed
<i>Lepidosperma longitudinale</i>	Pithy Sword-sedge
<i>Lepilaena</i> spp.	Water Mat
<i>Leptospermum lanigerum</i>	Woolly Tea-tree
<i>Leucopogon</i> aff. <i>Condah</i>	Beard Heath
<i>Lilaeopsis polyantha</i>	Australian Lilaeopsis
<i>Lobelia anceps</i>	Angled Lobelia
<i>Lycopus australis</i>	Australian Gipsywort
<i>Melaleuca ericifolia</i>	Swamp Paperbark
<i>Melaleuca squarrosa</i>	Scented Paperbark
<i>Mentha ?dimenica = ?leptophylla</i>	Slender Mint
* <i>Mentha pulegium</i>	Pennyroyal
<i>Mimulus repens</i>	Monkey Flower
<i>Myriophyllum crispatum</i>	Upright Water-milfoil

<b>Species</b>	<b>Common name</b>
<i>Myriophyllum verrucosum</i>	Red Water-milfoil
* <i>Nasturtium officinale</i>	Watercress
* <i>Nymphaea</i> sp.	Waterlily
* <i>Paspalum distichum</i>	Water Couch
<i>Persicaria decipiens</i>	Slender Knotweed
<i>Persicaria hydropiper</i>	Water-pepper
* <i>Persicaria maculosa</i>	Redshank
<i>Phragmites australis</i>	Common Reed
* <i>Plantago major</i>	Greater Plantain
* <i>Polypogon monspeliensis</i>	Annual Beard-grass
* <i>Polypogon viridus</i>	Water Bent
<i>Potamogeton ochreatus</i>	Blunt Pondweed
<i>Potamogeton pectinatus</i>	Fennel Pondweed
<i>Potamogeton tepperi</i>	Floating Pondweed
<i>Potamogeton tricarinatus</i> s.l.	Floating Pondweed
<i>Pteris ?comans</i>	Netted brake
<i>Pteris tremula</i>	Tender Brake
<i>Ranunculus amphitrichus</i>	Small River Buttercup
* <i>Ranunculus muricatus</i>	Sharp Buttercup
<i>Ranunculus papulentus</i>	Large River Buttercup
* <i>Ranunculus repens</i>	Creeping Buttercup
* <i>Ranunculus sceleratus</i>	Celery Buttercup
<i>Ranunculus sessiliflorus</i>	Annual Buttercup
* <i>Rorippa nasturtium aquaticum</i>	Two-row Water-cress
* <i>Salix fragilis</i>	Crack Willow
<i>Samolus repens</i>	Creeping Brookweed
<i>Schoenoplectus pungens</i>	Sharp Club-sedge
<i>Schoenoplectus tabernaemontani</i>	River Club-sedge
<i>Selaginella uliginosa</i>	Swamp Selaginella
<i>Selliera radicans</i>	Shiny Swamp-mat
<i>Senecio minimus</i>	Shrubby Fireweed
<i>Senecio pinnatifolius</i> var. <i>lanceolatus</i>	Variable Groundsel
<i>Sonchus hydrophilus</i>	Sow-thistle
* <i>Symphyotrichum subulatus</i>	Aster-weed
<i>Triglochin striata</i>	Streaked Arrowgrass
<i>Typha domingensis</i>	Narrow-leaf Cumbungi
* <i>Typha latifolia</i>	Lesser Reed-mace
<i>Typha orientalis</i>	Broad-leaf Cumbungi
<i>Urtica incisa</i>	Scrub Nettle
<i>Villarsia reniformis</i>	Running Marsh-flower
<i>Wolffia australiana</i>	Tiny Duckweed
* <i>Zantedeschia aethiopica</i>	White Arum Lily

Species particularly useful in locating the wetland boundary due to high cover values were:

**Table 7. Indicator plant species particularly useful in mapping**

\* Introduced species

Species	Common name	Use in boundary mapping
* <i>Agrostis stolonifera</i>	Creeping Bent	Indicator
<i>Calystegia sepium</i>	Large Bindweed	Indicator
* <i>Carex distans</i>	Distant sedge	Indicator
* <i>Cotula coronopifolia</i>	Water Buttons	Indicator
<i>Eleocharis acuta</i>	Common Spike-sedge	Indicator
* <i>Juncus articulatus</i>	Jointed Rush	Indicator
<i>Leptospermum lanigerum</i>	Woolly Tea-tree	Indicator
<i>Melaleuca ericifolia</i>	Swamp Paperbark	Indicator
* <i>Nasturtium officinale</i>	Watercress	Indicator
* <i>Paspalum distichum</i>	Water Couch	Indicator
<i>Phragmites australis</i>	Common Reed	Indicator
* <i>Polypogon monspeliensis</i>	Annual Beard-grass	Indicator
<i>Phragmites australis</i>	Common Reed	Indicator
<i>Typha domingensis</i>	Narrow-leaf Cumbungi	Indicator
* <i>Bromus diandrus</i>	Great Brome	Contraindicator
* <i>Cenchrus clandestinus</i>	Kikuyu	Contraindicator
<i>Ficinia nodosa</i>	Knobby Club-sedge	Contraindicator
* <i>Foeniculum vulgare</i>	Fennel	Contraindicator
* <i>Hordeum leporinum</i>	Barley-grass	Contraindicator
<i>Poa labillardierei</i>	Common Tussock-grass	Contraindicator
* <i>Poa trivialis</i>	Rough Meadow-grass	Contraindicator

DELWP (2017) defines 'patch' native vegetation as follows:

A patch of native vegetation is:

an area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native.

A similar threshold cover concept is used here to define the extent of Tootgarook Wetland as the:

**Area of characteristic wetland vegetation, consisting of vegetation where characteristic wetland flora species provide  $\geq 25$  per cent of total plant cover.**

Also following DELWP (2017), where hydrophytes occur at less than 25% relative cover they are 'scattered wetland flora' and not 'wetland (patch) vegetation'. The drop in hydrophyte percentage relative cover at the edge of the wetland, from over 50% to negligible or zero, usually occurs within 5 metres and is manifested where key indicators such as Swamp Paperbark *Melaleuca ericifolia*, Common Reed *Phragmites australis* or Creeping Bent *Agrostis stolonifera* drop out. The threshold cover value itself (25% versus say 50%) therefore has limited effect on the defined extent boundary at the scale of mapping in this study.

Whereas DELWP (2017) does not have area or width thresholds, the following were applied:

**The minimum area of wetland is 5 x 5 metres.**

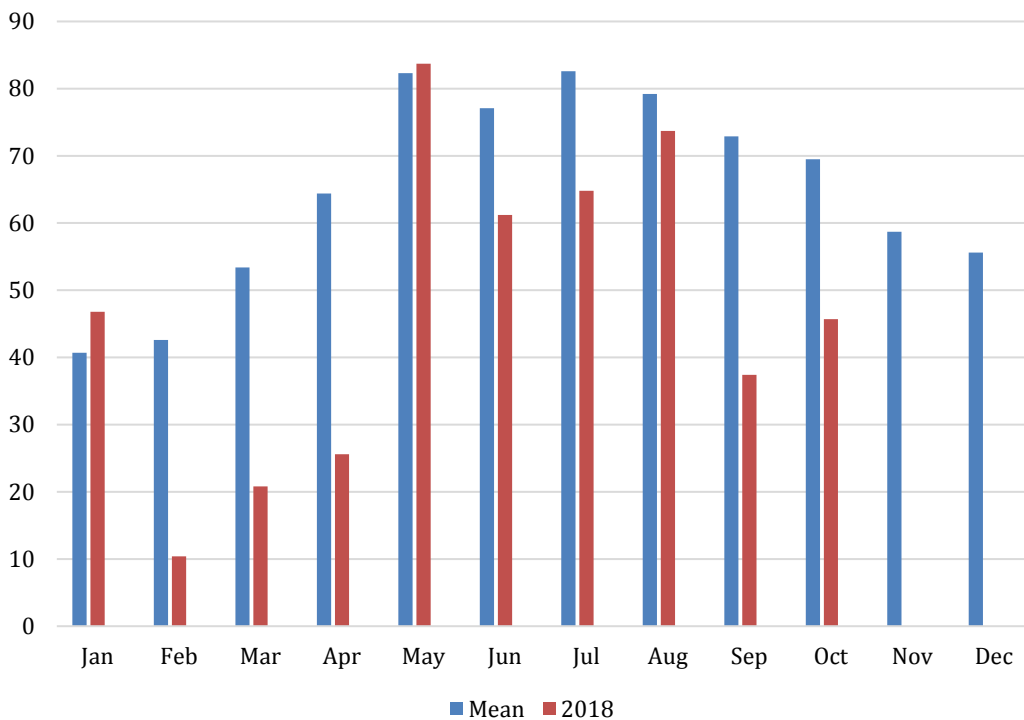
**The minimum width of a linear feature is 2 metres.**

This quantitative definition of wetland vegetation enables accurate, transparent and repeatable determination of the wetland boundary.

Due to the annual pattern of growth and dormancy in the major herbaceous species, Common Reed *Phragmites australis*, Cumbungi *Typha domingensis* and Marsh Club-sedge *Bolboschoenus medianus*, vegetation mapping is appropriately undertaken in the warmer six months when they are in their active growth phase.

The wetland boundary is in dynamic equilibrium, fluctuating with rainfall and corresponding groundwater levels further affected by water extraction activity. The winter prior to survey received 84% of average rainfall (BOM 2018b, Figure 7) placing the boundary at close to average position (BOM 2018b, Figure 7).

**Figure 7. Rainfall, Rosebud Country Club, 2.25 km east of Chinamans Creek**



Vegetation mapping was undertaken between 18 October and 18 November 2018.

## 6. Results

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### 6.1 Original wetland extent

The geology maps of Keble (1950, 1951) were a starting point in determining the historical (pre-European) wetland extent (Figure 5). The geological formation is Recent 'Swamp deposit' labelled 'Tootgarook Swamp' and described as 'Peat with small inliers of dune limestone'.

Original extent mapping was further guided by a Lidar digital elevation model of the wetland (Dahlhaus 2012), historical survey plans and historical aerial photography. These indicate that Keble is indicative only.

A single level in the Lidar model cannot be used to define the original wetland extent since there is a 2 metre fall in the wetland outer boundary from 4.5–5.0 metres ASL in the south to 2.5–3.0 metres ASL in the north. The lowest central area of the wetland is 1.0–1.5 metres. The Lidar model is reliable for grazed pasture but dense reedbeds (Common Reed *Phragmites australis*) can be mistaken for ground level.

On the islands and peninsulas the original (higher) wetland boundary cannot be determined accurately without detailed site investigations including soil profiling. Except where difference appears likely from the Lidar model, the original wetland boundary on the islands and peninsulas is set at the current level until further research is undertaken. The distances involved are relatively small, and since the islands and peninsulas are internal to the proposed ESO boundary, these differences do not affect the ESO.

The original wetland is estimated to have been a single large contiguous wetland occupying 500 hectares with a perimeter of 60 kilometres (Maps 3, 4). It generally extended beyond the Significant Inundation Overlay which is based on the contemporary 100 ARI flood level, particularly towards the south which is the upslope end of the wetland, consistent with a general lowering of the water level by Chinamans Creek drain.

The extent of the northern arm is unclear. Did it extend north of Eastbourne Road to almost reach the coast as per Keble (1950, Figure 5)? Earlier maps show a truncated northern arm (Smythe 1841, Figure 3) or breaks in the wetland (Callanan 1863, Figure 4). Historical aerial photography (1939) suggests a break similar to Smythe and Callanan, the northern wetland being an associated wetland possibly cut off in prehistoric time by sand drift. This uncertainty is largely of historical interest as it is outside current and proposed ESOs.

The original wetland boundary was highly convolute, particularly on the east side with numerous islands (inliers) and peninsulas of aeolian limestone. The west side had a more linear edge as the younger dunefield appears to have advanced on the swamp in prehistoric times, damming and perhaps partly burying it.

Delineating the former wetland extent is a forensic ecology exercise informed by historical and modern evidence and constrained by (a) inconsistent and inaccurate geology and survey maps, and (b) lack of detailed and comprehensive geophysical survey and mapping of the extent of the swamp deposit. Nonetheless the map compiled here is evidence-based and developed in scale, detail and accuracy.

## 6.2 Current wetland extent

The current extent of wetland vegetation was mapped in detail (Maps 3, 4). Wetland boundaries were relatively sharp and well-defined, with the transition to dryland vegetation usually occurring within 5 metres.

The current wetland is highly fragmented, with an estimated 84 remnants occupying 321.6 hectares, with the largest remnant north of Browns Road (250.5 ha). It has a perimeter of 61.6 kilometres (Table 8).

**Table 8. Summary statistics, Tootgarook Wetland**

	Number of wetlands	Area (ha)	Perimeter (km)
Original wetland	1	499.6	60.0
Current wetland	84	321.6	61.6

The area of current wetland (322 ha) is less than previous estimates: 382 ha 'remnant extent' (Condina 2011), 340 ha 'relatively undisturbed by human activity' (BMT 2018).

The horizontal map distance between the original and current wetland varies from over 200 metres to under 10 metres depending on local surface gradients and site history particularly vegetation clearance.

The smaller area-perimeter ratio of the current wetland (5.2 compared to 8.3) is consistent with wetland fragmentation, giving the current wetland more edge length for its size than previously. This means fewer and smaller core areas and relatively longer edges where modifying edge pressures on the wetland occur.

In all, 64% of the original swamp remains, considerably more than for the other major swamps in the region: the Kooweerup Swamp (<1%), Carrum Swamp (<5%) and the closest, Kangerong Swamp (<5%).

The current extent is smaller than within the original extent. The wetland has contracted for several reasons:

- extensive landfill, particularly in the north
- general lowering of water level with Chinamans Creek and tributary drains
- vegetation clearance in outer areas, particularly Swamp Paperbark and Woolly Tea-tree scrub.

Contraction of the wetland with general lowering of the water level may have caused a downslope migration in plant species and wetland zones. Within the current wetland, Swamp Paperbark *Melaleuca ericifolia* may have colonised downslope into previously treeless wetland. Outside the current wetland, Common Tussock-grass *Poa labillardierei* may have colonised down to the current boundary from the original boundary, into a zone of former wetland where it competes with invasive Tall Fescue *Festuca arundinacea*. Tall Fescue is also invasive within the upper levels of the wetland where it can provide up to 75% of the vegetation cover.

Much of the former wetland, particularly in the north, has been filled along the edges and no longer exists. The current wetland occurs on natural surfaces or excavations into the surface. Furthermore it no longer occupies the entire geological swamp deposit due to Chinamans Creek drain and tributary drains. Small areas of revegetation are included in the current extent where they comprise indigenous species.

The current wetland is an integrated hydrological and ecological system which extends off the original swamp deposit where there is artificially lowered topography cut into adjacent landforms: excavations and drains with native scrub and reeds such as Drum Alloc Creek drain and Chinamans Creek drain.

Tootgarook Wetland has a south-eastern arm running south to part of the Boneo Water Recycling Plant (Maps 3, 4), consistent with Keble (1950) and BMT (2018), which is not within the current ESO30.

Whereas the original wetland boundary would have been naturally complex and convolute, it is now overlain by a widespread site disturbance history involving drains and altered surface levels (landfill and excavations) making the current boundary more intricate, generally more convolute and sometimes more angular, as well as highly fragmented. Examples of the current wetland boundary are illustrated in Figures 8–15.

The wetland boundary is in dynamic equilibrium, fluctuating in response to climate oscillations such as the Indian Ocean Dipole (IOD) and the El Niño–Southern Oscillation (ENSO) which influence rainfall events and surface and groundwater levels which are then further influenced by water extraction activity in the catchment. This manifests as temporal fluctuation in the extent of non-wetland plants, particularly Kikuyu Grass *Cenchrus clandestinus* which advances in dry years and retreats in wet years. Depending on surface gradients, the edge is expected to fluctuate within sub-metres to metres and possibly over ten metres over a 20-year period, which is a short distance in relation to the scale of mapping. The winter prior to survey received 84% of average rainfall (BOM 2018b) placing the boundary close to average. Future contraction of the wetland may occur with less rainfall as per Melbourne climate projections (BOM 2018a).

Figure 8. Tootgarook Wetland boundary, Capel Sound, 18.10.18



Figure 9. Tootgarook Wetland boundary, view south, Boneo, 30.10.18

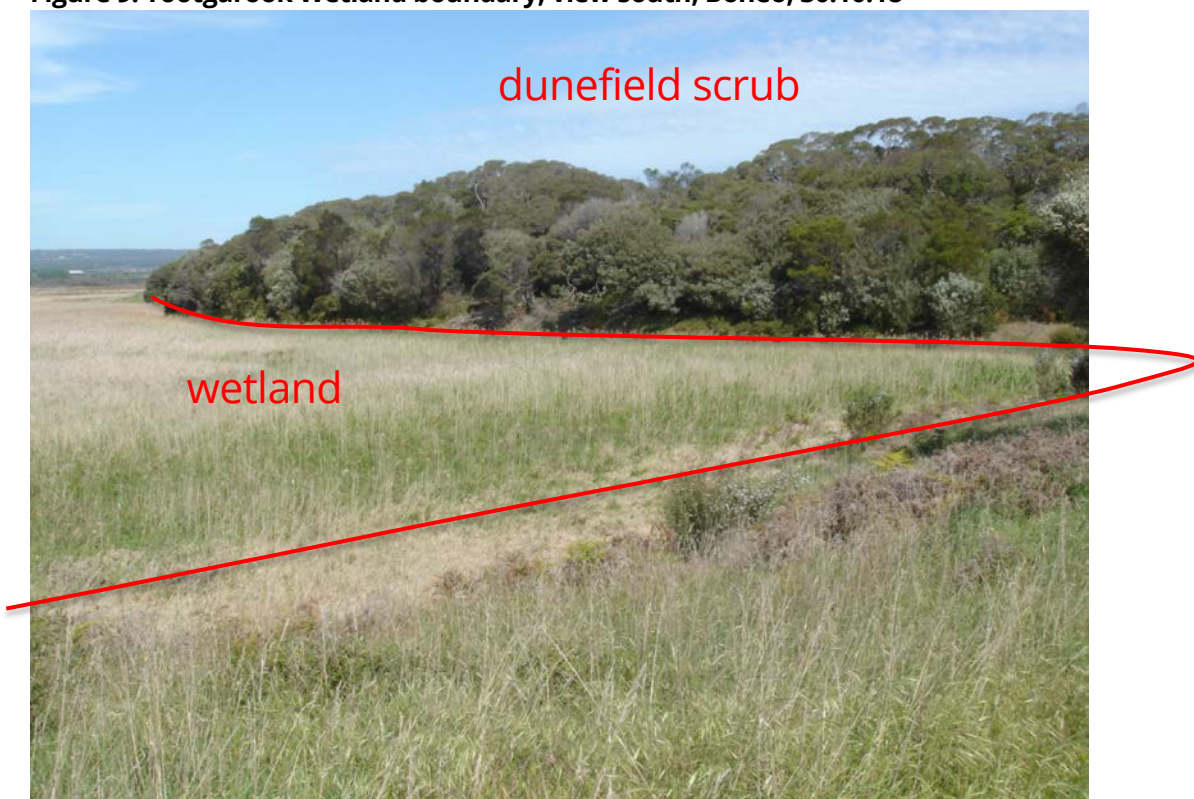


Figure 10. Tootgarook Wetland boundary, *Poa* grassland on St Elmos island (foreground), Capel Sound, 29.10.18



Figure 11. Tootgarook Wetland boundary, *Poa* grassland on island (foreground), Boneo, 30.10.18



Figure 12. Tootgarook Wetland boundary, freeway reserve, Capel Sound, 28.10.18



Figure 13. Tootgarook Wetland boundary, industrial zone water treatment pond, Capel Sound, 28.10.18



Figure 14. Tootgarook Wetland boundary, Boneo, 28.10.18



Figure 15. Tootgarook Wetland boundary, Boneo, 8.11.18

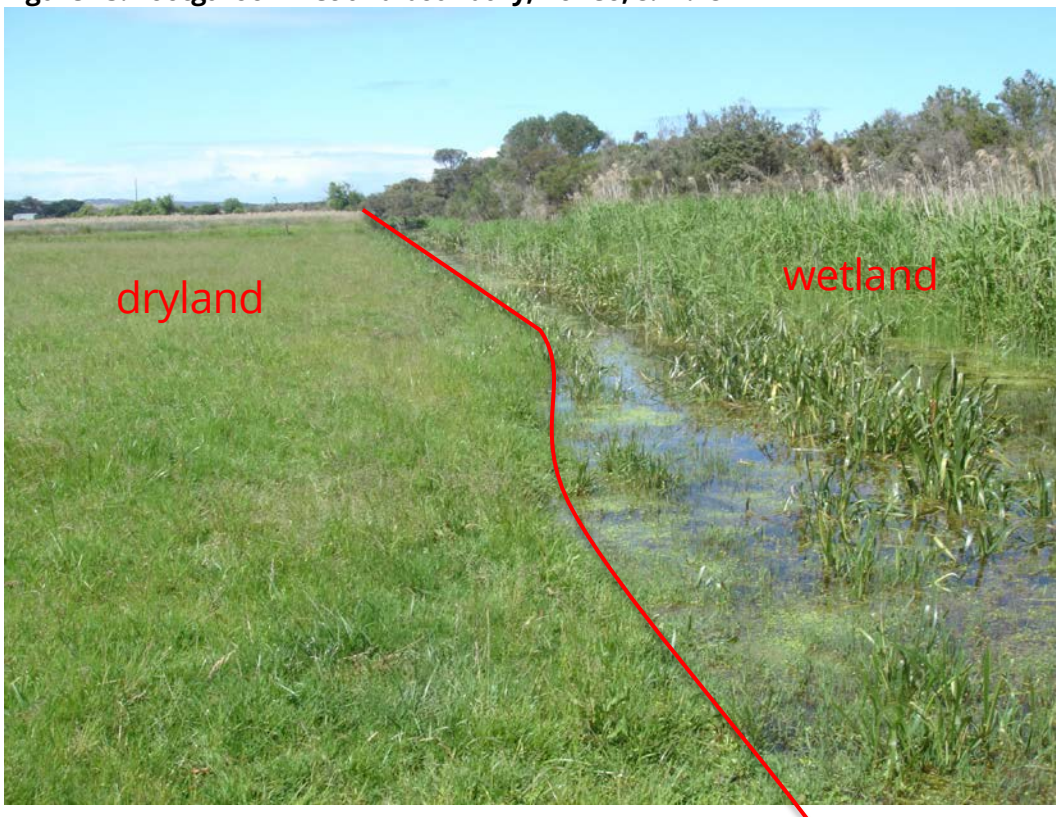
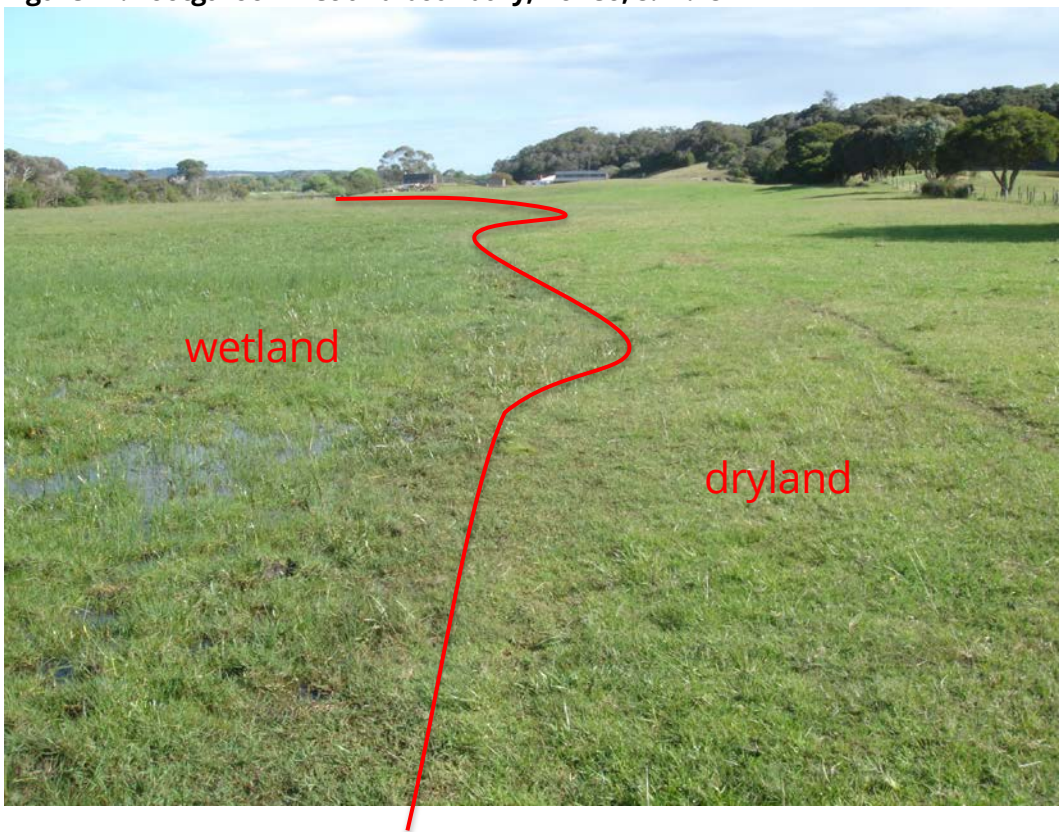


Figure 16. Tootgarook Wetland boundary, Boneo, 4.11.18



Figure 17. Tootgarook Wetland boundary, Boneo, 8.11.18



### 6.2.1 Associated wetlands

Several associated wetlands occur just beyond the edge of the original contiguous wetland, separated by low rises that once supported eucalypt woodland (Damp Sands Herb-rich Woodland) or coastal vegetation. A remarkable associated wetland is De Salis waterhole immediately south of Tootgarook Wetland. Another is the wetland straddling Boneo Road south of Browns Road.

The Lidar digital elevation model and historical aerial photography indicates these wetlands are not topographically connected to the larger wetland, and they are not mapped as Tootgarook Wetland.

### 6.2.2 Associated grasslands

The wetland has many associated grasslands on 'islands' and peninsulas within the wetland and on adjacent slopes dominated either by Common Tussock-grass *Poa labillardierei* or its introduced competitor Tall Fescue *Festuca arundinacea*. These areas rarely flood although most are within the 100 ARI flood level.

Although the islands and peninsulas do not support wetland vegetation, they form a complex mosaic with the wetland vegetation and are likely to shelter fauna during flood events, previously even cattle. Accordingly they are part of the Tootgarook Wetland ecological complex. Most of the associated grasslands are internal to the wetland outer boundary and thus do not contribute to the outer wetland delineation.

#### **Islands**

Tootgarook Wetland has approximately 20 internal low rises or 'islands' that emerge from the current wetland or once emerged from the original wetland, almost all on the east side (Maps, 3, 4). They correspond to 'small inliers of dune limestone' on survey and geology maps (Callanan 1863, Keble 1950, GSV 1967). They appear on these maps as inliers (not swamp or geological swamp deposit) but are not accurately shown. These low rises are rarely if ever flooded and represent low hills and ridges in the pre-wetland landscape that were gradually surrounded by swamp deposit. Presumably some are buried below the surface which now supports swamp vegetation. The Lidar digital elevation model, historical aerial photography and field survey were used to determine their number, size, shape and location (Figures 18, 19).

The islands add ecologic and landscape complexity to the wetland making it unique. Other large swamps in the region even in original condition had fewer islands: the giant Kooweerup Swamp had one known island (Yugovic 2011), Carrum Swamp had three (Rawlinson 1866) and Kangerong Swamp had at least three (GSV 1967). They were also different in geology, geomorphology and ecology to Tootgarook Wetland's islands.

The natural vegetation on the islands is native grassland dominated by Common Tussock-grass often with herbs such as Bidgee-widgee *Acaena novae-zelandiae*. The grassland on the larger islands has been destroyed by ploughing and sowing to Tall Fescue. Other introduced dryland grasses occur on the higher parts of the higher islands. An old veteran Swamp Gum *Eucalyptus ovata* suggests the original vegetation on the tops of the higher islands was Damp Sands Herb-rich Woodland, the eucalypt-dominated EVC that occurs immediately east of the wetland.

The grasslands have been variously described as Creekline Tussock Grassland (Tonkinson et al. 2003) and Plains Grassland (Sinclair et al. 2006) but they do not conform to EVC benchmarks. They are difficult to classify partly because past grazing has eliminated most of the flora but they are highly unusual if not unique in Victoria. They appear to represent an undescribed floristic community of the ecological vegetation class Plains Grassland. The grasslands are an interpretation challenge but are clearly related to geomorphology.

The number, size, shape and location of the islands is complex and the digital elevation model indicates that previous maps are not accurate. In particular, St Elmos Island is a large island which does not appear on historical maps despite being visible on historical aerial photos. *Poa* grassland occurs on its lower edges.

Figure 18. Lidar digital elevation model, current wetland, islands and peninsulas

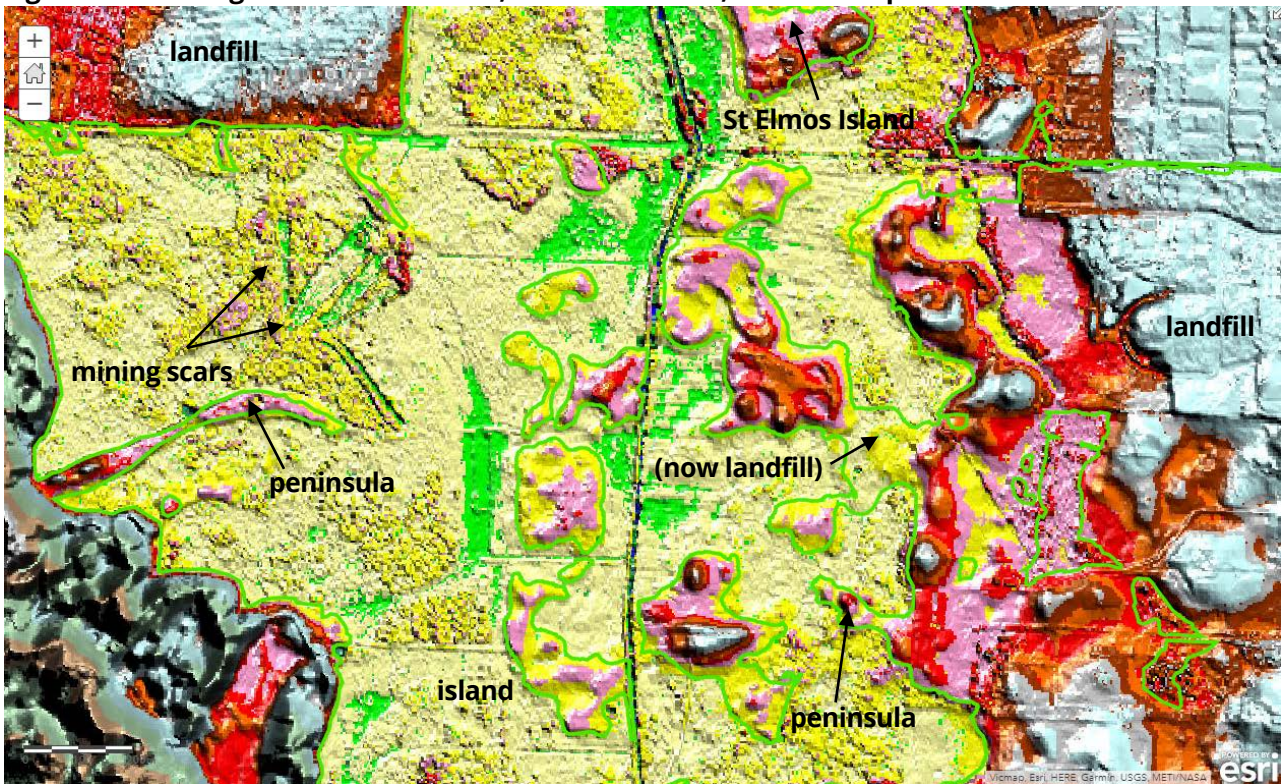
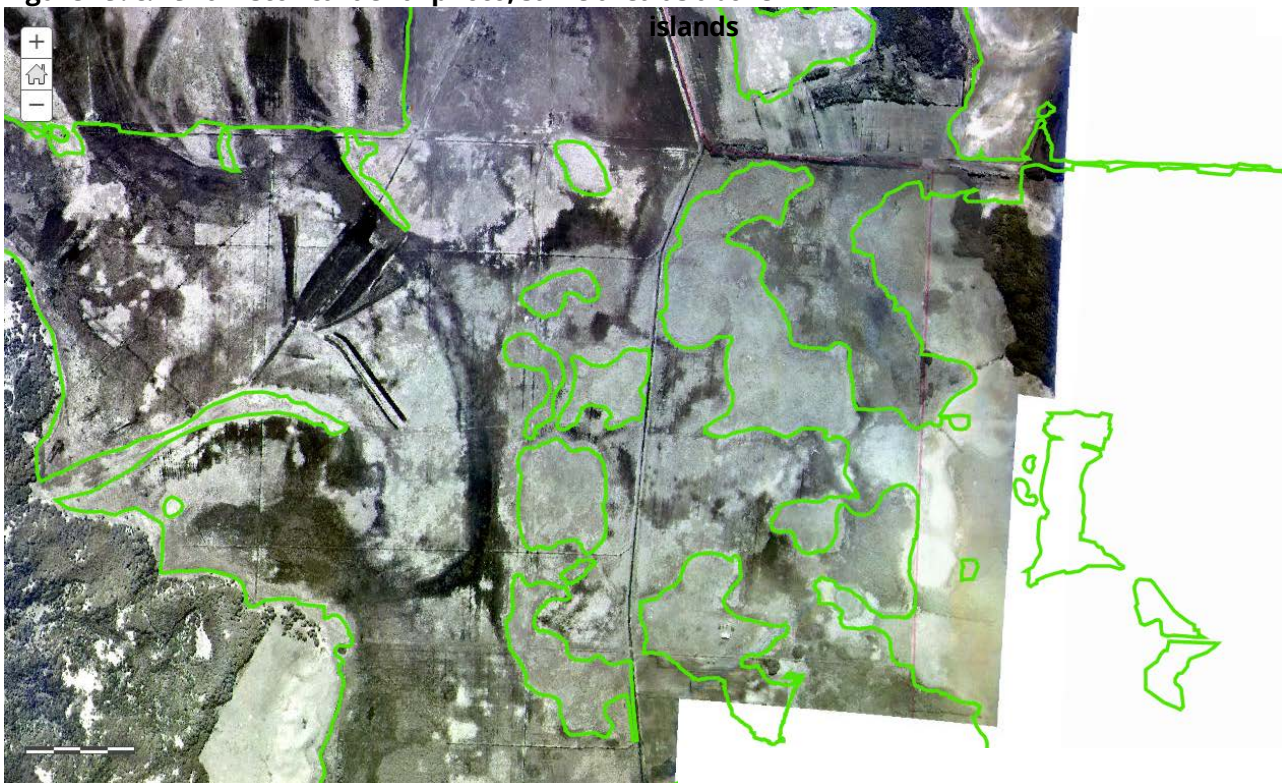


Figure 19. c. 1940 historical aerial photo, same area as above



## **Peninsulas**

Several low curved peninsulas, referred to as 'fingers', protrude into the north-west of the wetland, though they are now mostly under the Truemans Road landfill. They appear on survey and geology maps (Callanan 1863, Keble 1950, GSV 1967) as external to the wetland but their position is not accurately shown. The c. 1940 historical aerial photograph and the digital elevation model (Dahlhaus 2012) indicate their orientation is not consistent with the parallel coastal accretion ridges that dammed the wetland. From their size, location and configuration they appear to be relict beach sand spits formed when the wetland was a tidal lagoon during the marine retreat, now landlocked 1.4 to 2.2 km inland and with distinctive vegetation.

The vegetation is native grassland dominated by Common Tussock-grass with subdominant Knobby Club-sedge *Ficinia nodosa* and scattered Australian Hound's-tongue *Cynoglossum australe*. Most of the original flora is site-extinct due to past livestock grazing and replacement introduced species are now prevalent, making classification of the ecological vegetation class (EVC) difficult. From remnant species and geomorphic characteristics, the vegetation has affinities with Estuarine Flats Grassland but with Common Tussock-grass rather than Coast Tussock-grass *Poa poiformis* possibly due to reduced soil salinity.

Several aeolian limestone peninsulas also enter the wetland from the east side. These are low ridges from the pre-wetland landscape that were gradually surrounded by swamp deposit as the wetland formed. They are related to the islands and are of the same geological formation. Although largely cleared, some support remnants of scrub on their lower flanks and associated grassland vegetation. The vegetation on the higher parts was eucalypt-dominated Damp Sands Herb-rich Woodland, as evidenced by two large adjacent veteran Manna Gums *Eucalyptus viminalis*, one with an active Wedge-tailed Eagle *Aquila audax* nest in 2018.

## 7. Wetland buffer zone

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Buffer zones, where they exist, protect geophysical and ecological core natural areas by absorbing or moderating human impacts along the outer edges. Human-induced edge pressures include hydrological disturbance, vegetation clearing, invasive species, visitor pressure, sight, noise and light disturbance, toxic contamination and landscape intrusion. Wetlands especially benefit from well managed buffer zones since they are receiving basins for water runoff from surrounding land via their buffer zones (see *Literature review*).

### 7.1 Extent

Tootgarook Wetland is without an effective buffer zone currently except perhaps on the western side north of Browns Road where it is fringed by the extensive dunefield supporting Coastal Alkaline Scrub dominated by Moonah *Melaleuca lanceolata*. However, even along this boundary there is a zone of dense Kikuyu Grass *Cenchrus clandestinus* between the natural dunefield and the wetland.

Condina (2011) identifies a lack of buffer zones as an indirect threat to the wetland:

Lack of buffer zones to the swamp: Part of the problem for the swamp is that edge development to date is on a boundary with former swamp periphery areas. Edge effects are increased because of absence of buffers to the swamp. That is, there are no buffer zones between development and the remaining swamp. For example the only barrier between the swamp and the golf course at the Village Glen is a one metre wide crushed rock swale. Existing fences, where present are often in poor condition, allowing entry of cattle and pest animals and rubbish dumping.

The potential role of a buffer zone for Tootgarook Wetland is indicated by site inspection. While the central area of the wetland is relatively intact with high native biodiversity, edge pressures occur along almost all of the boundary and these can produce incremental reductions in wetland area and modifications in remaining wetland vegetation with reduced biodiversity. Edge pressures on Tootgarook Wetland include:

- landfill
- new or enlarged drains
- vegetation clearance
- inappropriate planting
- weed invasion
- trampling and grazing by cattle and horses
- human disturbance of wildlife
- importation of foreign geological and biological material
- visual landscape intrusions.

These pressures apply to both the current wetland and buffer zone.

While the deeper core area of the current wetland is relatively intact, much of the current wetland boundary is beset with significant management issues and problems. These can incrementally reduce the current wetland extent and reduce the value of the remaining wetland for native wildlife and biodiversity.

The deeper core area is naturally resilient and survives despite attempts to drain and utilise it for agriculture, due to the lateral inflow of groundwater. The outer wetland area is more modified with the outer swamp having been disproportionately more cleared than the wetter inner swamp. However, throughout the geological swamp deposit Swamp Paperbark *Melaleuca ericifolia* and Common Reed *Phragmites australis* are attempting to spread vegetatively by suckering away from current wetlands to recolonise the original wetland extent, while Woolly Tea-tree *Leptospermum lanigerum* is attempting this by seed.

In outer areas of the wetland, Swamp Paperbark in particular, being a large shrub or small tree, has deep roots able to access groundwater which the root zone of original wetland understorey vegetation can no longer reach, ensuring its survival despite local drains having lowered the water table, although it now has an introduced dryland understorey. With artificially increased soil drainage and oxygen availability to root systems, conditions may have improved for this species on previously wetter sites. However it is extensively cleared. As it is the last of the wetland species, when it is cleared the wetland no longer exists on that site.

Various studies recommend various buffer widths for wetlands in Australia (see *Literature Review*). Considering these recommendations including recent recommendations (Le Feuvre 2018), and the particular conditions of Tootgarook Wetland, the following buffer zone is proposed (Maps 5, 6):

**The Tootgarook Wetland buffer zone comprises:**

**1. Original wetland outside patches of current wetland**

- (a) the current wetland receives water directly from the original wetland area due to local topography controlling surface and groundwater flow, making it highly sensitive to this immediate catchment,
- (b) the current wetland is likely to share some shallow aquifer perching with the original wetland due the clay-rich aquitard swamp deposit, making the current wetland highly sensitive to disturbance in this area such as deep excavations rupturing the aquitard or pollution events,
- (c) the larger herbaceous and woody native wetland flora, such as Common Reed, Swamp Paperbark and Woolly Tea-tree, can still grow in this area, unlike on the dry land immediately beyond the original extent where they never grew,
- (d) the original wetland has cultural and historical links with the current wetland.

**2. Islands and peninsulas within the wetland**

- (a) the islands and peninsulas form a complex mosaic with the wetland and are likely to shelter fauna during flood events, making them integral to the Tootgarook Wetland ecological complex,
- (b) many of the islands and peninsulas support highly significant native grassland vegetation,
- (c) the islands and peninsulas are integral to the landscape character of the wetland.

**3. Areas within 100 metres of a current wetland**

- (a) based on literature review, this a minimum width and less than some recommendations,
- (b) wetland birds can be highly sensitive to humans and domestic animals visible within 100 metres,
- (c) the buffer zone provides protection for wildlife accessing the wetland,
- (d) groundwater within the buffer zone flows towards the wetland regardless of surface topography,
- (e) the current wetland is highly sensitive to change in landscape character within 100 metres, even if a building base level is behind a ridge the building may be visible.

**The buffer zone is located in the rural green wedge zone, and excludes areas in the north:**

- **Residential areas, e.g. west of Truemans Road, north of Elizabeth Ave**

In these dense residential areas, each property is too small for an individual development proposal to impact on the wetland significantly, so there is no ecological reason to include these properties. Furthermore, an ESO over these properties would unnecessarily involve hundreds of properties and thus impose an unnecessary burden on planning permit applicants and the Shire in consideration of planning permit applications. Also, north of Elizabeth Avenue, the current wetland is along Chinamans Creek drain which is an artificial drain downstream of the original wetland, and is thus a lower priority for planning protection. The Village Glen golf course is included in the ESO due to its size.

- **Industrial areas (Colchester Road and Henry Wilson Drive industrial estates)**

These areas are built up by landfill and now have support small factories and businesses. As for the dense residential areas, each property is too small for an individual development proposal to potentially impact on the wetland significantly, so there is no ecological reason to include them. Furthermore, an ESO would unnecessarily involve many properties and impose an unnecessary burden on planning permit applicants and the Shire in consideration of planning permit applications. There is no prospect of restoring the wetland and these areas are subject to EPA water quality guidelines.

The proposed buffer zone has two subzones:

(a) lower buffer zone – the geological swamp deposit not supporting current wetland (original wetland)

(b) upper buffer zone – extends onto adjacent land systems within 100 metres of a current wetland.

The upper buffer zone could be extended to include 100 metres around the entire original wetland if the entire wetland was to be restored, which is not under consideration. Accordingly the proposed buffer is a minimal buffer aimed at protecting what remains of the wetland (the current wetland).

All 84 current wetlands are situated within the lower buffer zone, forming an integrated hydrogeological unit. The upper buffer zone notably includes a 100 metre strip of Moonah woodland on the western side north of Browns Road which provides a natural landscape backdrop to the wetland. The upper buffer zone protects individual wetlands near the edge of the swamp deposit, groundwater entering the wetland, and the landscape character of the wetland.

This is in part an aspirational buffer zone as there is currently no effective buffer zone, except perhaps along the western dunefield interface north of Browns Road. Land use and management within the buffer zone may require change for it to become more effective, particularly by facilitating natural regeneration or planting revegetation. Livestock grazing is a broadly compatible land use within the buffer zone. Of importance, control of proposed new activities and developments within the buffer zone may assist in preventing deterioration in the extent, condition and landscape character of the current wetland.

## Technical issues

A buffer zone designated around Tootgarook Wetland may not absorb or moderate all types of impact (Table 9). Multiple functions are performed by buffer zones and these may require different widths.

**Table 9. Function of potential buffer zone around Tootgarook Wetland**

Impact	Function	Capacity
Ecological – flora	Protect from intrusions of: <ul style="list-style-type: none"> <li>• introduced flora</li> </ul>	<b>Low to moderate.</b> Introduced wetland flora are already within the system. They are bird-dispersed and do not enter the wetland from adjacent dryland vegetation which is not their habitat. However humans have sown or planted serious wetland weeds within the buffer zone.
Ecological – fauna	Protect from intrusions of: <ul style="list-style-type: none"> <li>• introduced fauna</li> <li>• noise</li> <li>• light</li> <li>• pollution</li> </ul>	<b>High.</b> Screens of site-indigenous woody vegetation would reduce disturbance to waterbirds with large flight initiation distances.
Geophysical	Protect from artificial change in: <ul style="list-style-type: none"> <li>• water quality (pollution)</li> <li>• water quantity</li> <li>• mobilised foreign geological material</li> </ul>	<b>Moderate to high.</b> The wetland is highly sensitive to hydrological influences in all of its catchment (e.g. groundwater extraction, constructed drains), limiting the protective effect of a buffer zone. However prevention of deep excavation may prevent rupture of any near surface aquitard. There is some protection against mobilised foreign geological material entering the wetland.
Landscape	Protect from: <ul style="list-style-type: none"> <li>• visual intrusion diminishing landscape character of wetland</li> </ul>	<b>High.</b> Dependent on screening vegetation, and height, type and angle of elevation of adjacent built structures.

It is apparent that a buffer against ecological impacts on birdlife is relatively narrow while a buffer against landscape impacts is potentially moderately large. A buffer against geophysical impacts is potentially very large and may include all of the groundwater and surface catchment.

While any buffer zone is better than none, the limited knowledge base and differing scientific recommendations on buffer widths make the determination of optimal or useful buffer zone widths for Tootgarook Wetland imprecise. Hansen et al. (2010) recommend minimum 120 metre buffers for water quality in wetlands and Hansen et al. (2015) recommend 250 metres for terrestrial fauna (birds, frogs etc.). Most wetland remnants are within 200 metres of another remnant, so 100 or 120 metre buffers around each remnant would meet to form a larger combined buffer area. By extension almost the entire geological swamp deposit is effectively one buffer zone. Current wetlands are in proximity to each other within the buffer zone, are on the same geological swamp deposit and may share one or more perched water tables with the buffer zone, making the swamp deposit (original wetland) itself an appropriate buffer zone.

## Socio-political issues

It is widely recognised that terrestrial habitat (buffer zone) adjacent to wetlands is important in maintaining wetland biodiversity and thus the integrity of wetland ecosystems. Consequently, protecting wetlands requires the extension of some protection to surrounding terrestrial areas. However, 'balancing human land use and habitat conservation is challenging, and well-informed land use policy is hindered by a lack of knowledge of the specific risks of varying amounts of habitat loss' (Harper et al. 2008). Logistic constraints such as existing infrastructure can also limit buffer zones to less than optimal size.

Tootgarook Wetland lacks an effective buffer zone and to create one by hydrological restoration and facilitated woodland and wetland recovery could create restrictions and requirements that may be socially and economically significant. These would represent an environmental cost of the wetland.

Little or no grazing by cattle and horses and slashing/mowing currently occurs in the mapped wetland but they occur along the edges. These activities prevent expansion of the wetland fragments to recolonise the buffer zone. A substantial increase in wetland extent, particularly in Swamp Paperbark, would be likely if these forms of biomass reduction were to cease. However livestock grazing is an existing use.

The degree to which Tootgarook Wetland should be allowed to recover to its former extent by blocking the drains (restoring the hydrology) and withdrawing livestock grazing versus allowing existing uses and protecting what remains of the wetland is a socio-political question rather than a scientific question.

## 7.2 Management guidelines

The following management guidelines are aimed at maintaining or enhancing the ecological function of the Tootgarook Wetland buffer zone in order to protect Tootgarook Wetland. The intention is to promote land management in the buffer zone that is compatible with or sympathetic to the current wetland.

**Table 10. Tootgarook Wetland buffer zone management guidelines**

Impact	Function	Guidelines
Ecological – flora	Protect from intrusions: <ul style="list-style-type: none"> <li>• introduced flora</li> </ul>	<ol style="list-style-type: none"> <li>1. Avoid importation of novel wetland weeds.</li> <li>2. Avoid livestock grazing and mowing in <i>Poa</i> grasslands.</li> <li>3. Continue hay production in Tall Fescue grasslands.</li> <li>4. Facilitate the spread (return) of wetland scrub and marsh into the lower buffer zone where appropriate.</li> <li>5. Control introduced flora (weeds) where appropriate.</li> </ol>
Ecological – fauna	Protect from intrusions: <ul style="list-style-type: none"> <li>• introduced fauna</li> <li>• noise</li> <li>• light</li> <li>• pollution</li> </ul>	<ol style="list-style-type: none"> <li>6. Facilitate site-indigenous screening vegetation through natural regeneration or revegetation: most relevant EVCs are Swamp Scrub and Tall Marsh.</li> <li>7. Avoid excessive noise and disturbance.</li> <li>8. Avoid excessive lighting over the wetland at night.</li> <li>9. Control introduced fauna where appropriate.</li> </ol>
Geophysical	Protect from artificial change: <ul style="list-style-type: none"> <li>• water quality (pollution)</li> <li>• water quantity</li> <li>• mobilised foreign geological material</li> </ul>	<ol style="list-style-type: none"> <li>10. Avoid further landfill.</li> <li>11. Avoid further construction of drains.</li> <li>12. Avoid water extraction.</li> <li>13. Avoid further excavations, protecting the natural surface for natural wetland development.</li> <li>14. Prevent chemical spills and/or contamination of groundwater and ensure rapid clean up.</li> <li>15. Provide for best practice stormwater quality treatment measures on all drains to the swamp.</li> <li>16. Avoid importation of foreign geological material.</li> </ol>
Landscape	Protect from: <ul style="list-style-type: none"> <li>• visual intrusion reducing landscape character of wetland</li> </ul>	<ol style="list-style-type: none"> <li>17. Plant site-indigenous trees and shrubs rather than exotic trees.</li> <li>18. Avoid large built structures in wetland viewscape.</li> </ol>

Management guidelines for the mapped current wetland (Maps 5, 6) are the same as above except that, in addition, livestock grazing and slashing/mowing of vegetation are also to be avoided in wetland, while these activities are fairly benign and acceptable in the buffer zone (which by definition is not current wetland).

The *Poa* grassland island vegetation (which is all within the buffer zone) warrants special protection. The large majority of this significant and possibly unique vegetation has been lost to ploughing and sowing to Tall Fescue. A few of the smaller, more remote islands with *Poa* remain. Unlike Kangaroo Grass *Themeda triandra* found elsewhere, *Poa* does not require grazing or mowing to maintain tussock health. The *Poa* grasslands are not currently grazed or mowed and should not be in future unless for conservation purposes.

## 8. Planning considerations

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### 8.1 Assessment

This section:

- assesses whether it is necessary to amend the Planning Scheme to give effect to the management recommendations set out in Section 7.1,
- assesses the form of any control that could be applied to address identified threats to the wetland,
- identifies broader management requirements (e.g. including proactive management) that sit outside of the planning system.

### 8.2 Methodology

The following methodology was used to undertake this planning assessment.

1. The threats to the wetland were reviewed and expressed in planning terms, with references to the land use definitions at clause 73 of the Planning Scheme and the definition of buildings and works.
2. A gap analysis was undertaken at four locations (as detailed below) to identify how the current zoning and overlay controls operated to protect the wetland from the identified threats. Locations were selected on the basis of the combination of controls to ensure that typical scenarios were selected.
3. Gap and duplication of planning controls were identified and recommendations were made regarding changes to the Planning Scheme and broader management requirements. The recommendations focussed on the controls that address the threats to the wetland and buffer, and do not represent a holistic review of the overlay controls outside of this area. It is likely that further rationalisation and review of the ESO controls and their boundaries will be required.

### 8.3 Gap analysis

Table 11 analyses the manner in which the current Planning Scheme addresses the threats to the wetland and buffer areas.

As part of the analysis matters that sit outside the planning system were identified, such as the need to proactively rehabilitate or regenerate particular sites.

The following locations were reviewed in the gap analysis:

- **Location A (191A–191 Browns Road Boneo)** – This location is zoned Green Wedge Zone 2 (GWZ2) and is affected by Bushfire Management Overlay (BMO), Land Subject to Inundation Overlay (LSIO) and several Environmental Significant Overlays including ESO14 (Tootgarook Swamp – Boneo Flats), ESO18 (Wetlands), ESO19 (Fluviatile Deposits) and ESO30 (Tootgarook Wetland).
- **Location B (92 Elizabeth Avenue, Capel Sound – Southern part)** - The property is covered by three different zones. However, for the purpose of this exercise only Special Use Zone 4 (SUZ4) which is the dominant zone has been assessed. This location is also affected by ESO19, ESO30, LSIO, Public Acquisition Overlay 1 (PAO1) and Significant Landscape Overlay – Schedule 3 (SLO3).

- **Location C (66 Henry Wilson Drive Rosebud)** – Zoned Industrial Use 3 Zone (IN3Z) and affected by ESO19, ESO30 and LSIO.
- **Location D (92 Elizabeth Avenue, Capel Sound – Southern part)** – The northern section of this property is zoned General Residential Zone 1 (GRZ1) and covered by ESO19, ESO30 and LSIO.

**Table 11. Assessment of current planning controls**

Item	Threats	Current zone response	Current overlay response / particular provisions	Capacity of current planning scheme to address threat	Other non- planning measures	Recommendation
<b>Location A</b>						
<b>GWZ2</b>						
<b>BMO, LSIO, ESO14, ESO18, ESO19<sup>1</sup>, ESO30, Clause 52.17</b>						
<b>A1</b>	Landfill  (Use of land for Refuse disposal [Industry])	Permit required for land use.	Do not control land use.	Permit is required and relevant considerations include impacts on water quality (LSIO), environmental values (ESO14, ESO18 and ESO19), groundwater contamination (ESO19) and wetland (ESO18, ESO30).	EP Act (including SEPP)	No additional control required.  Removal of duplication between ESOs warranted (especially ESO14, ESO18, ESO19 and ESO30).
<b>A2</b>	Trampling and grazing by cattle and horses  (Use of land for Agriculture or Animal production)	Permit not required for Agricultural or Horse stables uses.  Permit is required for most Animal production but not for Grazing animal production.	Does not control land use.	A permit is required for Animal production (but not Grazing animal production).  A permit is not required for Horse stables.	Land management practices (e.g. Catchment Management Plan)	No change required to planning scheme but land management practices are required in some sensitive locations.  In sensitive areas ( <i>Poa</i> grasslands) grazing should be avoided (but not prohibited through planning controls).
<b>A3</b>	New or enlarged drains or earthworks  (Use of the land for Minor utility installation, buildings and works)	Permit required for earthworks which change flow rates or increase discharge of saline water.  No permit required for minor utility installation use.	A permit is required for certain buildings and works (LSIO, ESO18, ESO19, ESO30).  Some permit triggers depend on changes to sediment discharge and floodplain capacity (ESO14).	Permit required under zone and overlays.  Environmental values, sediment discharge etc. are relevant considerations.	Water Act / Statutory authority requirements	No additional control required.  Removal of duplication between the assessed ESOs warranted.
<b>A4</b>	Native vegetation removal	Permit not required.	Permit required under cl 52.17 (a number of exemptions apply)  BMO includes a number of exemptions for native vegetation removal.  Permit required to remove certain native vegetation (ESO14 and ESO19). A permit is required to remove any vegetation (ESO18, ESO30)	Permit required.  Exemptions do affect the scope of permit requirements.  Decision guidelines require consideration of role of vegetation in protecting water quality, riparian environments, groundwater and identified landscape values.	FFG Act  EPBC Act	No additional control required (noting that Council cannot amend the BMO mapping).  Removal of duplication between the assessed ESOs warranted.

<sup>1</sup> ESO19 appears to be a generic overlay that applies to alluvial plains and/or reclaimed swamps. We have assumed that ESO19, as it applies in the vicinity of the Wetland and buffer, has been applied to protect 'reclaimed swamp' and not alluvial plain.

Item	Threats	Current zone response	Current overlay response / particular provisions	Capacity of current planning scheme to address threat	Other non- planning measures	Recommendation
A5	Inappropriate planting (ecological impacts)	Permit not required.	Permit not required but if new planting is proposed, impact on wetland can be considered (ESO30), and landscape values (ESO14) and environmental sensitivity (ESO18).	Permit not required to plant new vegetation.  If new planting is proposed as part of an application impact on wetland can be considered (ESO30), and landscape values (ESO14) and environmental sensitivity (ESO18).	N/A	No additional control required.  Removal of duplication between the assessed ESOs warranted.  Management guidance may assist with encouraging more appropriate landscaping treatments.
A6	Inappropriate planting (exotic species which remove water from the wetland via evapotranspiration)	Permit not required.	Permit not required but if new planting is proposed, impact on wetland can be considered (ESO30), and landscape values (ESO14) and environmental sensitivity (ESO18).	As above (A5).	N/A	No additional control required.  Removal of duplication between the assessed ESOs warranted.  Management guidance may assist with encouraging more appropriate landscaping treatments.
A7	Human disturbance of wildlife (intensification of land use, subdivision)	Permit required for subdivision.	Permit is required to subdivide land and ecological values and the wetland are a relevant consideration (ESO14, ESO19, ESO30) and flooding (LSIO).	Permit required and intensification of land uses unlikely given purpose of the GWZ2.	N/A	No additional control required.  Removal of duplication between the assessed ESOs warranted.
A8	Inappropriate structures (Potential ecological impacts and intrusion)  (Buildings and works)	Permit required for building and works associated with certain uses.	Permit required for many building and works. For instance, under the ESO14 structures less than a certain height in the GWZ do not require a permit.	Permit required.  Design of structures is a relevant consideration under the BMO, LSIO, ESO14, ESO19, ESO30 having regard to environmental values, flooding impacts and bushfire mitigation. ESO14 addresses landscape values and vistas.	N/A	No additional control required.  Removal of duplication between the assessed ESOs warranted.
A9	Importation of foreign geological or biological material  (Buildings and works and roadworks)  (General biological contamination – poor environmental management / cross contamination)	Permit required for building and works associated with certain uses.  Permit not required for roadworks.	Permit is required for buildings and works under the BMO, LSIO, ESO14, ESO18 and ESO30.  Permit not require in most instances for roadworks (cl 62.02-2).  Permit required under LSIO for roadworks if flow patch redirected. As part of that process an EMP conditions could be included which would have the effect of managing the threat.	Permit required for buildings and works.  Permit not required for roadworks in most instances.	N/A	More of an environmental management issue (rather than a planning issue).  Can be dealt with via good environmental management systems.

Item	Threats	Current zone response	Current overlay response / particular provisions	Capacity of current planning scheme to address threat	Other non- planning measures	Recommendation
<b>Location B</b>						
<b>SUZ4</b>						
<b>ESO19, ESO30, LSIO, SLO, PAO, Clause 52.17</b>						
<b>B1</b>	Landfill (Use of land for Refuse disposal [industry])	Prohibited use	Do not control land use.	Prohibited.	EP Act (including SEPP)	No additional control required.
<b>B2</b>	Trampling and grazing by cattle and horses (Use of land for Agriculture or Animal production)	Permit is required for use of land for Agriculture (incl. Grazing animal production and Horse stables)	Do not control land use.	A permit is required for Grazing animal production.	Land management practices (e.g. Catchment Management Plan)	Refer to item A2.
<b>B3</b>	New or enlarged drains or earthworks (Use of the land for Minor utility installation, buildings and works)	Some earthworks (buildings and works) trigger a permit.  Minor utility installation is exempt.	A permit is required for certain buildings and works (LSIO, ESO19 and ESO30).	As per item A3.	Water Act / Statutory authority requirements	No additional control required.
<b>B4</b>	Native vegetation removal	Permit not required.	Permit required under cl 52.17 (a number of exemptions apply).  Permit required to remove certain native vegetation (ESO19).	Permit not required to plant new vegetation.  If new planting is proposed as part of an application impact on wetland can be considered (ESO30) and landscape values (LSIO).	FFG Act EPBC Act	No additional control required.
<b>B5</b>	Inappropriate planting (visual impacts)	Permit not required.	Permit not required but if new planting is proposed, impact on Wetland can be considered (ESO30) and landscape values (LSIO).	Permit not required to plant new vegetation.  If new planting is proposed as part of an application impact on wetland can be considered (ESO30) and landscape values (LSIO).	N/A	No additional control required.
<b>B6</b>	Inappropriate planting (exotic species which remove water from the wetland via evapotranspiration)	Permit not required.	As above (B5).	As above (B5).	N/A	No additional control required.
<b>B7</b>	Human disturbance of wildlife (intensification of land use, subdivision)	Permit required for subdivision.	Permit is required to subdivide land and ecological values and the wetland are a relevant consideration (ESO19, ESO30).	Permit required and intensification of land uses unlikely given that SUZ4 covers relatively small portion of the wetland and buffer zone.	N/A	No additional control required.  Removal of duplication between the assessed ESOs warranted.

Item	Threats	Current zone response	Current overlay response / particular provisions	Capacity of current planning scheme to address threat	Other non- planning measures	Recommendation
<b>B8</b>	Inappropriate structures (Potential ecological impacts and intrusion) (Buildings and works)	Permit required for building and works associated with certain uses.	Permit required for some building and works subject to a number of conditions.	Permit required.  Design of structures is a relevant consideration under the SUZ4, SLO3, ESO19 and ESO30 having regard to environmental values.	N/A	No additional control required.  Removal of duplication between the assessed ESOs warranted.
<b>B9</b>	Importation of foreign geological or biological material (Buildings and works and roadworks)  (General biological contamination – poor environmental management / cross contamination)	Permit required for building and works associated with certain uses.  Permit not required for roadworks (cl 62.02-2).	Permit required for some building and works.  Permit not require for roadworks in most instances (cl 62.02-2).  Permit required under LSIO for roadworks if flow patch redirected. As part of that process an EMP condition could be included which would have the effect of managing the threat.	Permit required for some buildings and works. If a new application is proposed, the potential for contamination of ground and surface water is considered under ESO19 and ESO30.  Roadworks is exempt from permit requirements under Clause 62.02-2.	N/A	Refer to item A9.
<b>Location C</b>						
<b>IN3Z</b>						
<b>LSIO, ESO19, ESO30, Clause 52.17</b>						
<b>C1</b>	Landfill (Use of land for Refuse disposal [industry])	Permit is required to use the land for a landfill.	Do not control land use.	The IN3Z requires permit for most of the industrial uses by having regards to their potential impacts on the environment (i.e. emissions to land or water).	EP Act (including SEPP)	No additional control required.
<b>C2</b>	Trampling and grazing by cattle and horses (Use of land for Agriculture or Animal production)	Permit is required for most of the Agricultural uses but not for Grazing animal production.  A permit is required for Horse stables.	Do not control land use.	Permit not required for grazing animal production.  Permit required for Horse stables.	Land management practices (e.g. Catchment Management Plan)	Refer to item A2.
<b>C3</b>	New or enlarged drains or earthworks (Use of the land for Minor utility installation, buildings and works)	Most earthworks (buildings and works) trigger a permit.  Minor utility installation is exempt.	A permit is required for certain buildings and works (ESO19). A permit is required for buildings and works under ESO30.	Refer to item A3.	Water Act / Statutory authority requirements	No additional control required.
<b>C4</b>	Native vegetation removal	Permit not required.	Permit required under cl 52.17 (a number of exemptions apply).  Permit required to remove certain Native vegetation (ESO19). A permit is	Refer to item B4.	FFG Act EPBC Act	No additional control required.

Item	Threats	Current zone response	Current overlay response / particular provisions	Capacity of current planning scheme to address threat	Other non- planning measures	Recommendation
			required to remove y vegetation (ESO30).			
<b>C5</b>	Inappropriate planting (ecological impacts)	Permit not required.	Permit not required.	Permit not required to plant new vegetation.  Landscape treatment is a relevant consideration under the IN3Z.  The ESO30 considers the impact of proposed planting on the wetland.	N/A	No additional control required.
<b>C6</b>	Inappropriate planting (exotic species which remove water from the wetland via evapotranspiration)	Permit not required.	Permit not required but if new planting is proposed, impact on wetland can be considered (ESO30).	Refer to item C5.	N/A	No additional control required.
<b>C7</b>	Human disturbance of wildlife (intensification of land use, subdivision)	Permit required for subdivision.	Permit is required to subdivide land and ecological values and the wetland are a relevant consideration under the zone and overlays.	Permit required and intensification of land uses unlikely given the purpose of IN3Z.	N/A	No additional control required.  Removal of duplication between the assessed ESOs warranted.
<b>C8</b>	Inappropriate structures (Potential ecological impacts and intrusion) (Buildings and works)	Permit required for most building and works associated with certain uses.	Permit required for some building and works subject to a number of conditions.	Permit required.  The IN3Z contains considerations relevant to built form and landscape treatment.  Design of structures is a relevant consideration under the LSIO, ESO19 and ESO30 having regard to environmental values.		No additional control required.  Removal of duplication between the assessed ESOs warranted.
<b>C9</b>	Importation of foreign geological or biological material (Buildings and works and roadworks) (General biological contamination – poor environmental management / cross contamination)	Permit required for building and works subject to some exemptions.  Permit not required for roadworks (cl 62.02-2).	Permit required for some buildings and works.  Permit not require for roadworks in most instances (cl 62.02-2).  Permit required under LSIO for roadworks if flow patch redirected. As part of that process an EMP conditions could be included which would have the effect of managing the threat.	Permit required for some buildings and works. If a new application is proposed, the potential for contamination of ground and surface water is considered under ESO19 and ESO30.  Roadworks is exempt from permit requirements under Clause 62.02-2.	N/A	Refer to item A9.

Item	Threats	Current zone response	Current overlay response / particular provisions	Capacity of current planning scheme to address threat	Other non- planning measures	Recommendation
<b>Location D</b>						
<b>GRZ1</b>						
<b>ESO19, ESO30, LSIO, Clause 52.17</b>						
<b>D1</b>	Landfill (Use of land for Refuse disposal [industry])	Prohibited use.	Do not control land use.	Prohibited.	N/A	No additional control required.
<b>D2</b>	Trampling and grazing by cattle and horses (Use of land for Agriculture or Animal production)	Permit is required for most of agricultural uses (incl. grazing animal production).  Horse stables is prohibited.	Do not control land use.	A permit is required for grazing (Horse stable is prohibited).	Land management practices (e.g. Catchment Management Plan)	No additional control required.
<b>D3</b>	New or enlarged drains or earthworks (Use of the land for Minor utility installation, buildings and works)	Permit required for some earthworks (buildings and works).  No permit required for minor utility installation.	A permit is required for certain buildings and works (LSIO, ESO19).	As above.	Water Act / Statutory authority requirements	No additional control required.
<b>D4</b>	Native vegetation removal	Permit not required.	Permit required under cl 52.17 (a number of exemptions apply)  Permit required to remove certain native vegetation (ESO19). A permit is required to remove any vegetation (ESO30).	Refer to item B4.	FFG Act EPBC Act	No additional control required.
<b>D5</b>	Inappropriate planting (ecological impacts)	Permit not required.	Permit not required.	Permit not required to plant new vegetation.  The ESO30 considers the impact of proposed planting on the wetland.	NA	No additional control required.
<b>D6</b>	Inappropriate planting (exotic species which remove water from the wetland via evapotranspiration)	Permit not required.	Refer to item C6.	Refer to item C6.	NA	No additional control required.
<b>D7</b>	Human disturbance of wildlife (intensification of land use, subdivision)	Permit required for subdivision.	Permit is required to subdivide land (GRZ) and ecological values of the wetland are a relevant consideration (ESO19) and flooding (LSIO).	Permit required and intensification of land uses is unlikely given that GRZ1 covers a very small portion of the wetland and buffer zone.	NA	No additional control required.

Item	Threats	Current zone response	Current overlay response / particular provisions	Capacity of current planning scheme to address threat	Other non- planning measures	Recommendation
D8	Inappropriate structures (Potential ecological impacts and intrusion) (Buildings and works)	Permit required for building and works associated with certain uses.	Permit required for many building and works.	Permit required.  Design, height, setback and appearance of proposed buildings and work are considered under the GRZ  Design of structures is a relevant consideration under the LSIO and ESO19 having regard to environmental values and flooding impacts.	NA	No additional control required.  Removal of duplication between the assessed ESOs warranted.
D9	Importation of foreign geological or biological material (Buildings and works and roadworks)  (General biological contamination – poor environmental management / cross contamination)	Permit required for buildings and works associated with some uses.  Permit not required for roadworks (cl. 62.02-2 exemption applies).	Refer to item C9.	Refer to item C9.	NA	Refer to item A9.

## 8.4 Findings

The gap analysis indicates that:

- The current Planning Scheme controls address the threats to the wetland, these being the threats that can actually be controlled through the planning system and the current suite of controls in the VPPs.
- There is significant duplication between controls, particularly ESO14, ESO18, ESO19 and ESO30 which all serve a very similar purpose. There is a risk of confusion if all ESO controls were applied simultaneously. This also creates an administrative burden for permit applicants and Council statutory planners.
- There is not one single control which accurately reflects the extent of the wetland and buffer (as identified in this report).
- Some of the existing ESO controls (refer to Table 11) include 'unrelated' objectives that go beyond protecting the ecological values of the wetland from the identified threats. For example:
  - ESO14 protects aesthetic values of the landscape (in addition to ecological values). The visual landscape values of the wetland have merit, however they may be better dealt with through a review of Significant Landscape Overlay (SLO) or other equivalent planning controls.
  - ESO19 is a generic control that applies to alluvial plains and reclaimed swamps on the peninsula and calls for the views of relevant drainage, stream or catchment management authorities to be taken into account. Referral requirements are already included in Clause 66 (Referral and notice provisions) of the Planning Scheme and these may be sufficient to address the current requirements of ESO19.

Further review of these 'unrelated' objectives in existing ESO controls may be required. There may be another rationale for retaining these objectives in the Planning Scheme (i.e. unrelated to the ecological protection of the wetland).

- Some of the existing ESO controls (refer to Table 11) contain prescriptive requirements (e.g. as a threshold for when a permit is required). For example:
  - ESO14 contains a permit exemption for building or any structure under the height of 8 metres above natural ground level associated with a Section 1 use in the GWZ. Although the potential ecological impacts associated with structures has been identified as a threat, the impacts are largely unknown and unstudied.
- There is an opportunity to implement broader management measures through proactive land management plans and guidelines that would sit outside the planning framework.

## 8.5 Recommendations

The following recommendations are made in response to the findings from the gap analysis:

### Planning Scheme recommendations

- **Mapping**

- A new ESO should be applied to the wetland and buffer area based on the current and original extent identified in this study (refer to Maps 5, 6).
- ESO30 should be deleted as it does not reflect the extent of the wetland and its buffer.
- ESO14, ESO18 and ESO19 should be deleted from the wetland and buffer area, as these overlays will be replaced by the new ESO (refer to Map 7).

- **Content of planning scheme controls**

- The new ESO should consolidate and rationalise the content currently contained in the ESO14, ESO18, ESO19 and ESO30. A draft control is included at Appendix A that is consistent with the *Ministerial Direction – The Form and Content of Planning Schemes*.
- The draft ESO only addresses the ecological threats that have been identified in this study.
- If Council seeks to retain prescriptive controls in the new ESO (e.g. prescribing a building height over which a permit is required), it may need to undertake further investigation in relation to the rationale for any prescriptive requirements.

- **General recommendations**

- Council may consider a further review of any 'unrelated' provisions in ESO14 and ESO19 to confirm if there is another rationale for retaining such controls in the Planning Scheme (unrelated to the ecological protection of the wetland), for example visual landscape values. If another rationale exists, the mapping for these ESOs would need to be reviewed having regard to their objectives. It may also be necessary to review other overlay controls, such as the SLO depending on other policy objectives.

- **Incorporated and background documents**

- *Planning Practice Note 13: Incorporated and Background Documents* explains when a document should or must be either incorporated or made a background document.
- The existing ESO30 contained a list of Reference documents (now referred to as Background documents). We have reviewed the list of reference documents as part of this study to identify which, if any of the documents, may warrant inclusion in the Planning Scheme. Notably, the current *Ministerial Direction – The Form and Content of Planning Schemes* does not allow lists to be included in the ESO, they must be located in clause 72.08 of the Planning Scheme.
- It is recommended that the following documents should be listed as Background documents in Clause 72.08 of the Planning Scheme:
  1. *Extent of Tootgarook Wetland, Mornington Peninsula, Victoria (Biosis 2019)*
- Documents that relate to other legislation, such as EPBC Act guidance do not need to be listed in the Planning Scheme. These controls apply regardless of whether they are listed in the Planning Scheme.

- **Other recommendations**

- *Poa* grasslands have been identified as a sensitive vegetation and warrant more proactive grazing management. Whilst grazing does not need to be prohibited (e.g. via changes to the zoning controls), it should be avoided and discouraged and appropriate revegetation and rehabilitation should be encouraged in these locations. Specific management guidelines should be developed in consultation with the CMA, as well as other community based organisations such as Landcare.
- Threats such as the importation of geological and biological materials are to be addressed via good environmental management guidance. If a permit application is made, Council may consider including a condition that calls for environmental management plans. If no permit application is made, land management guidance should be prepared in consultation with Melbourne Water, EPA and any local land managers to provide advice on best practice techniques for land owners.
- Encouraging appropriate planting of local species and genetic provenances both in terms of visual impacts and species selection is recommended. Council should consider developing relevant landscape guidelines in consultation with Melbourne Water and local land managers as a reference that can be used in future developments.

## Glossary

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Aquifer	Underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand or silt)
Aquitard	Bed of low permeability tending to confine an aquifer
Buffer zone	Zone which protects geophysical and ecological core areas by absorbing or moderating human impacts along the outer edges
Characteristic wetland flora	Plant species that require frequent or permanent flooding (hydrophytes), see Table 6
Current wetland extent	Area of vegetation comprising patch wetland vegetation
DELWP	Department of Environment, Land, Water and Planning, Victoria
DNRE	Department of Natural Resources and Environment, Victoria (1996–2002), now <i>DELWP</i>
DSE	Department of Sustainability and Environment, Victoria (2002–2013), now <i>DELWP</i>
Ecological vegetation class	Standard unit for classifying vegetation types in Victoria <a href="http://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks">www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks</a>
ESO30	Environmental Significance Overlay – Tootgarook Wetland, Mornington Peninsula Planning Scheme, Clause 42.01 <a href="http://schemes.delwp.vic.gov.au/schemes/morningtonpeninsula/ordinance/42_01s30_morn.pdf">schemes.delwp.vic.gov.au/schemes/morningtonpeninsula/ordinance/42_01s30_morn.pdf</a>
Hydrology	Study of the movement, distribution and quality of water
Lidar	Survey method using airborne laser light reflectance giving ground contour maps
LSIO	Land Subject to Inundation Overlay, Mornington Peninsula Planning Scheme, Clause 44.04 <a href="http://schemes.delwp.vic.gov.au/schemes/morningtonpeninsula/ordinance/44_04s_morn.pdf">schemes.delwp.vic.gov.au/schemes/morningtonpeninsula/ordinance/44_04s_morn.pdf</a>
Original wetland extent	Pre-European area of vegetation comprising <i>patch wetland vegetation</i>
Patch native vegetation	An area of vegetation where $\geq 25\%$ of the total perennial understorey plant cover is composed of plants native to Victoria (DELWP 2017)
Patch wetland vegetation	Similar to DELWP (2017), an area where <i>characteristic wetland flora</i> provide $\geq 25\%$ of total plant cover
Scattered wetland flora	Similar to DELWP (2017), an area where <i>characteristic wetland flora</i> provide $< 25\%$ of total plant cover

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## Appendix A. Proposed Environmental Significance Overlay

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C--**SCHEDULE [NUMBER] TO CLAUSE 42.01 ENVIRONMENTAL SIGNIFICANCE OVERLAY**

Shown on the planning scheme map as **ESO**  
[supersedes ESO14, ESO18, ESO19 and ESO30].

**TOOTGAROOK WETLAND****1.0 Statement of environmental significance**--/20--  
C--

Tootgarook Wetland is the largest wetland on the Mornington Peninsula. The wetland is within the Chinamans Creek catchment and operates as a retarding basin providing critical flood storage protecting downstream areas from severe flooding.

Despite many disturbances and modifications, Tootgarook Wetland supports a wide range of biodiversity values, including protected ecological communities, native vegetation, migratory bird species, and aquatic and terrestrial fauna species.

Many of these communities and species are protected under the *Flora and Fauna Guarantee Act 1988* (Vic.) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth.) or recognised under international migratory agreements. The protection of ecological communities and species within the wetland is important for protecting the ongoing function of the wetland.

Tootgarook Wetland is critical in conserving the habitat of resident and migratory species, especially during seasonal or prolonged periods of drought (habitat contraction).

Development within Tootgarook Wetland and its buffer zone needs to be carefully managed to protect and maintain the ecological values and functions of the wetland.

**2.0 Environmental objective to be achieved**--/20--  
C--

To protect and enhance the ecological values and functions of Tootgarook Wetland.

**3.0 Permit requirement**--/20--  
C--

A permit is required to construct a fence. This does not apply to:

- A post and plain wire fence.
- Open agricultural or equestrian fencing..
- A portable fence required for an equestrian event that is both constructed and demounted within 14 days of that event.

**4.0 Application requirements**--/20--  
C--

The following application requirements apply to an applications for a permit under Clause 42.01, in addition to those specified elsewhere in the scheme and must accompany an application, as appropriate, to the satisfaction of the responsible authority:

- Report prepared by a suitably qualified person on the potential for acid sulfate soils and any management recommendations having regard to the *Victorian Coastal Acid Sulfate Soils Strategy 2009*.
- Report prepared by a suitably qualified person on the potential for contamination of ground and surface water.
- Land management plan that addresses:
  - Integrated approach to managing the land, environmental and water resources on the site
  - Any wider catchment management plans or strategies that apply to Toogarook Wetland

- Any recommended management or mitigation measures required to mitigate risks to the wetland, such as pest and weed management measures or land management plans.
- Site Environmental Management Plan which addresses project management details, construction details, construction impacts and impact mitigation measures.

## 5.0 Decision guidelines

--/20--  
C--

The following decision guidelines apply to an application for a permit under Clause 42.01, in addition to those specified in Clause 42.01 and elsewhere in the scheme which must be considered, as appropriate, by the responsible authority:

- The existing and proposed use of the land and the purpose of the development in relation to that use.
- The impact on vegetation, surface water quality, groundwater, habitat values or stability of the wetland or watercourse.
- The protection of the wetland for its environmental, cultural, landscape and scientific values.
- The means of treatment and disposal of sewerage, sullage and any other wastes where connection to the reticulated sewerage system is not viable.
- The potential for flooding to occur and whether the proposed development will impose additional flooding or drainage risk or constraint.
- Appropriate measures to prevent detrimental alterations to flow regimes in the wetland, including any water sensitive urban design features.
- Appropriate measures to prevent litter, pollution, increased nutrient loads, siltation and increased turbidity of water in the wetland and its buffer.
- Any approved management plan or strategies that are applicable to the wetland.
- Appropriate species selection for landscaping, having regard to the character of the wetland, light spill from urban development and the potential for exotic species to remove water from the wetland through evapotranspiration.
- The siting and design of the buildings and structures, having regard to its responsiveness to the undulating lowland landscape character of the wetland and its buffer.
- Any measures to avoid or minimise the impacts of the development on the ecological values and functions of Tootgarook Wetland.

## Appendix B. Maps

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<b>Map 1. Planning zones, Tootgarook Wetland</b>	79
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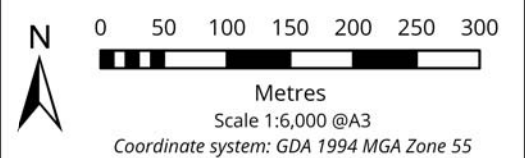
## Map 1. Planning zones, Tootgarook wetland

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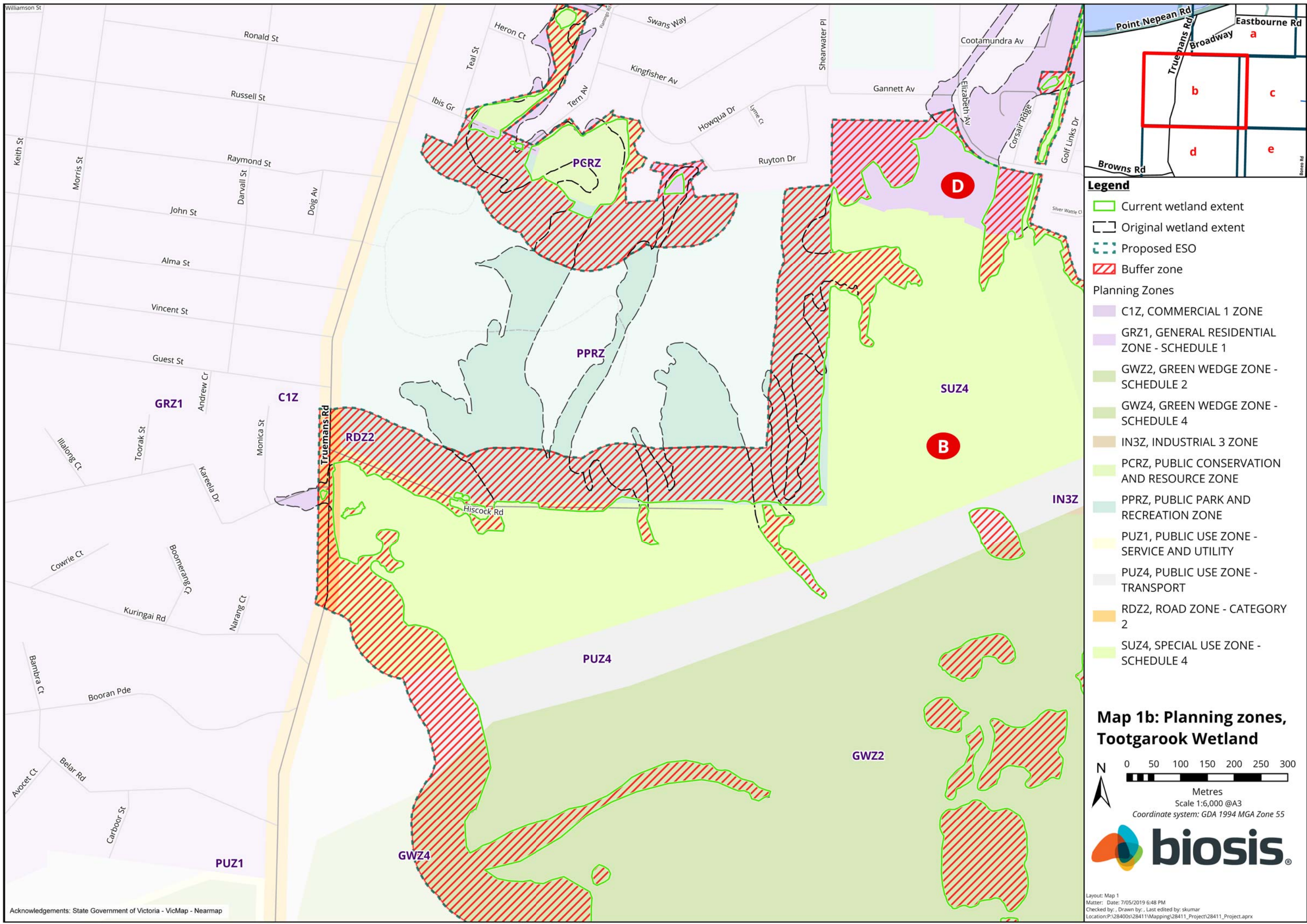
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  - Buffer zone
- Planning Zones**
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  - PCRZ, PUBLIC CONSERVATION AND RESOURCE ZONE
  - PPRZ, PUBLIC PARK AND RECREATION ZONE
  - PUZ2, PUBLIC USE ZONE - EDUCATION
  - PUZ3, PUBLIC USE ZONE - HEALTH AND COMMUNITY
  - PUZ6, PUBLIC USE ZONE - LOCAL GOVERNMENT
  - RDZ1, ROAD ZONE - CATEGORY 1
  - RDZ2, ROAD ZONE - CATEGORY 2

**Map 1a: Planning zones, Tootgarook Wetland**



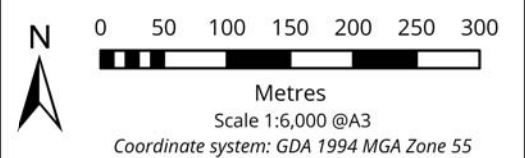
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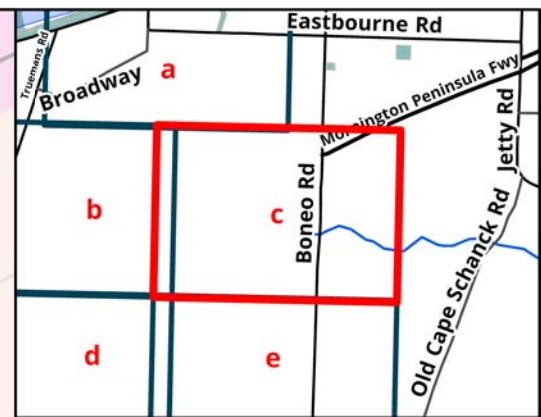
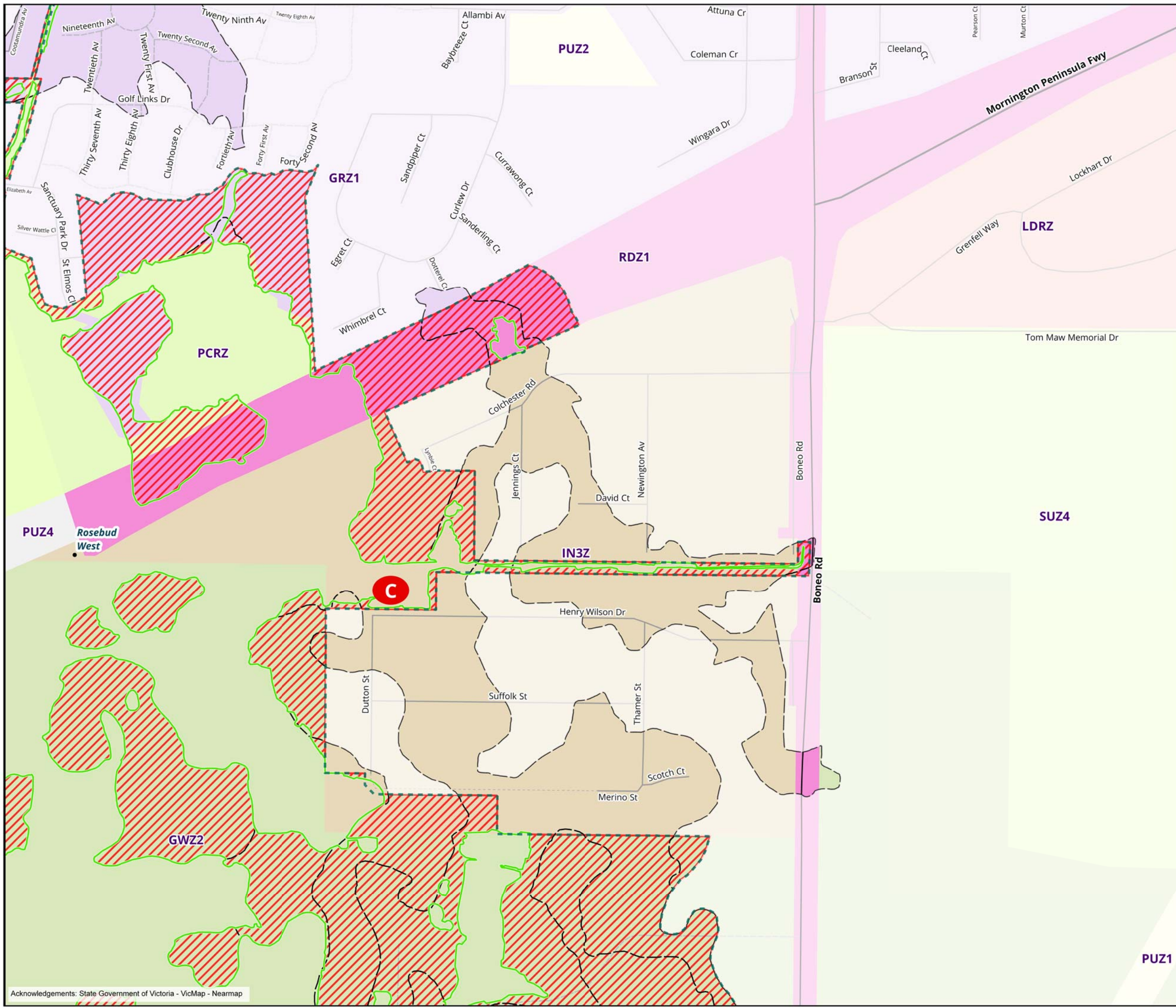
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  - Proposed ESO
  - Buffer zone
- Planning Zones**
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  - GWZ2, GREEN WEDGE ZONE - SCHEDULE 2
  - GWZ4, GREEN WEDGE ZONE - SCHEDULE 4
  - IN3Z, INDUSTRIAL 3 ZONE
  - PCRZ, PUBLIC CONSERVATION AND RESOURCE ZONE
  - PPRZ, PUBLIC PARK AND RECREATION ZONE
  - PUZ1, PUBLIC USE ZONE - SERVICE AND UTILITY
  - PUZ4, PUBLIC USE ZONE - TRANSPORT
  - RDZ2, ROAD ZONE - CATEGORY 2
  - SUZ4, SPECIAL USE ZONE - SCHEDULE 4

**Map 1b: Planning zones, Tootgarook Wetland**



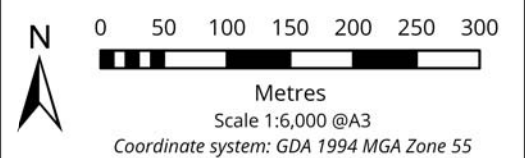
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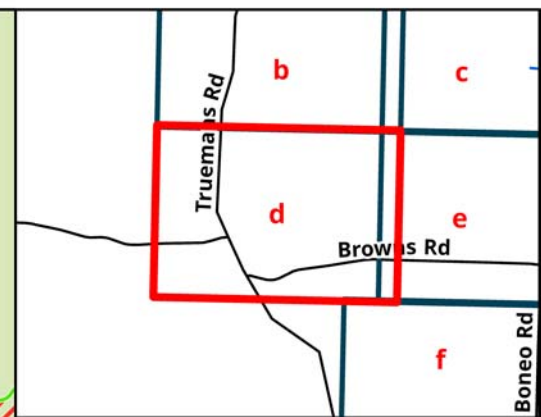
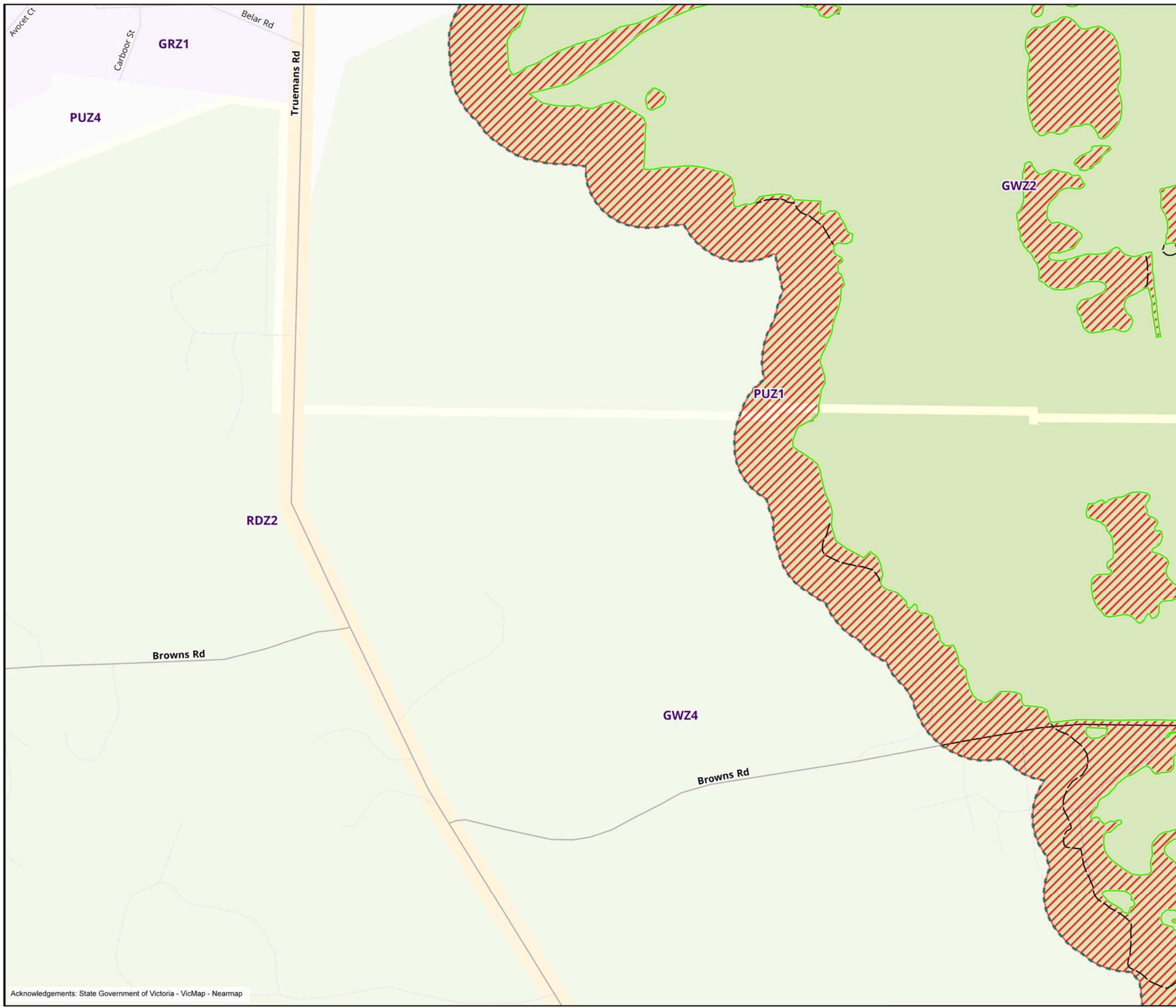
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- Planning Zones**
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  - GWZ2, GREEN WEDGE ZONE - SCHEDULE 2
  - IN3Z, INDUSTRIAL 3 ZONE
  - LDRZ, LOW DENSITY RESIDENTIAL ZONE
  - PCRZ, PUBLIC CONSERVATION AND RESOURCE ZONE
  - PUZ1, PUBLIC USE ZONE - SERVICE AND UTILITY
  - PUZ2, PUBLIC USE ZONE - EDUCATION
  - PUZ4, PUBLIC USE ZONE - TRANSPORT
  - RDZ1, ROAD ZONE - CATEGORY 1
  - SUZ4, SPECIAL USE ZONE - SCHEDULE 4

**Map 1c: Planning zones, Tootgarook Wetland**



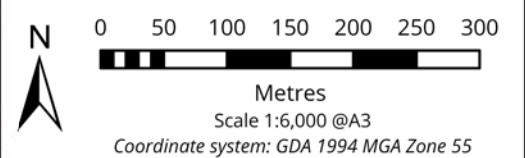
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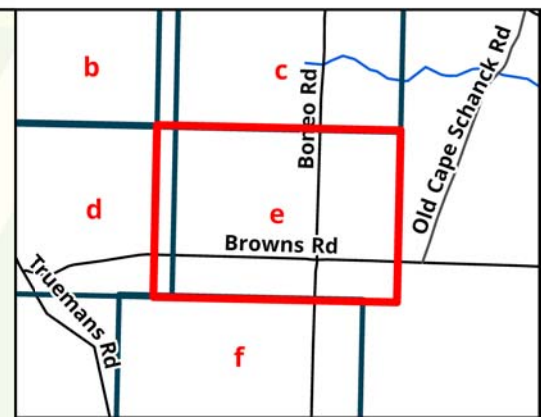
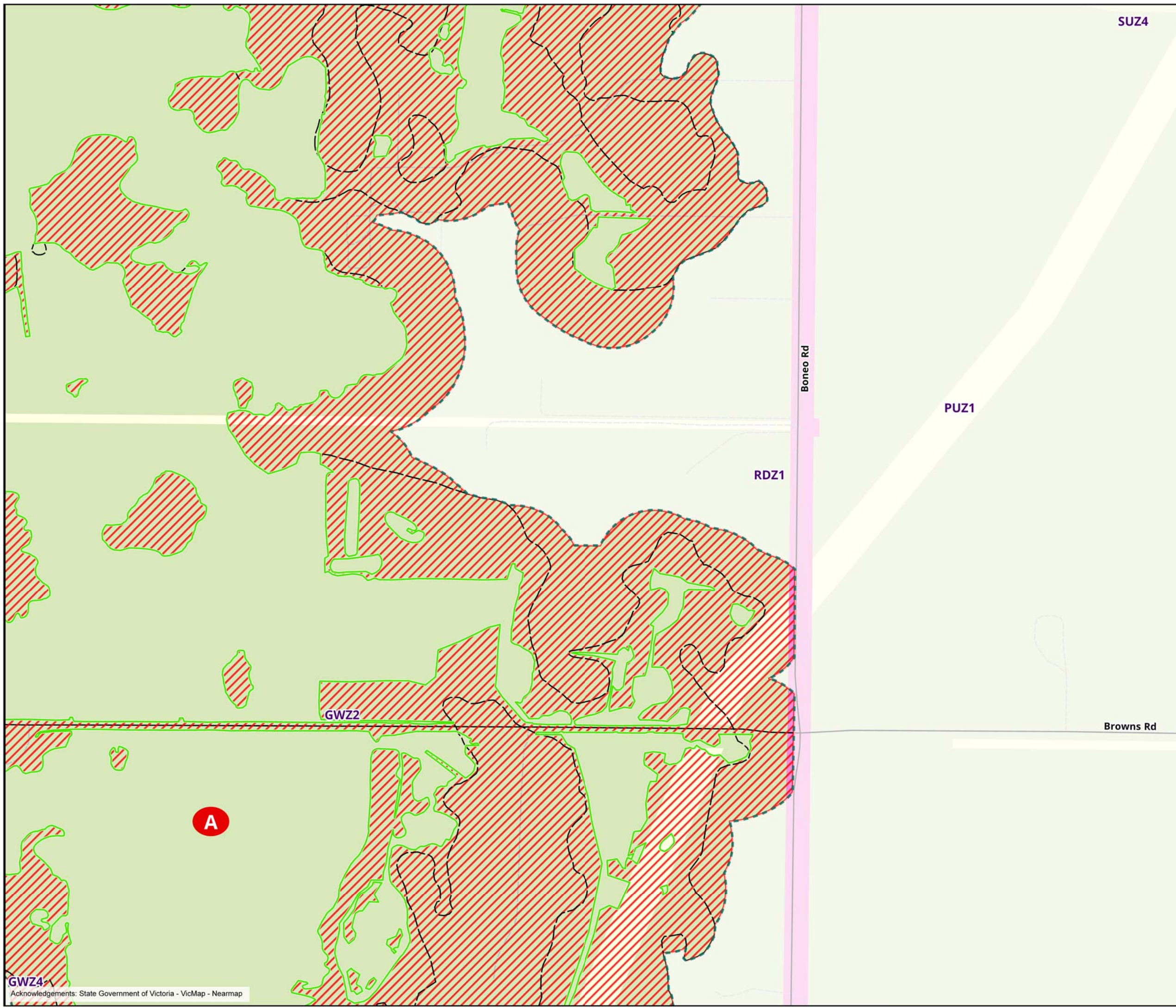
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- Legend**
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  - Buffer zone
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  - GWZ4, GREEN WEDGE ZONE - SCHEDULE 4
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  - RDZ2, ROAD ZONE - CATEGORY 2

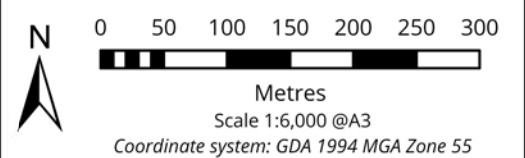
**Map 1d: Planning zones, Tootgarook Wetland**

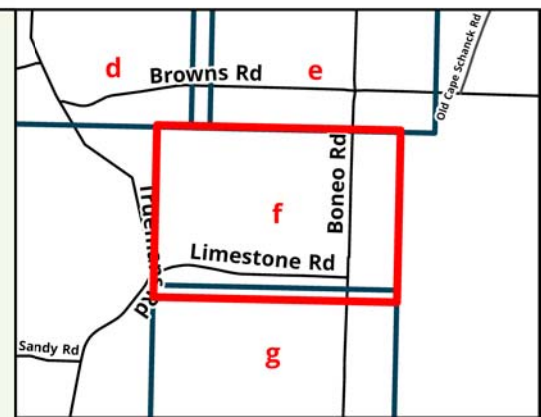
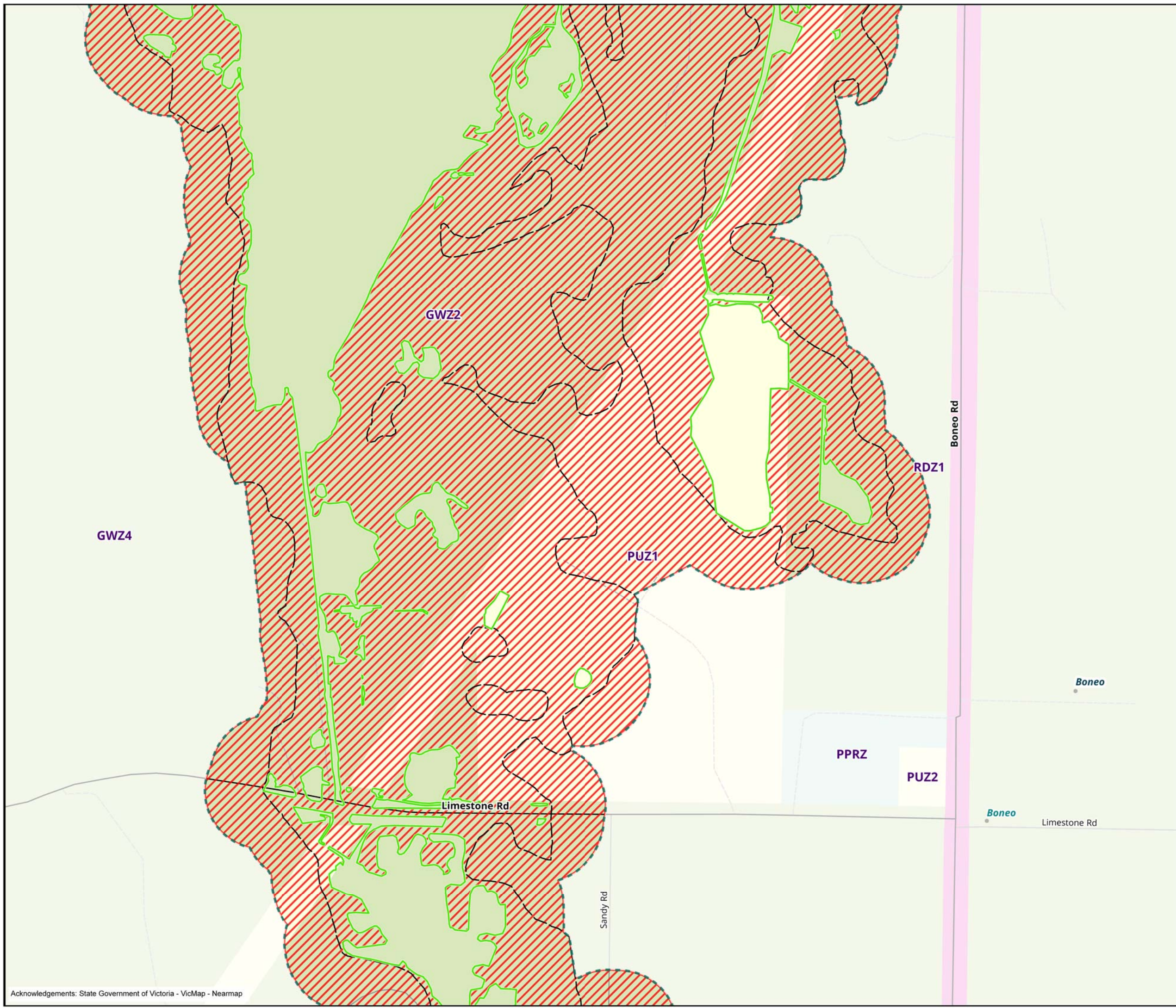




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  - RDZ1, ROAD ZONE - CATEGORY 1
  - SUZ4, SPECIAL USE ZONE - SCHEDULE 4

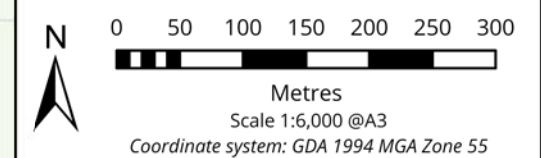
**Map 1e: Planning zones, Tootgarook Wetland**





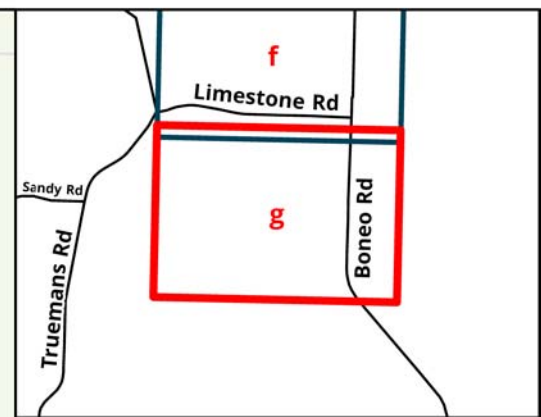
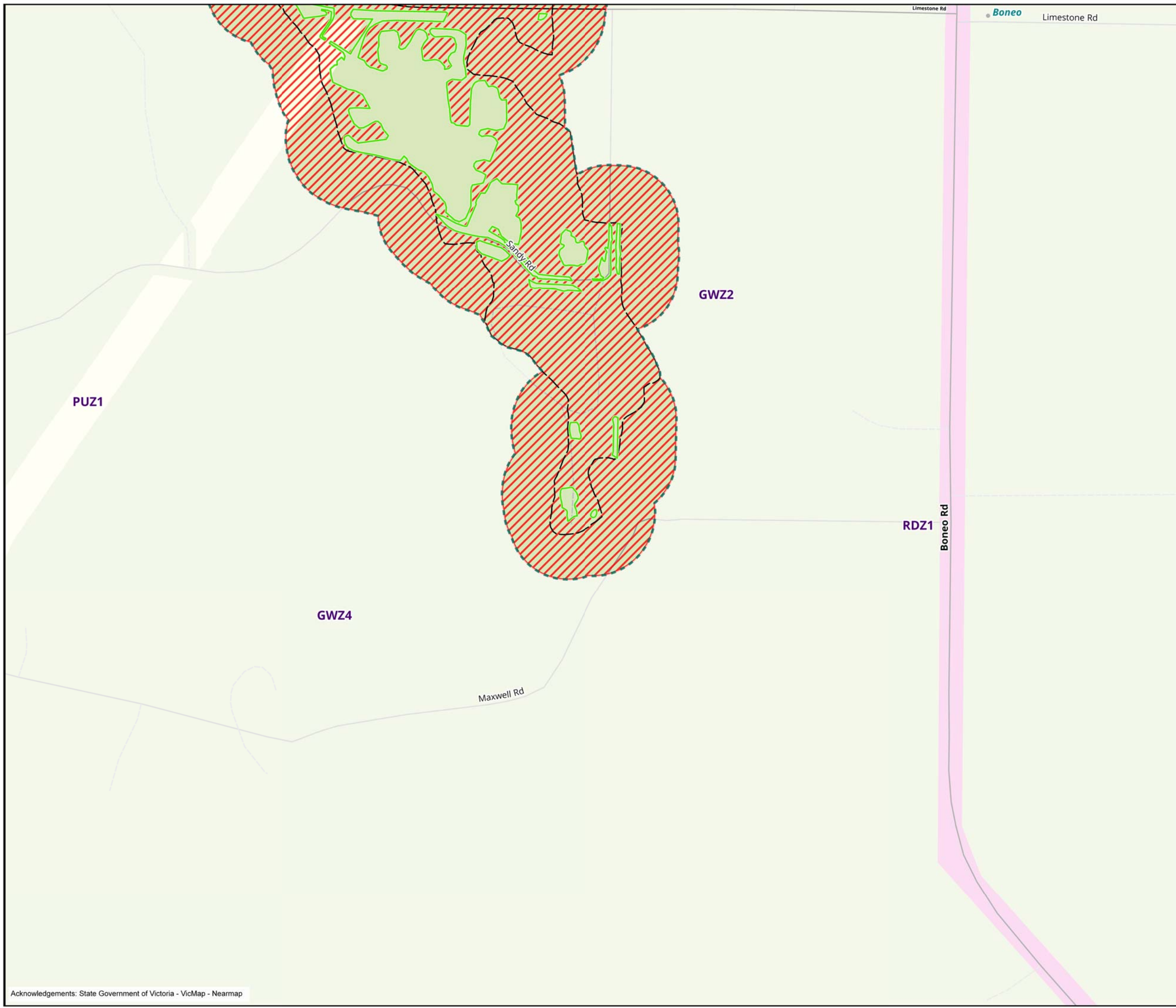
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  - RDZ1, ROAD ZONE - CATEGORY 1

**Map 1f: Planning zones, Tootgarook Wetland**



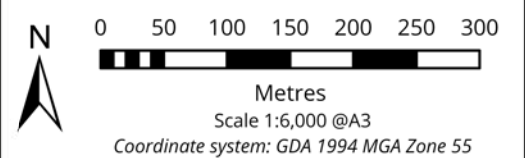
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  - GWZ4, GREEN WEDGE ZONE - SCHEDULE 4
  - PUZ1, PUBLIC USE ZONE - SERVICE AND UTILITY
  - RDZ1, ROAD ZONE - CATEGORY 1

**Map 1g: Planning zones, Tootgarook Wetland**



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## Map 2.1 Environmental significance overlays, Tootgarook Wetland

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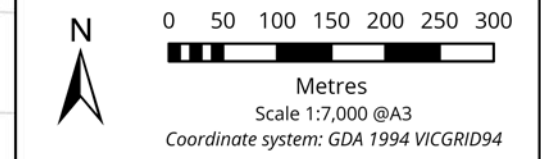
**Legend**

- Original Wetland Extent
- Current Wetland Extent
- Proposed ESO
- Buffer zone

Environmental Significance Overlays

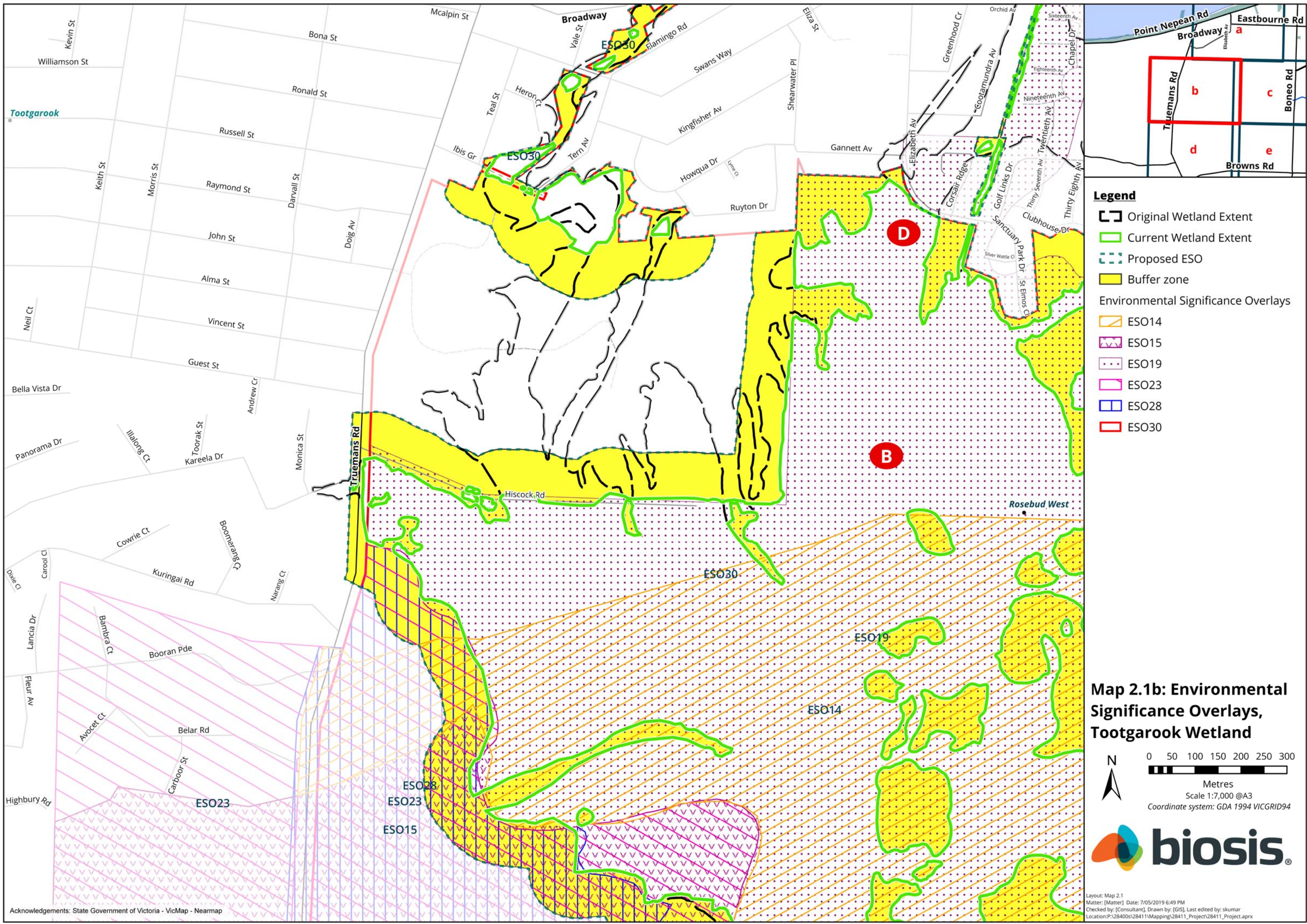
- ESO19
- ESO25
- ESO30

**Map 2.1a: Environmental Significance Overlays, Tootgarook Wetland**



Acknowledgements: State Government of Victoria - VicMap - Nearmap

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- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Environmental Significance Overlays**
- ESO14
  - ESO15
  - ESO19
  - ESO23
  - ESO28
  - ESO30

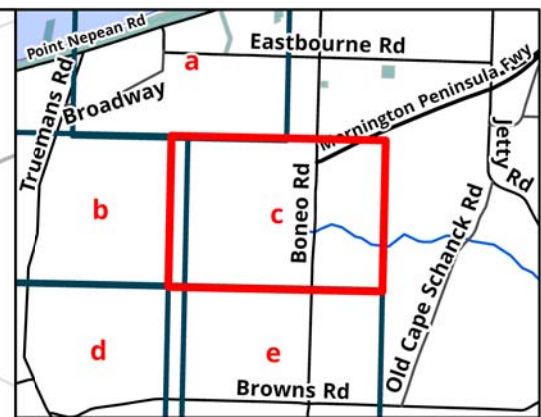
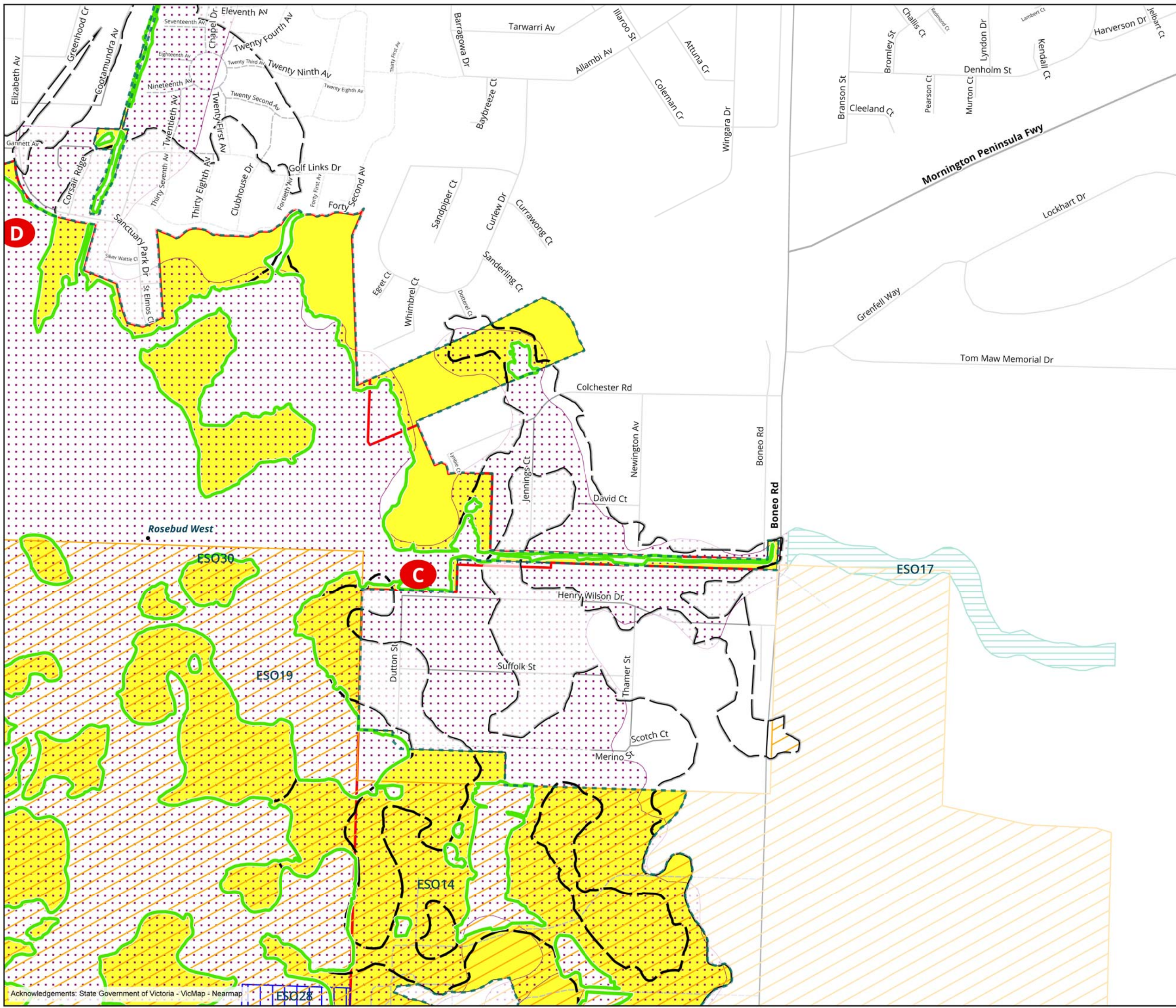
**Map 2.1b: Environmental Significance Overlays, Tootgarook Wetland**

N  
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 Metres  
 Scale 1:7,000 @A3  
 Coordinate system: GDA 1994 VICGRID94



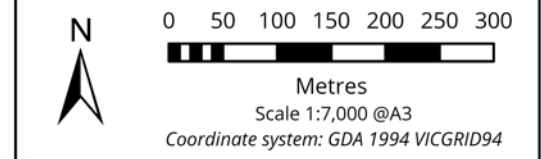
Acknowledgements: State Government of Victoria - VicMap - Nearmap

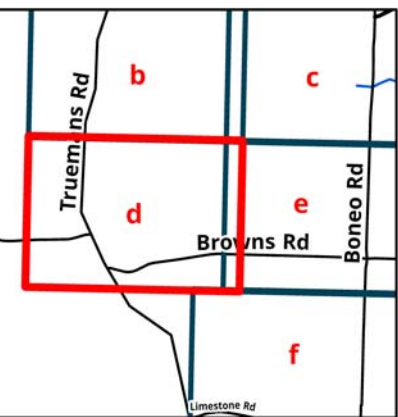
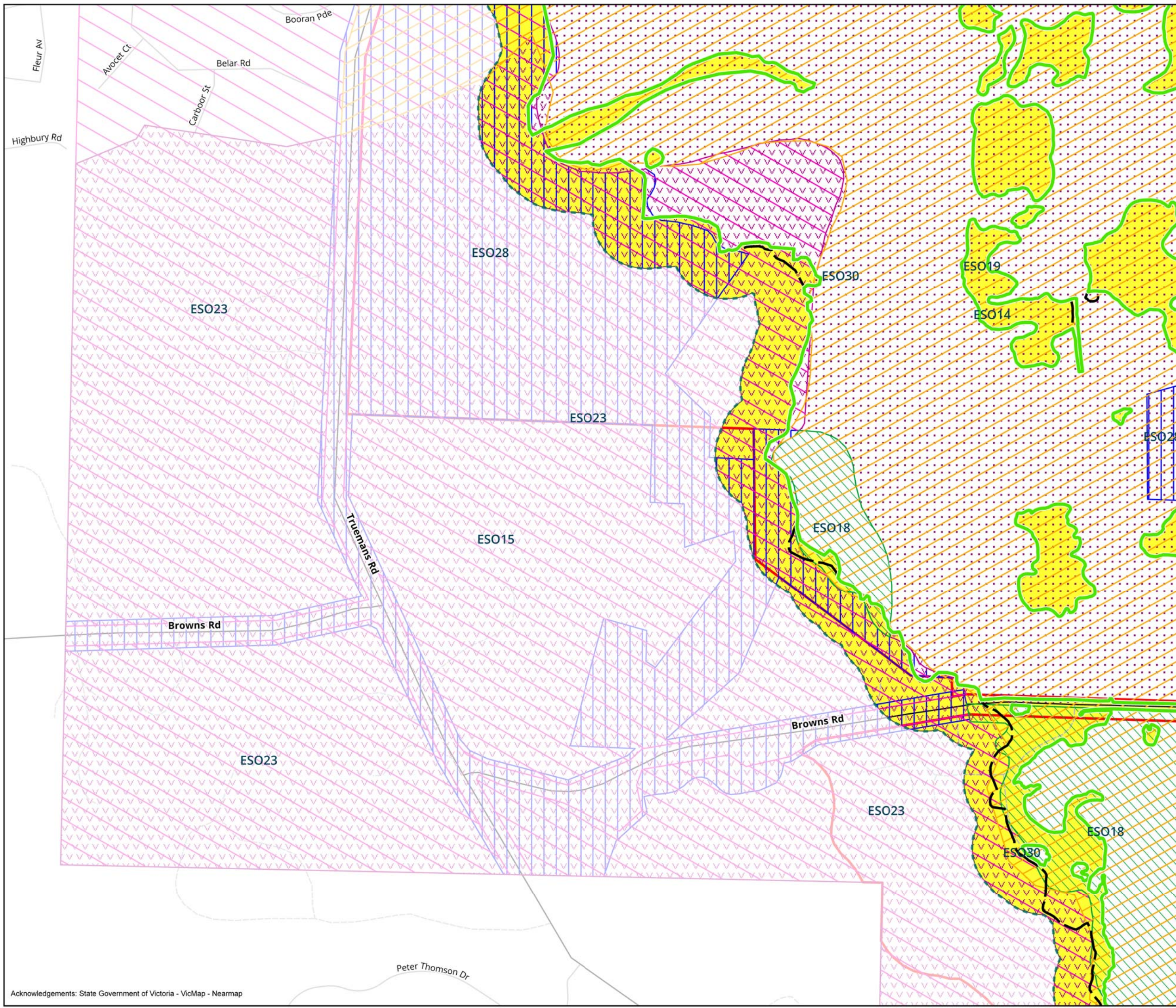
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 Checked by: [Consultant], Drawn by: [GIS], Last edited by: skumar  
 Location: P:\28400s\28411\mapping\28411\_Project\28411\_Project.aprx



- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Environmental Significance Overlays
- ESO14
  - ESO17
  - ESO19
  - ESO28
  - ESO30

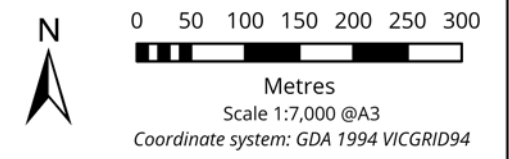
**Map 2.1c: Environmental Significance Overlays, Tootgarook Wetland**

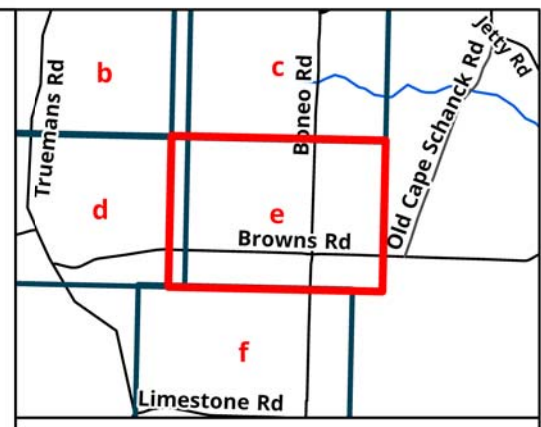
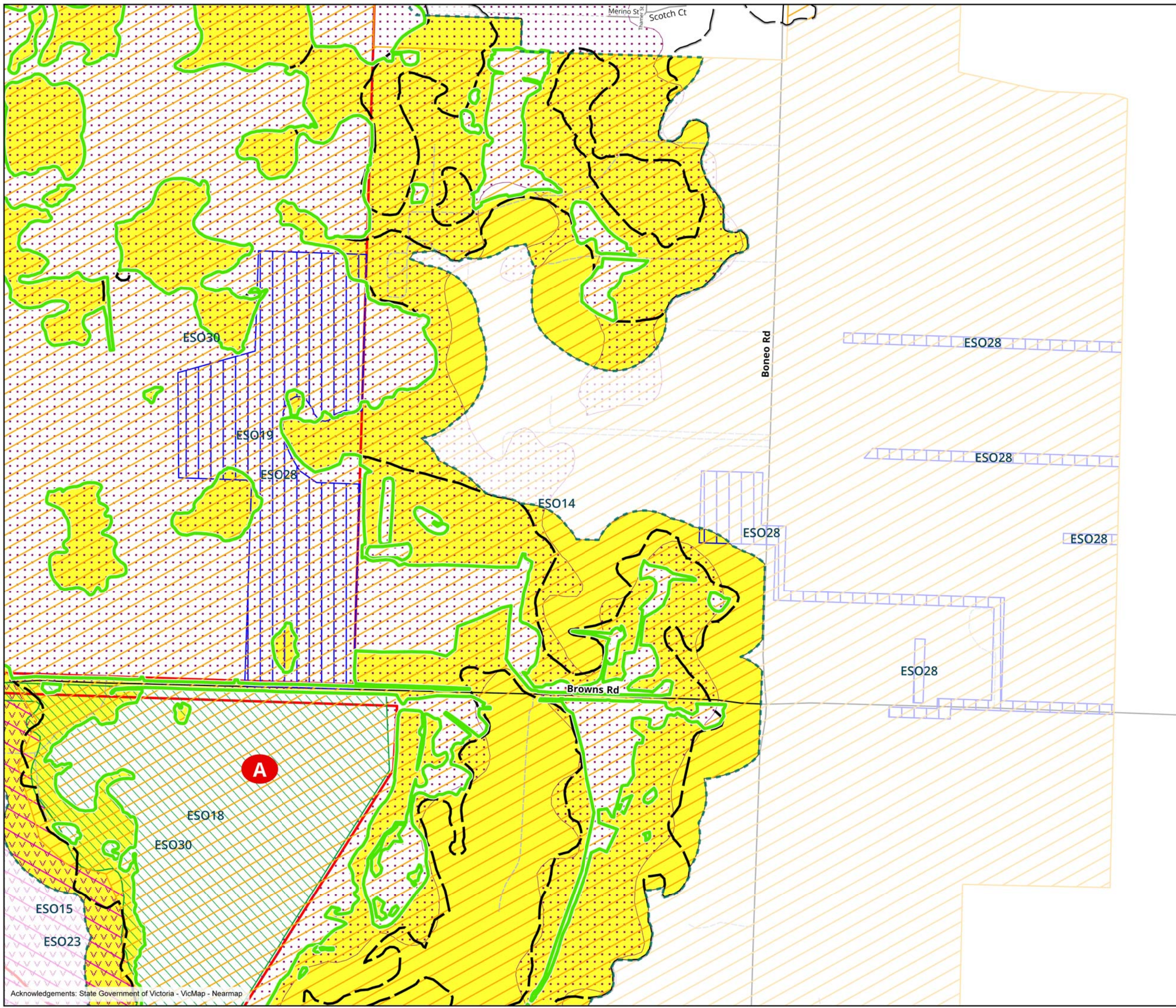




- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Environmental Significance Overlays**
- ESO14
  - ESO15
  - ESO18
  - ESO19
  - ESO23
  - ESO28
  - ESO30

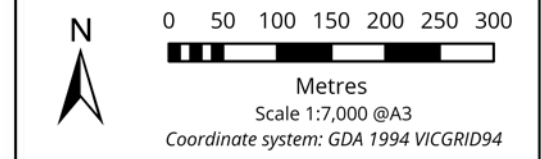
**Map 2.1d: Environmental Significance Overlays, Tootgarook Wetland**





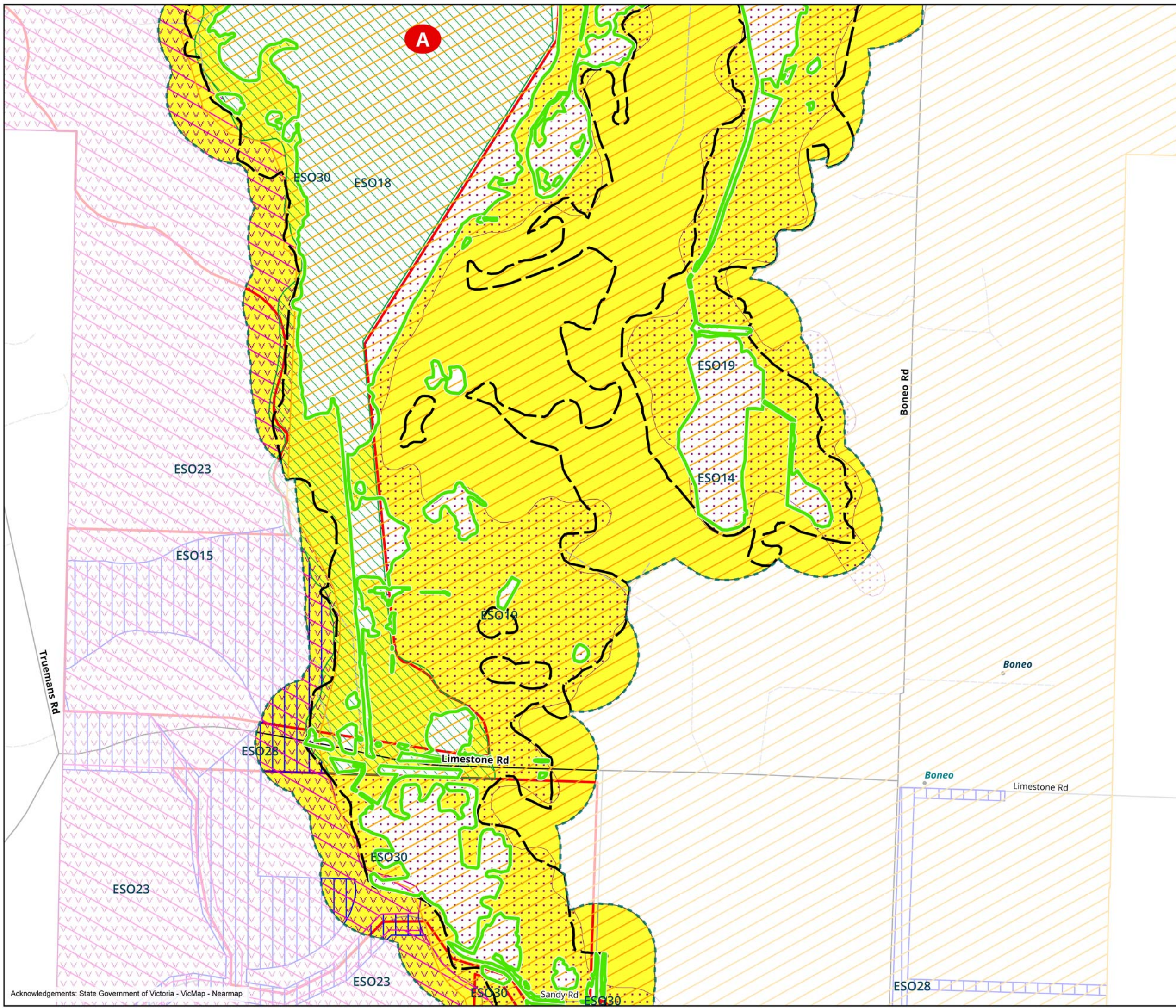
- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Environmental Significance Overlays
- ESO14
  - ESO15
  - ESO18
  - ESO19
  - ESO23
  - ESO28
  - ESO30

**Map 2.1e: Environmental Significance Overlays, Tootgarook Wetland**



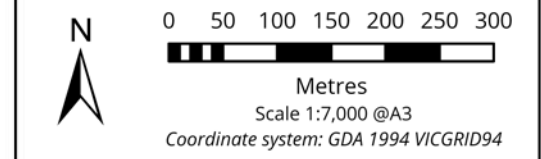
Acknowledgements: State Government of Victoria - VicMap - Nearmap

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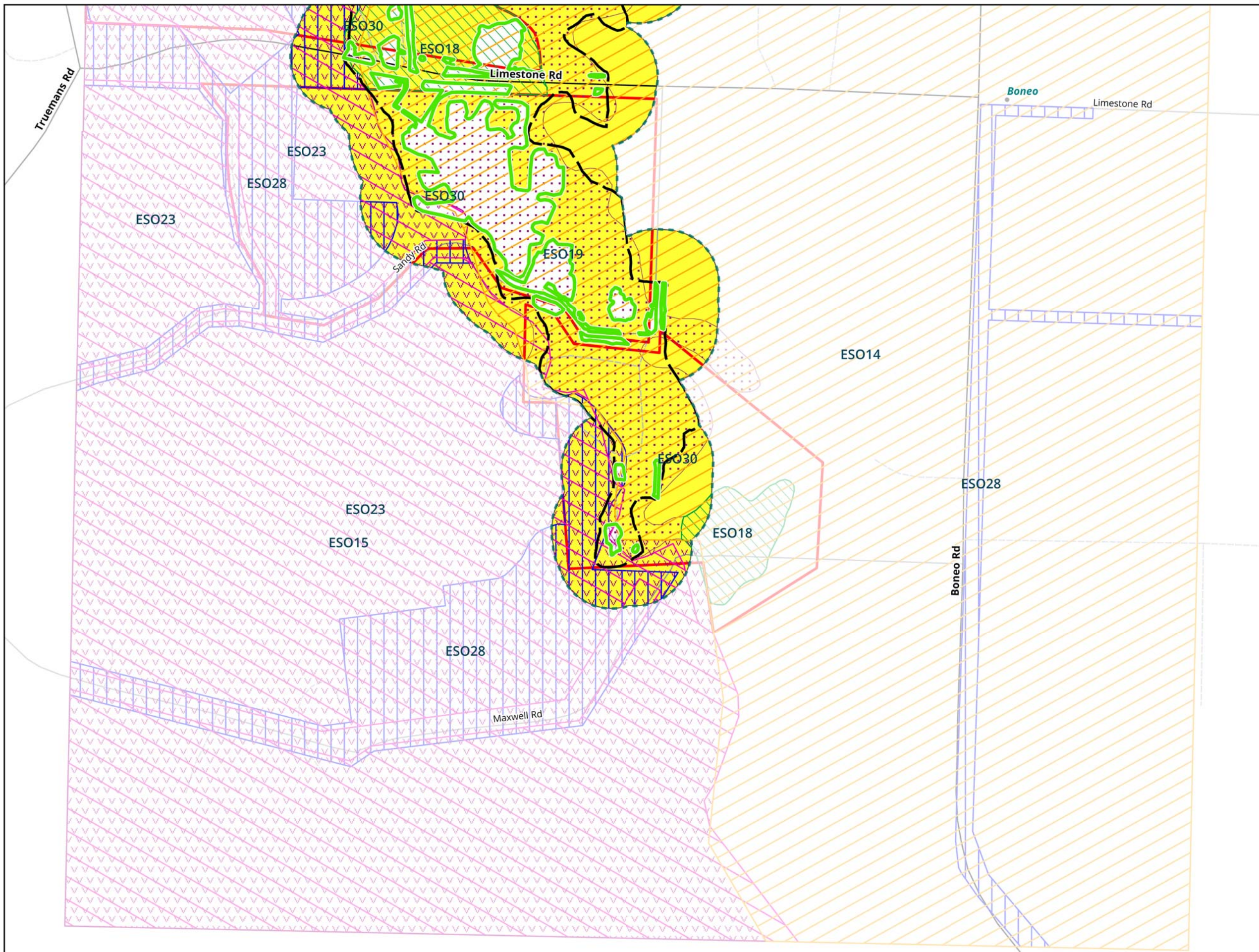
- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Environmental Significance Overlays
- ESO14
  - ESO15
  - ESO18
  - ESO19
  - ESO23
  - ESO28
  - ESO30

**Map 2.1f: Environmental Significance Overlays, Tootgarook Wetland**



Acknowledgements: State Government of Victoria - VicMap - Nearmap

Layout: Map 2.1  
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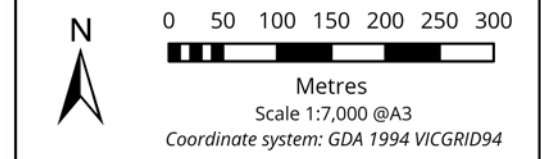
**Legend**

- Original Wetland Extent
- Current Wetland Extent
- Proposed ESO
- Buffer zone

Environmental Significance Overlays

- ESO14
- ESO15
- ESO18
- ESO19
- ESO23
- ESO28
- ESO30

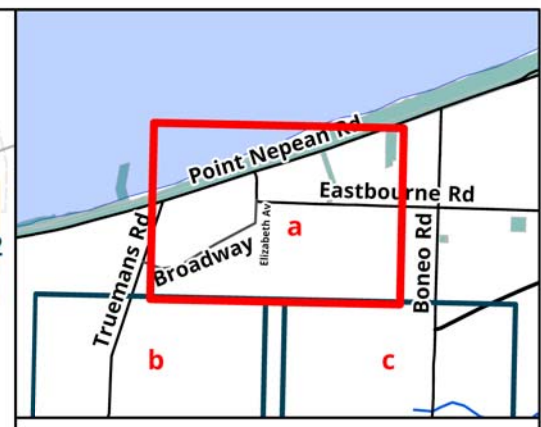
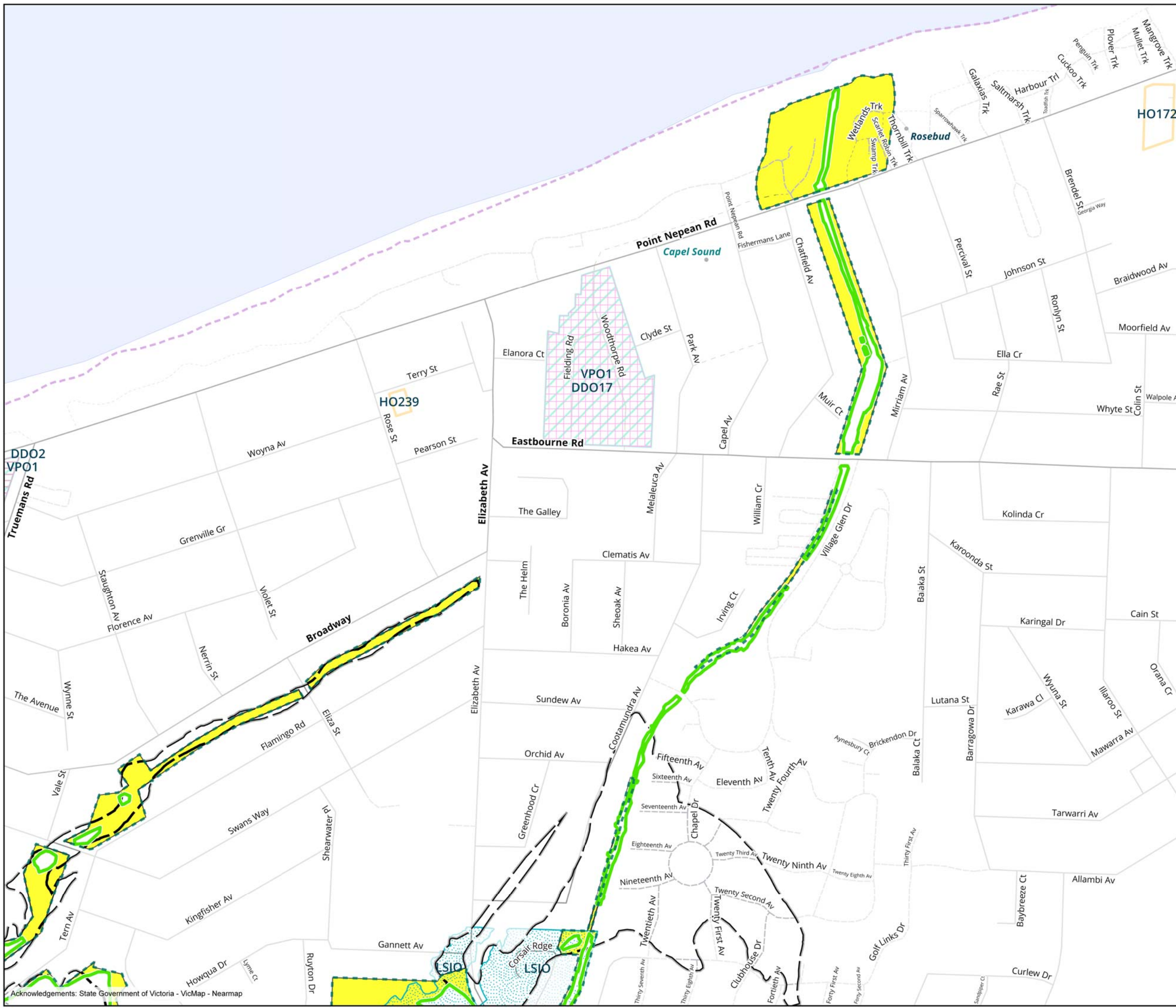
**Map 2.1g: Environmental Significance Overlays, Tootgarook Wetland**



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## Map 2.2 Other planning overlays, Tootgarook Wetland

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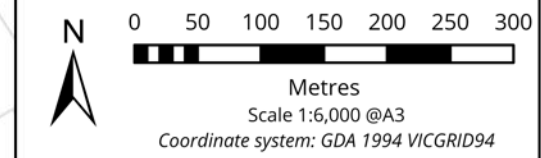
**Legend**

- Original Wetland Extent
- Current Wetland Extent
- Proposed ESO
- Buffer zone

Planning overlays

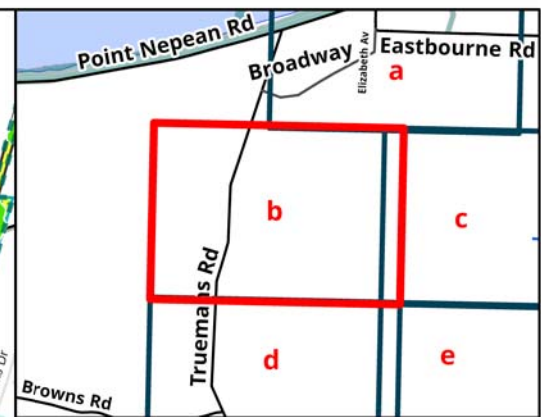
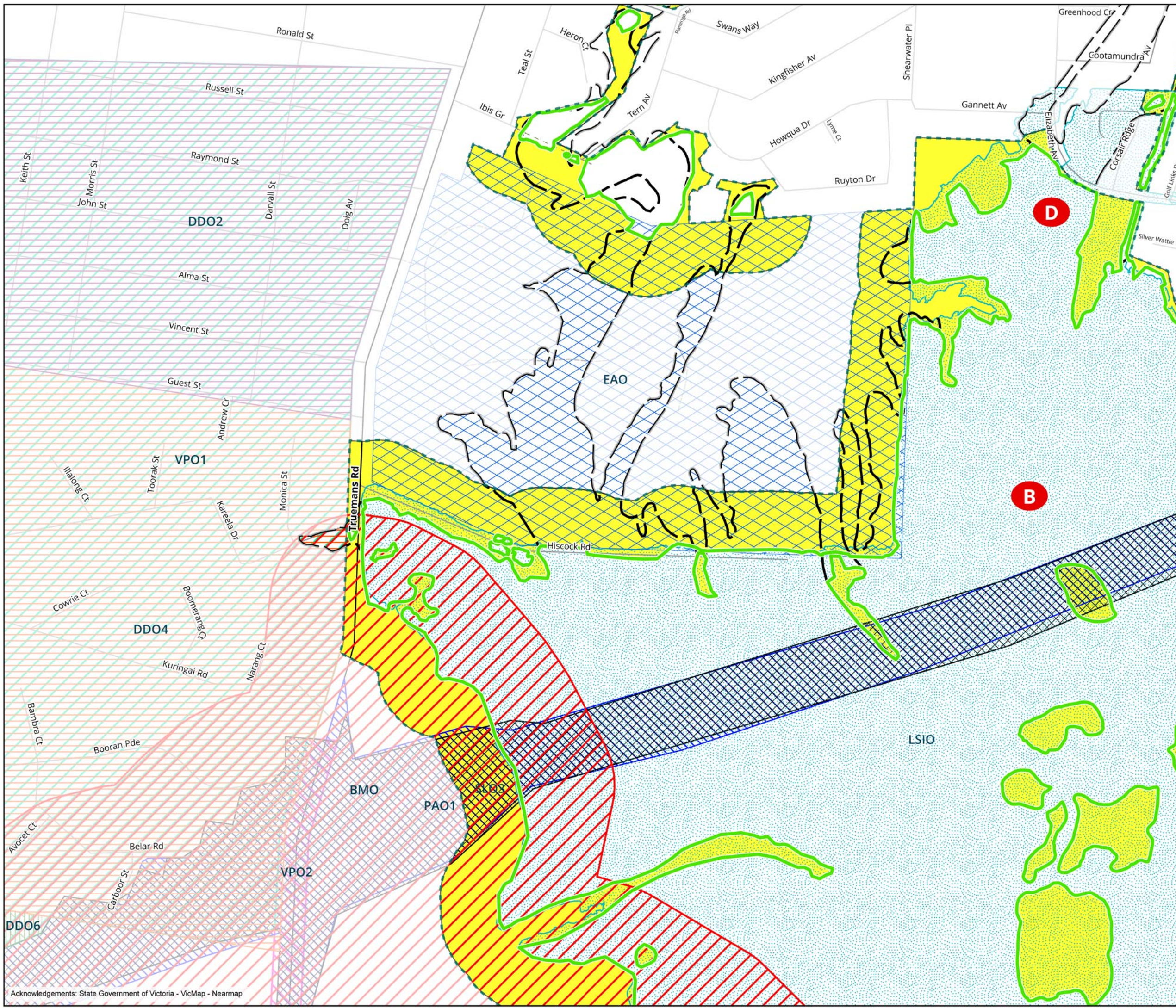
- DDO17
- DDO2
- HO
- LSIO
- VPO1

**Map 2.2a: Other Planning overlays, Tootgarook Wetland**



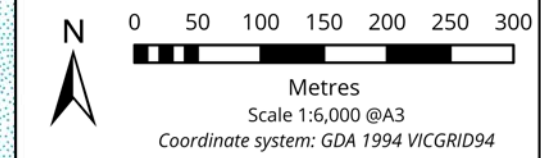
Acknowledgements: State Government of Victoria - VicMap - Nearmap

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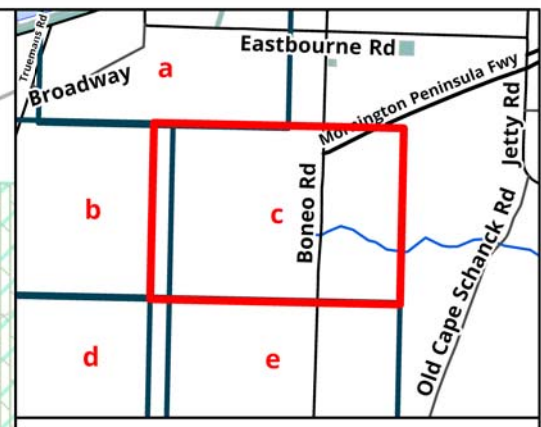
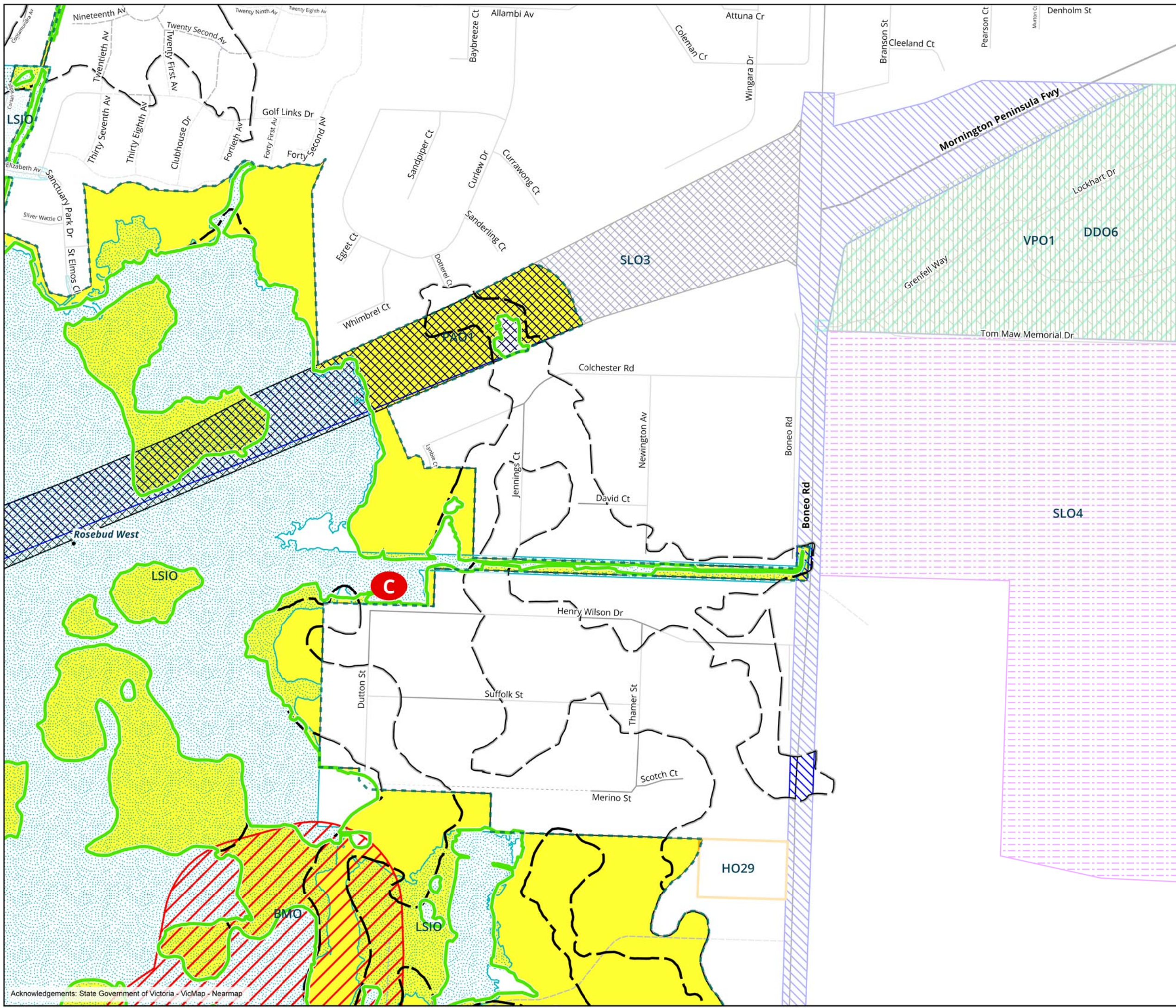
- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Planning overlays
- BMO
  - DDO2
  - DDO4
  - DDO6
  - EAO
  - LSIO
  - PAO1
  - SLO3
  - VPO1
  - VPO2

**Map 2.2b: Other Planning overlays, Tootgarook Wetland**



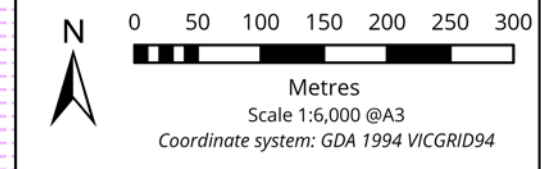
Acknowledgements: State Government of Victoria - VicMap - Nearmap

Layout: Map 2.2  
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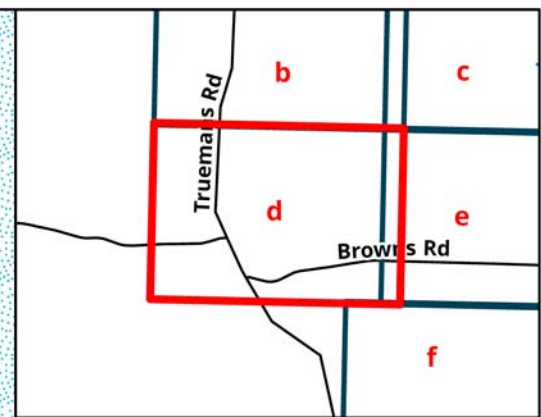
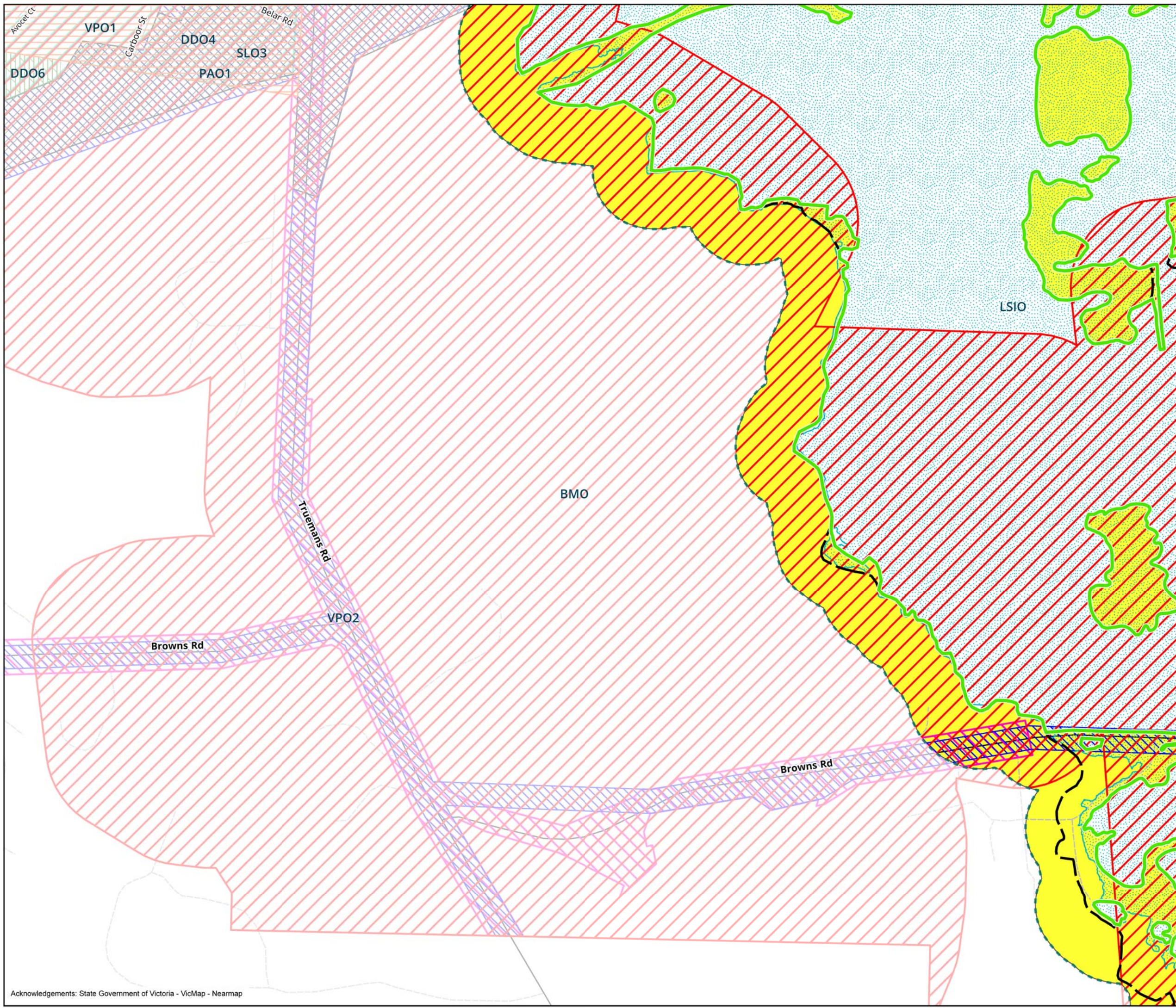
- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Planning overlays
- BMO
  - DDO6
  - HO
  - LSIO
  - SLO3
  - SLO4
  - VPO1

**Map 2.2c: Other Planning overlays, Tootgarook Wetland**



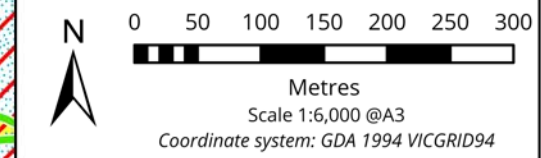
Acknowledgements: State Government of Victoria - VicMap - Nearmap

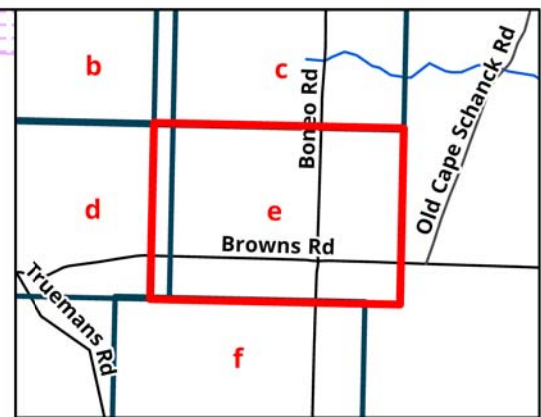
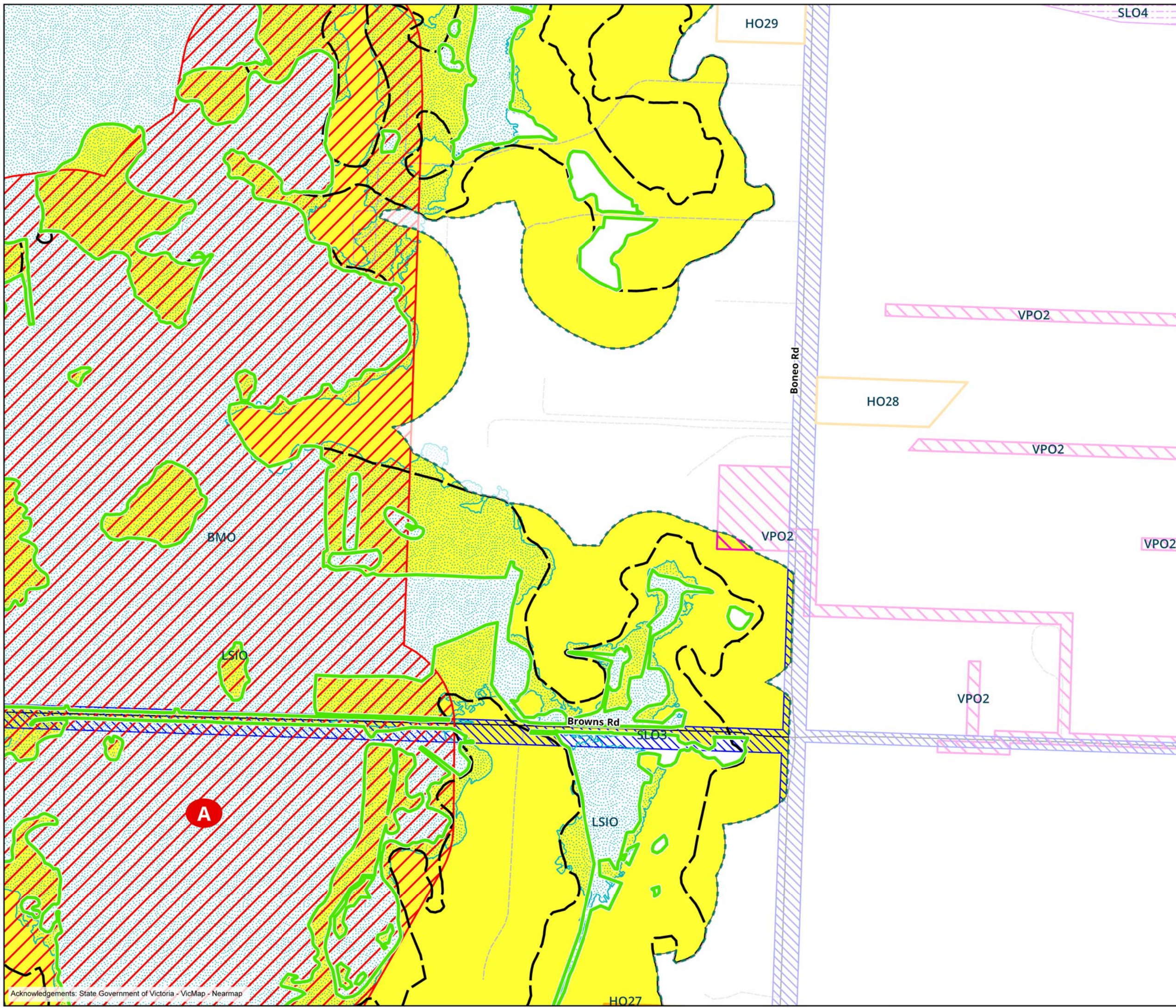
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 Checked by: [Consultant], Drawn by: [GIS], Last edited by: skumar  
 Location: P:\28400s\28411\Mapping\28411\_Project\28411\_Project.aprx



- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Planning overlays
- BMO
  - DDO4
  - DDO6
  - LSIO
  - PAO1
  - SLO3
  - VPO1
  - VPO2

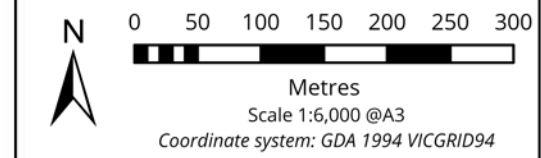
**Map 2.2d: Other Planning overlays, Tootgarook Wetland**





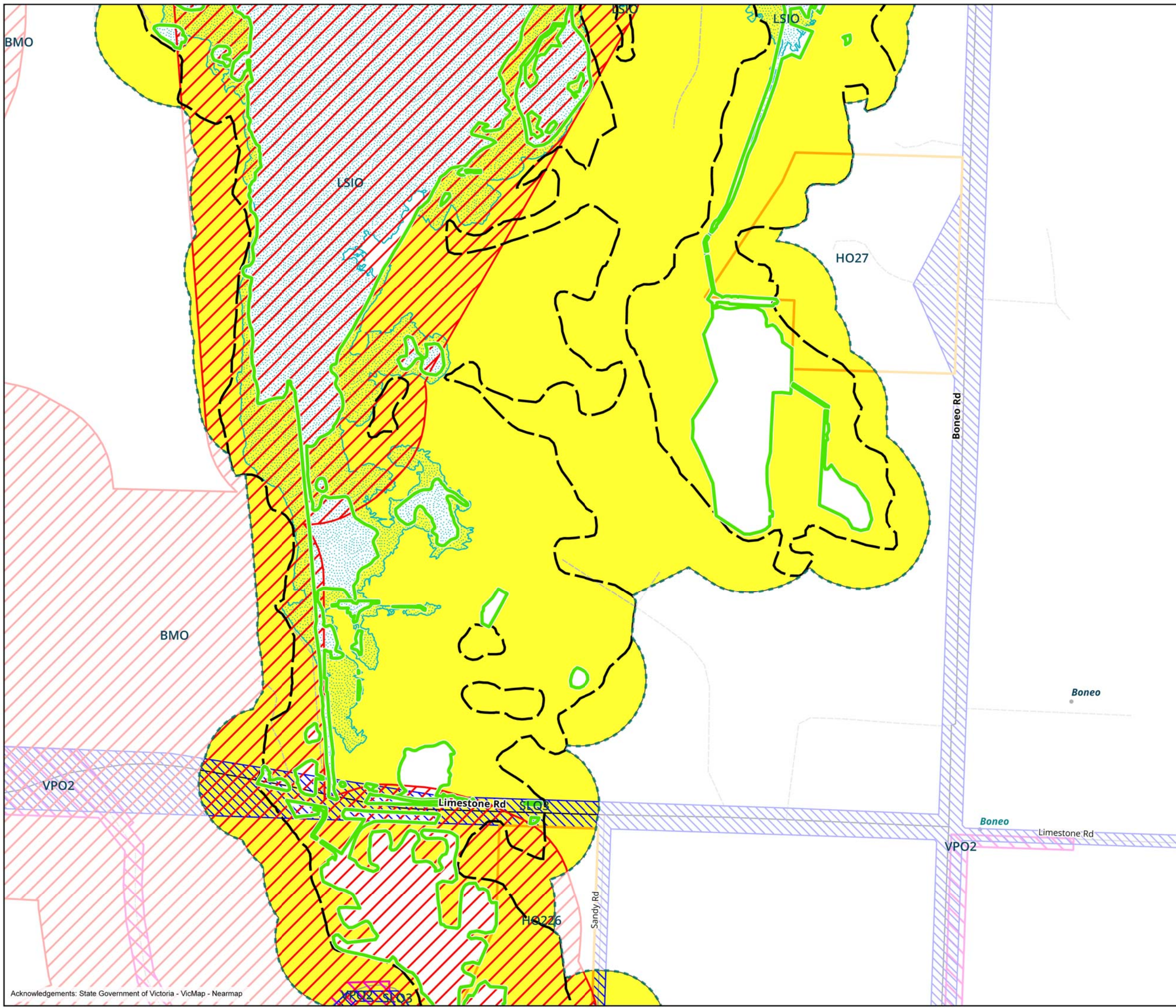
- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Planning overlays
- BMO
  - HO
  - LSIO
  - SLO3
  - SLO4
  - VPO2

**Map 2.2e: Other Planning overlays, Tootgarook Wetland**



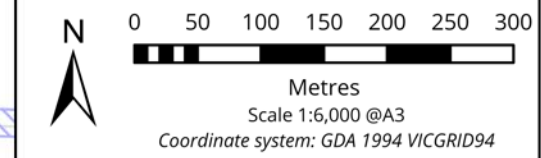
Acknowledgements: State Government of Victoria - VicMap - Nearmap

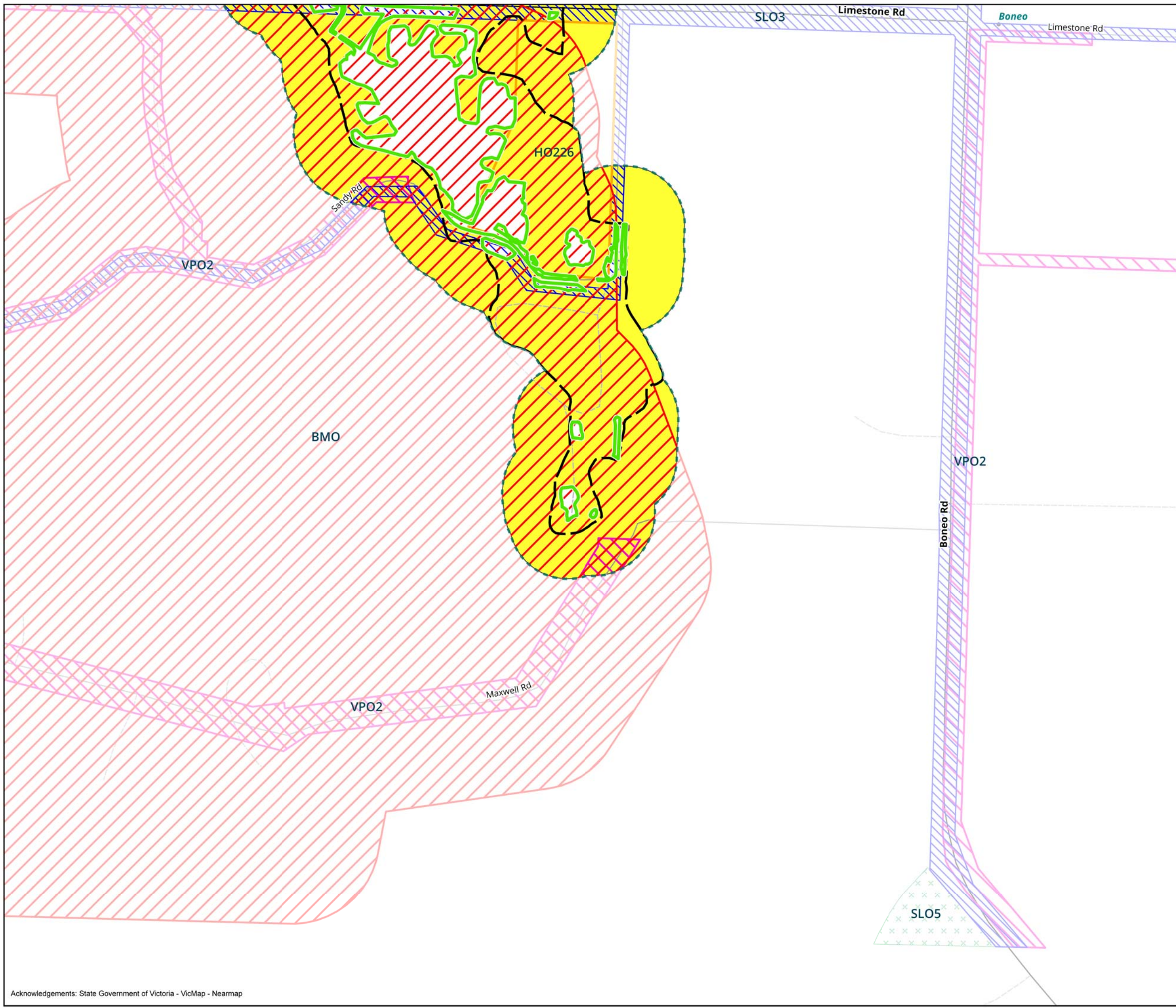
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- Legend**
- Original Wetland Extent
  - Current Wetland Extent
  - Proposed ESO
  - Buffer zone
- Planning overlays
- BMO
  - HO
  - LSIO
  - SLO3
  - VPO2

**Map 2.2f: Other Planning overlays, Tootgarook Wetland**





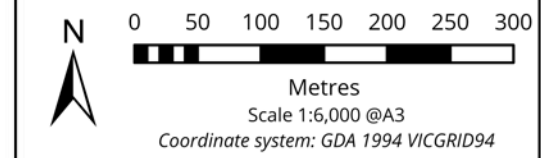
**Legend**

- Original Wetland Extent
- Current Wetland Extent
- Proposed ESO
- Buffer zone

Planning overlays

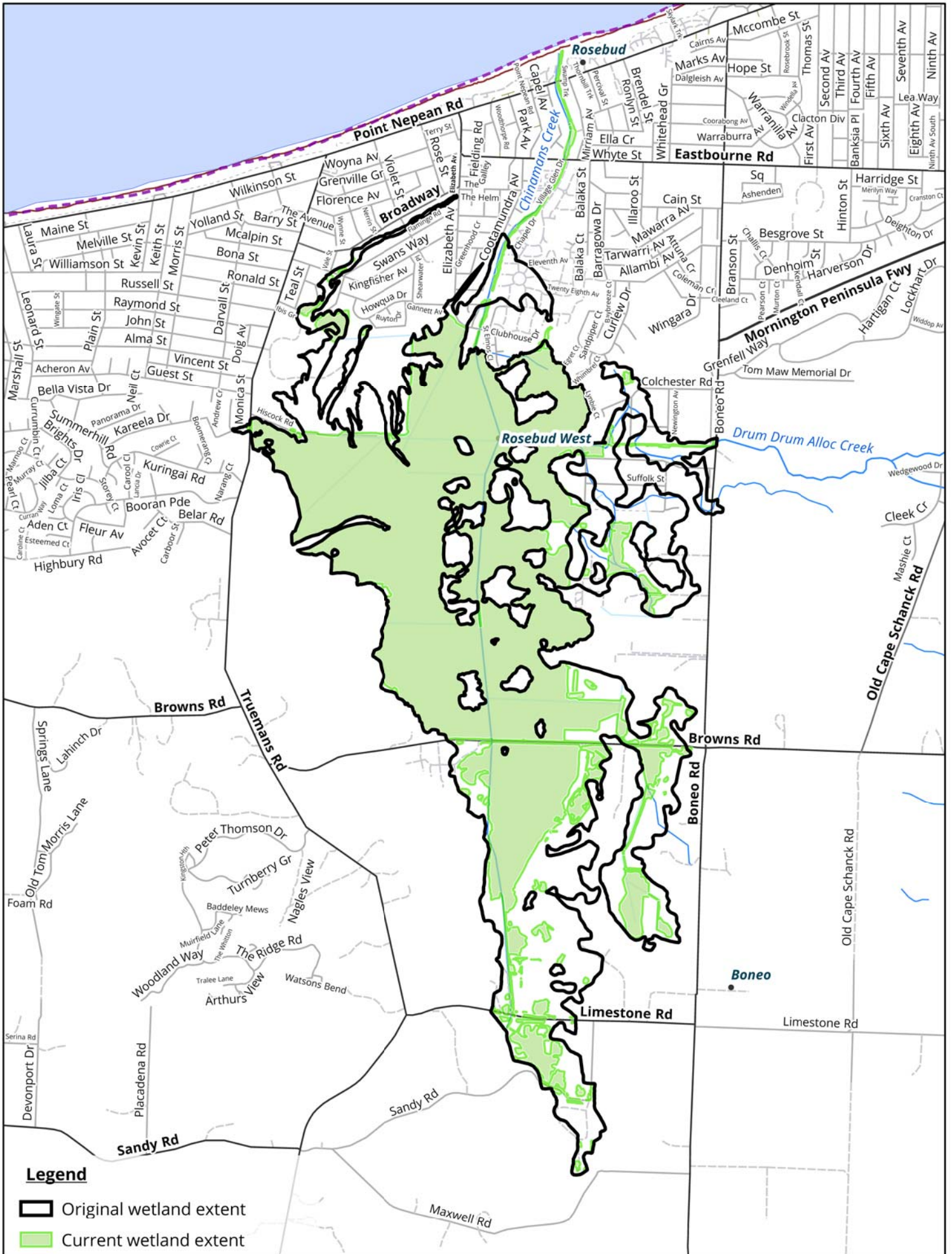
- BMO
- HO
- SLO3
- SLO5
- VPO2

**Map 2.2g: Other Planning overlays, Tootgarook Wetland**



## Map 3. Original and current extent of Tootgarook Wetland – Overview

---



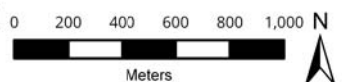
**Legend**

- Original wetland extent
- Current wetland extent

**Map 3: Original and current extent of Tootgarook Wetland**

**- Overview**

Matter: Date exported: 7/05/2019 6:52 PM  
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 Location: P:\28400s\28411\Mapping\28411\_Project.aprx  
 Acknowledgements: Vicmap ©State of Victoria, Nearmap



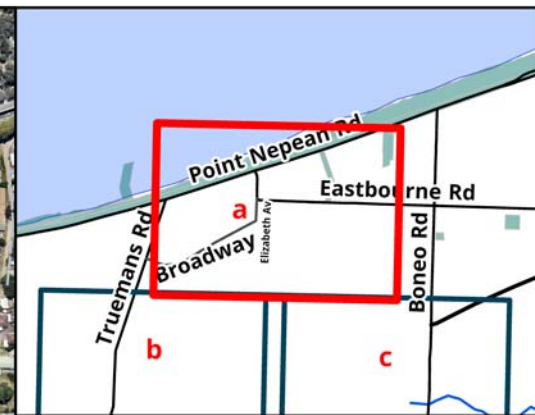
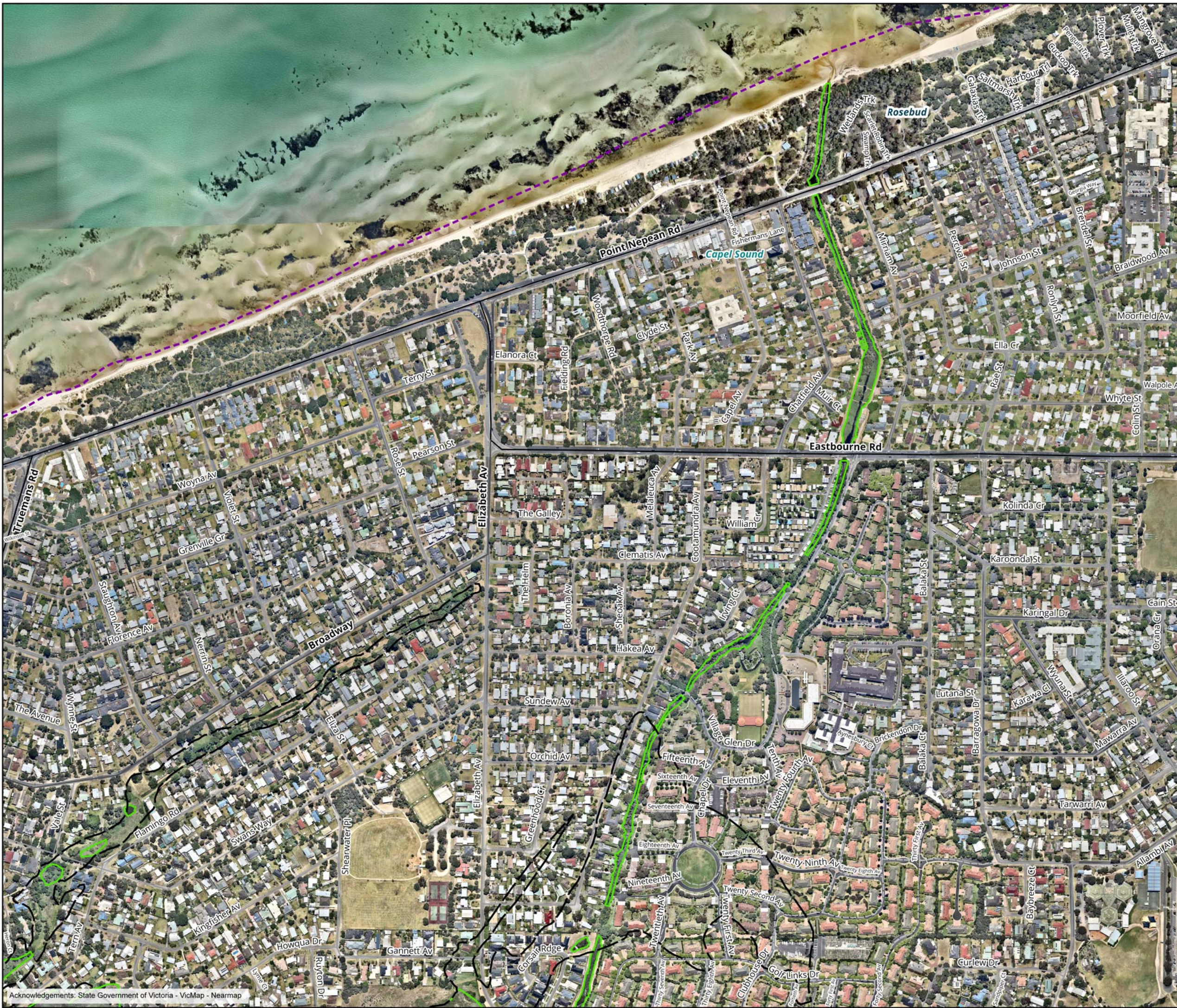
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 Scale 1:28,000 @A4  
 Coordinate system: GDA 1994 VICGRID94



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## Map 4. Original and current extent of Tootgarook Wetland – Detail

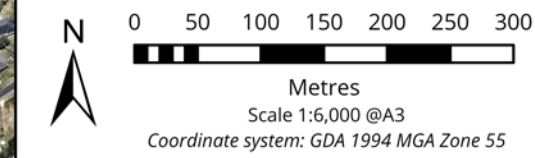
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**Legend**

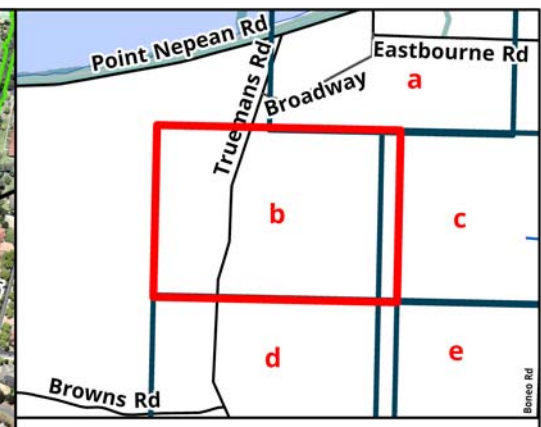
- Original wetland extent
- Current wetland extent

**Map 4a: Original and current extent of Tootgarook Wetland - Detail**



Acknowledgements: State Government of Victoria - VicMap - Nearmap

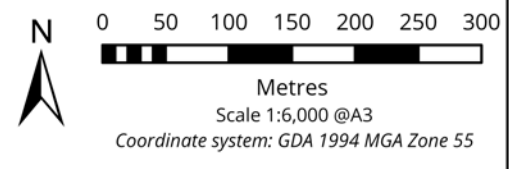
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**Legend**

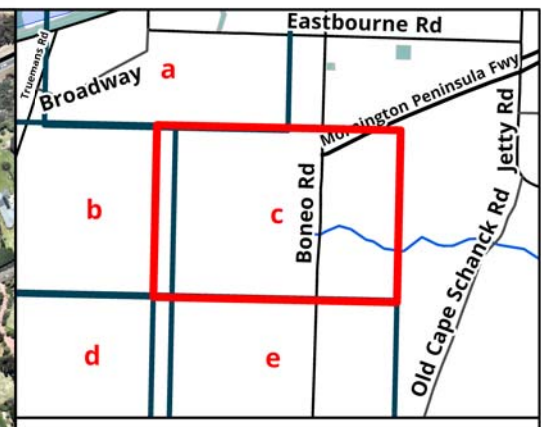
- Original wetland extent
- Current wetland extent

**Map 4b: Original and current extent of Tootgarook Wetland - Detail**



Acknowledgements: State Government of Victoria - VicMap - Nearmap

Layout: Map 4  
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 Checked by: Drawn by: Last edited by: skumar  
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**Legend**

- Original wetland extent
- Current wetland extent

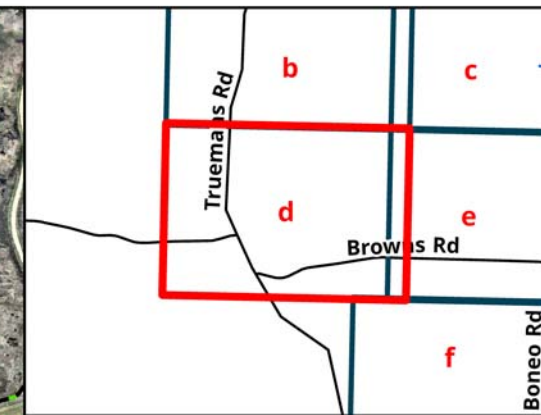
**Map 4c: Original and current extent of Tootgarook Wetland - Detail**

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 Metres  
 Scale 1:6,000 @A3  
 Coordinate system: GDA 1994 MGA Zone 55



Acknowledgements: State Government of Victoria - VicMap - Nearmap

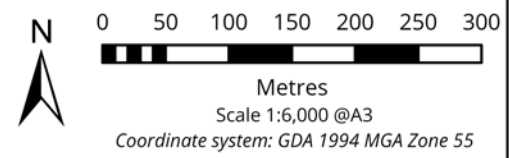
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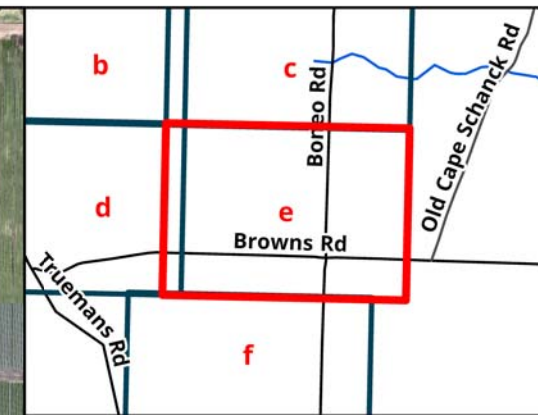


**Legend**

- Original wetland extent
- Current wetland extent

**Map 4d: Original and current extent of Tootgarook Wetland - Detail**

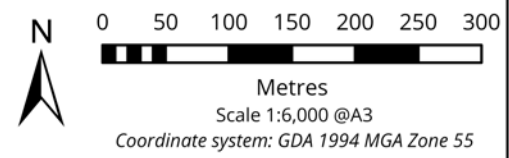




**Legend**

- Original wetland extent
- Current wetland extent

**Map 4e: Original and current extent of Tootgarook Wetland - Detail**

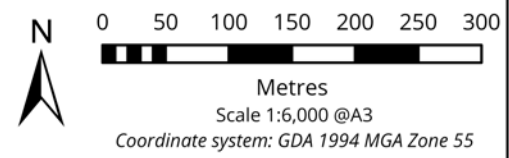






**Legend**

- Original wetland extent
- Current wetland extent

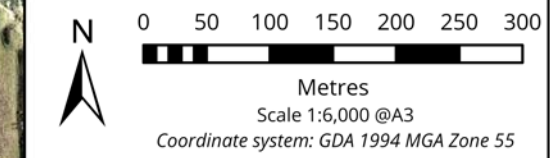
**Map 4f: Original and current extent of Tootgarook Wetland - Detail**





- Legend**
-  Original wetland extent
  -  Current wetland extent

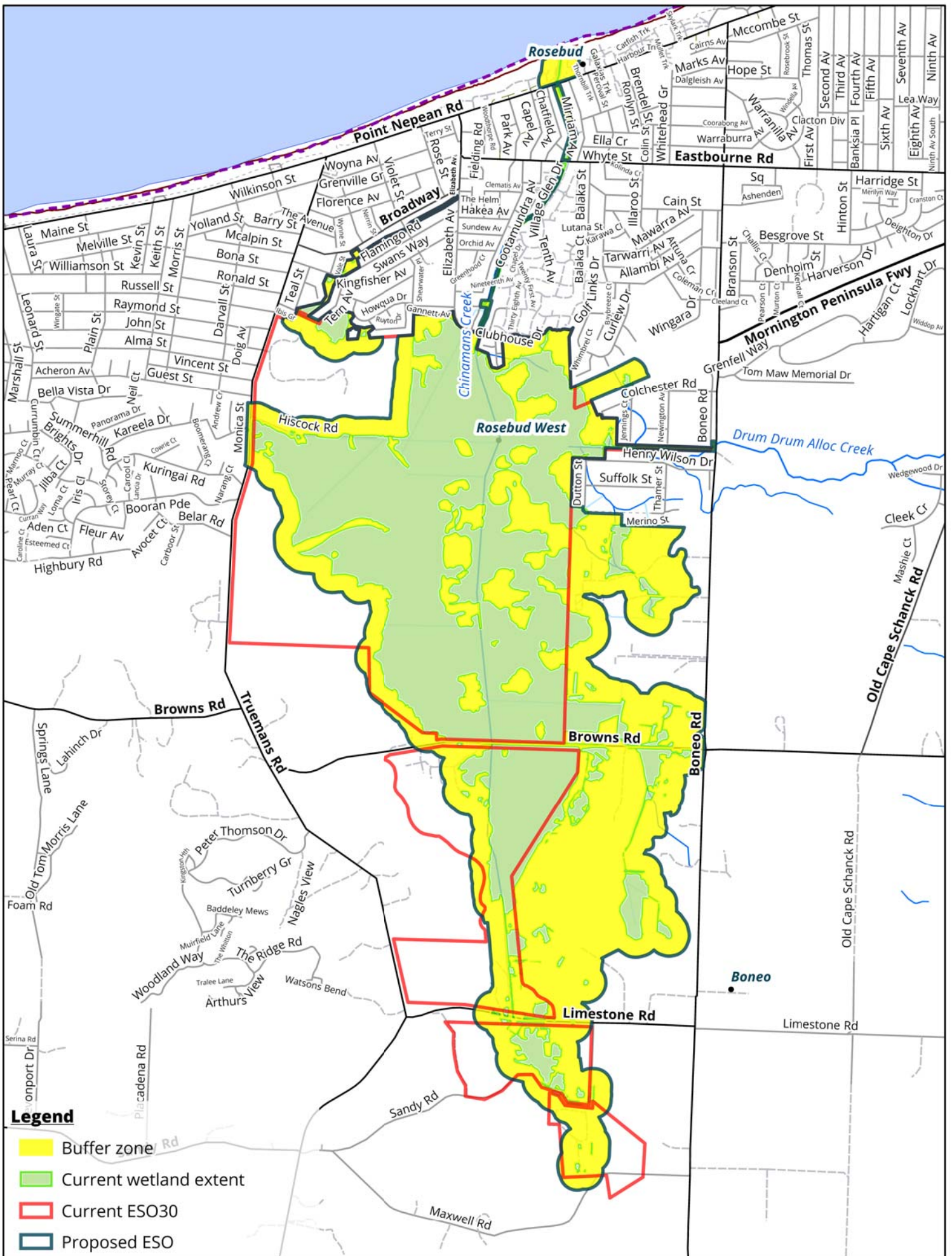
**Map 4g: Original and current extent of Tootgarook Wetland - Detail**



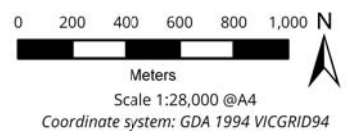
## Map 5. Current extent of Tootgarook Wetland, buffer zone and proposed ESO

### – Overview

---



**Map 5: Current extent of Tootgarook Wetland, buffer zone and proposed ESO - Overview**

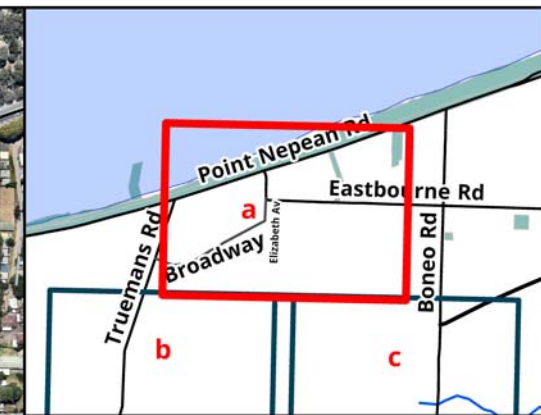


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 Location: P:\28400s\28411\Mapping\28411\_Project\28411\_Project.aprx  
 Acknowledgements: Vicmap ©State of Victoria, Nearmap

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**Map 6. Current extent of Tootgarook Wetland,  
buffer zone and proposed ESO  
– Detail**

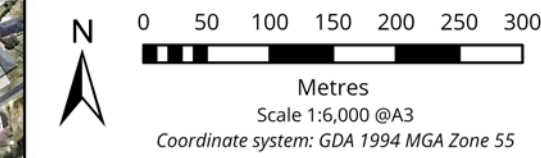
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**Legend**

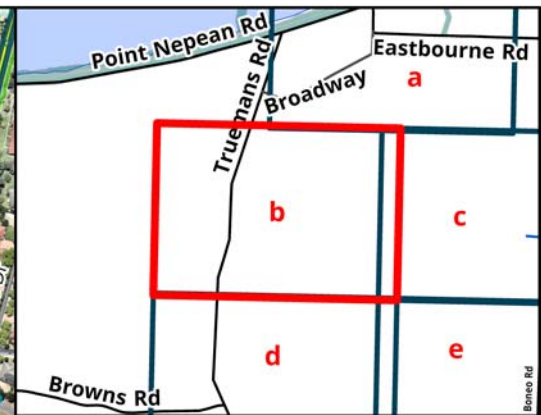
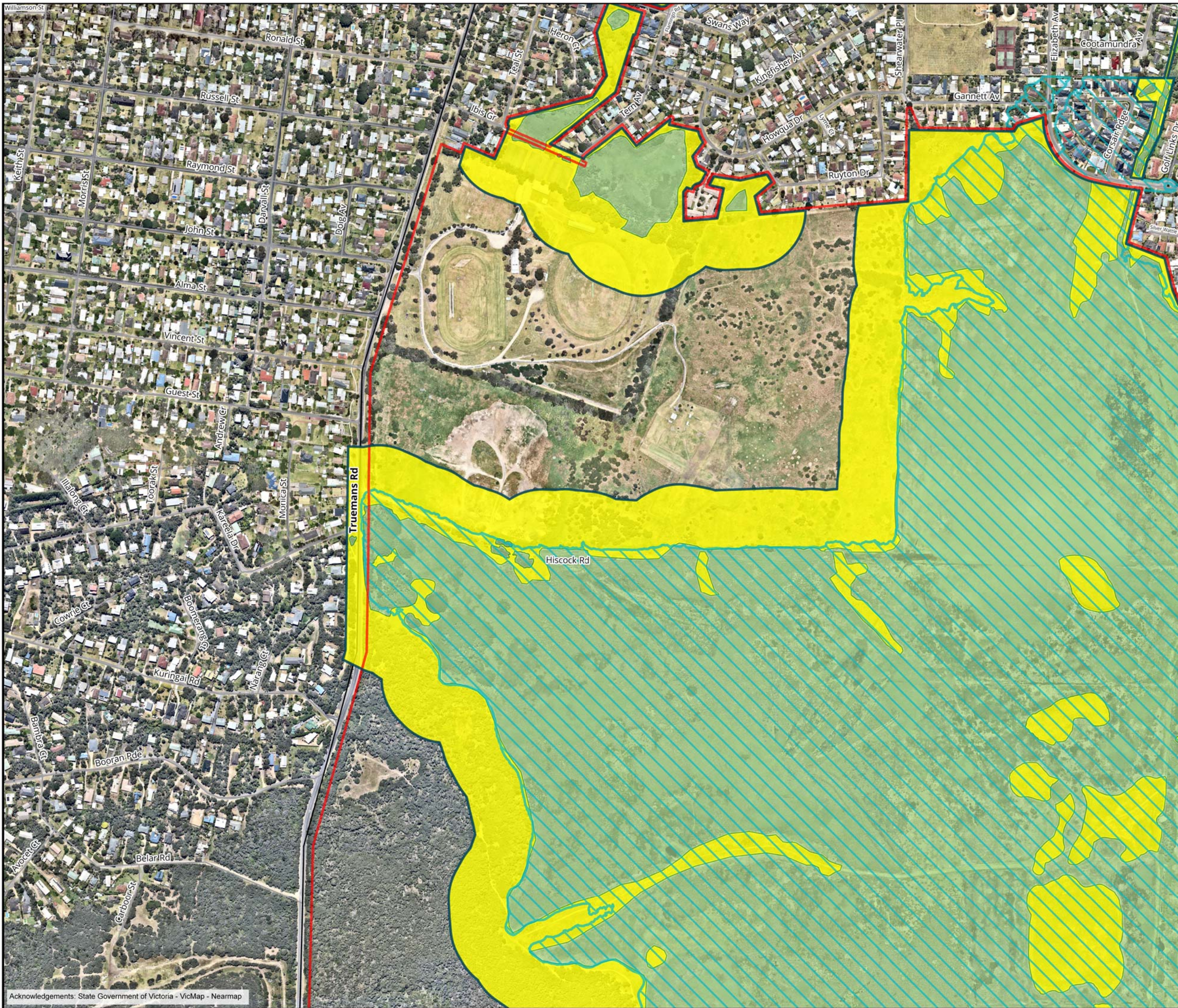
- Current ESO30
- LSIO
- Buffer zone
- Current wetland extent
- Proposed ESO

**Map 6a: Current extent of Tootgarook Wetland, buffer zone and proposed ESO - Detail**



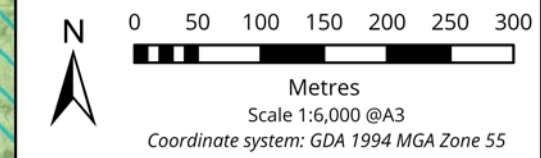
Acknowledgements: State Government of Victoria - VicMap - Nearmap

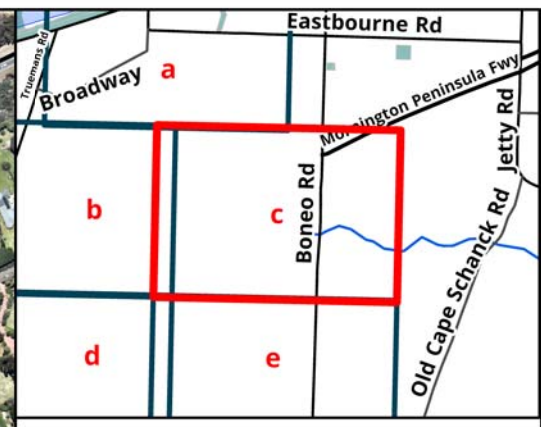
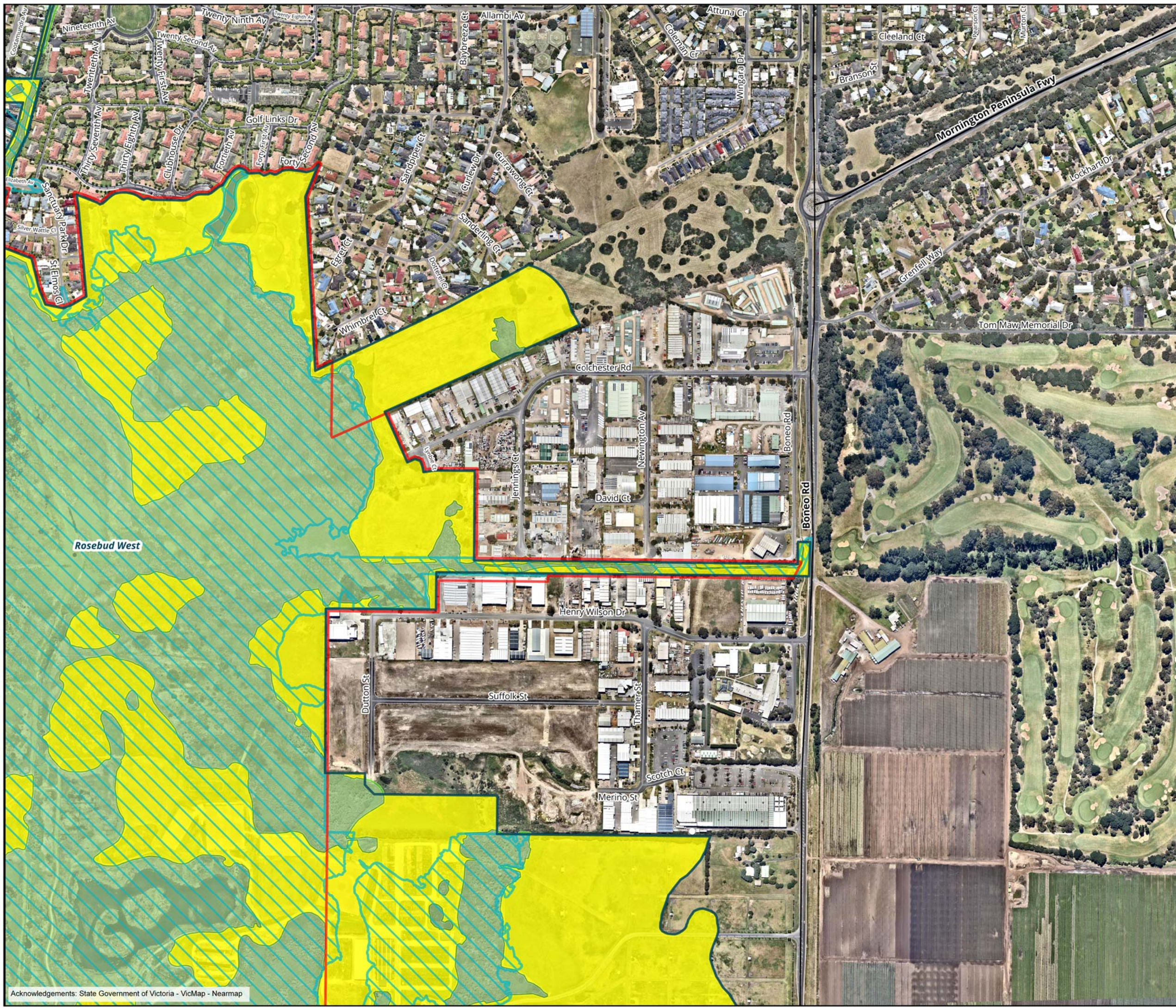
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 Checked by: Drawn by: Last edited by: skumar  
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- Legend**
- Current ESO30
  - LSIO
  - Buffer zone
  - Current wetland extent
  - Proposed ESO

**Map 6b: Current extent of Tootgarook Wetland, buffer zone and proposed ESO - Detail**



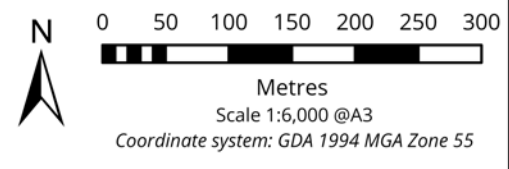


**Legend**

- Current ESO30
- LSIO
- Buffer zone
- Current wetland extent
- Proposed ESO

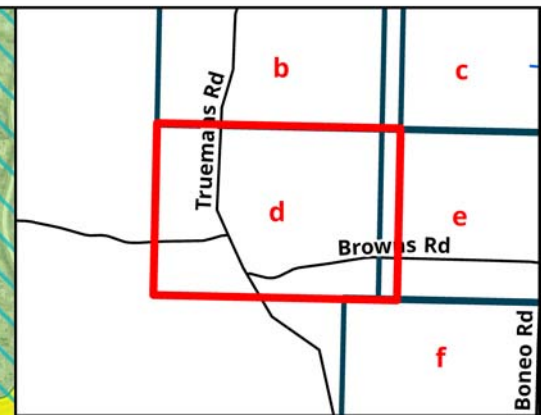
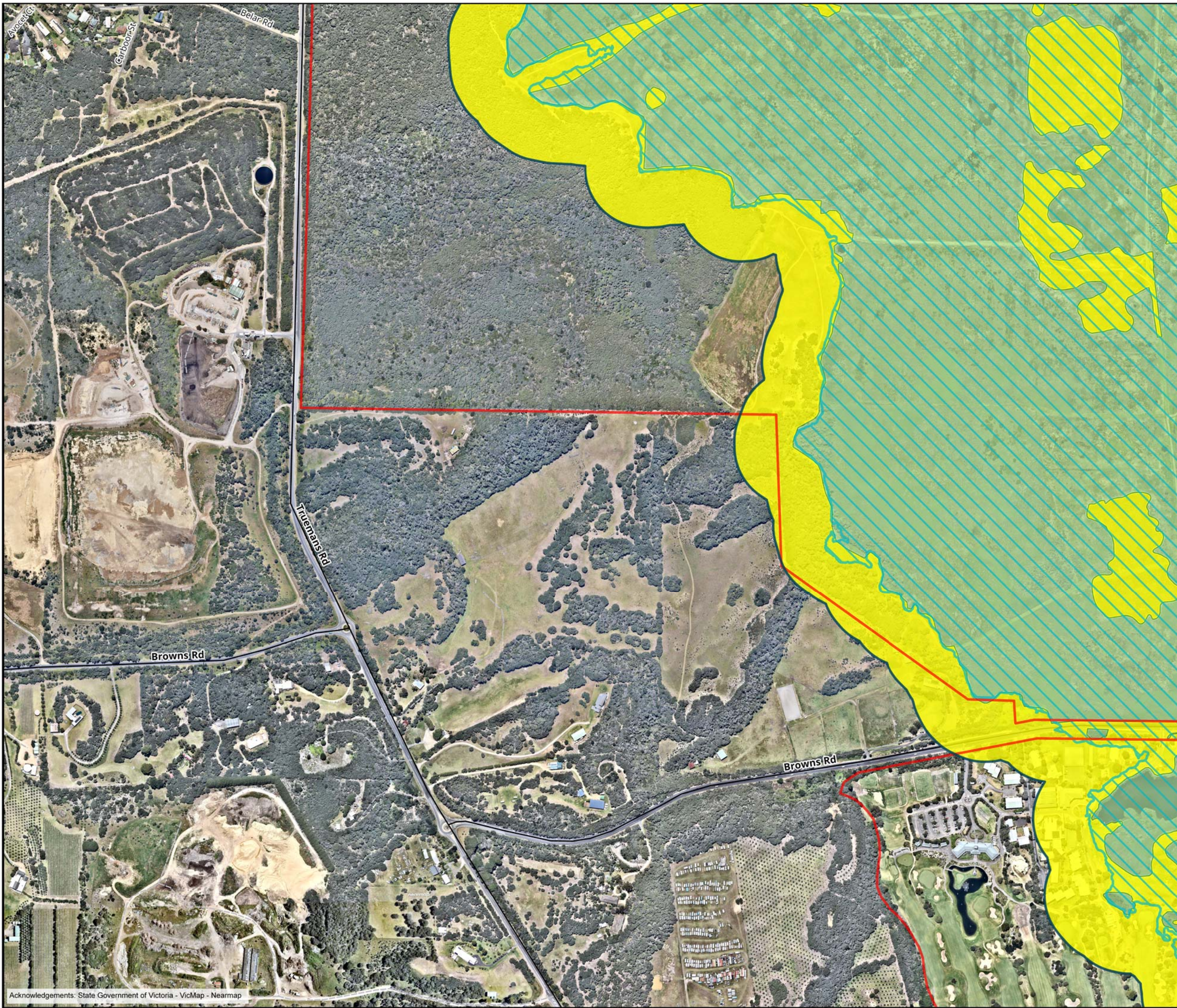
Rosebud West

**Map 6c: Current extent of Tootgarook Wetland, buffer zone and proposed ESO - Detail**



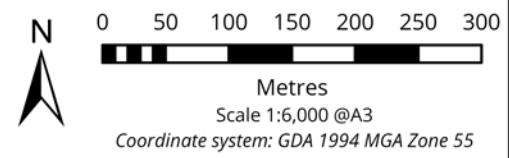
Acknowledgements: State Government of Victoria - VicMap - Nearmap

Layout: Map 6  
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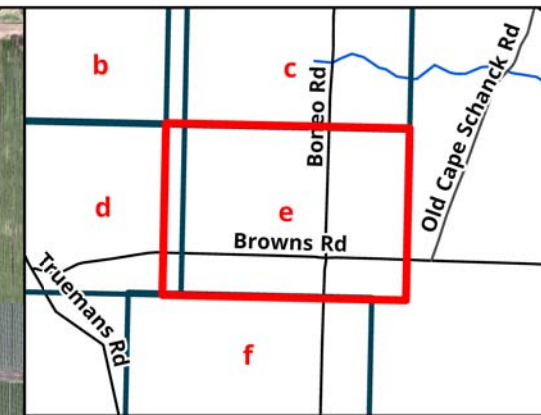
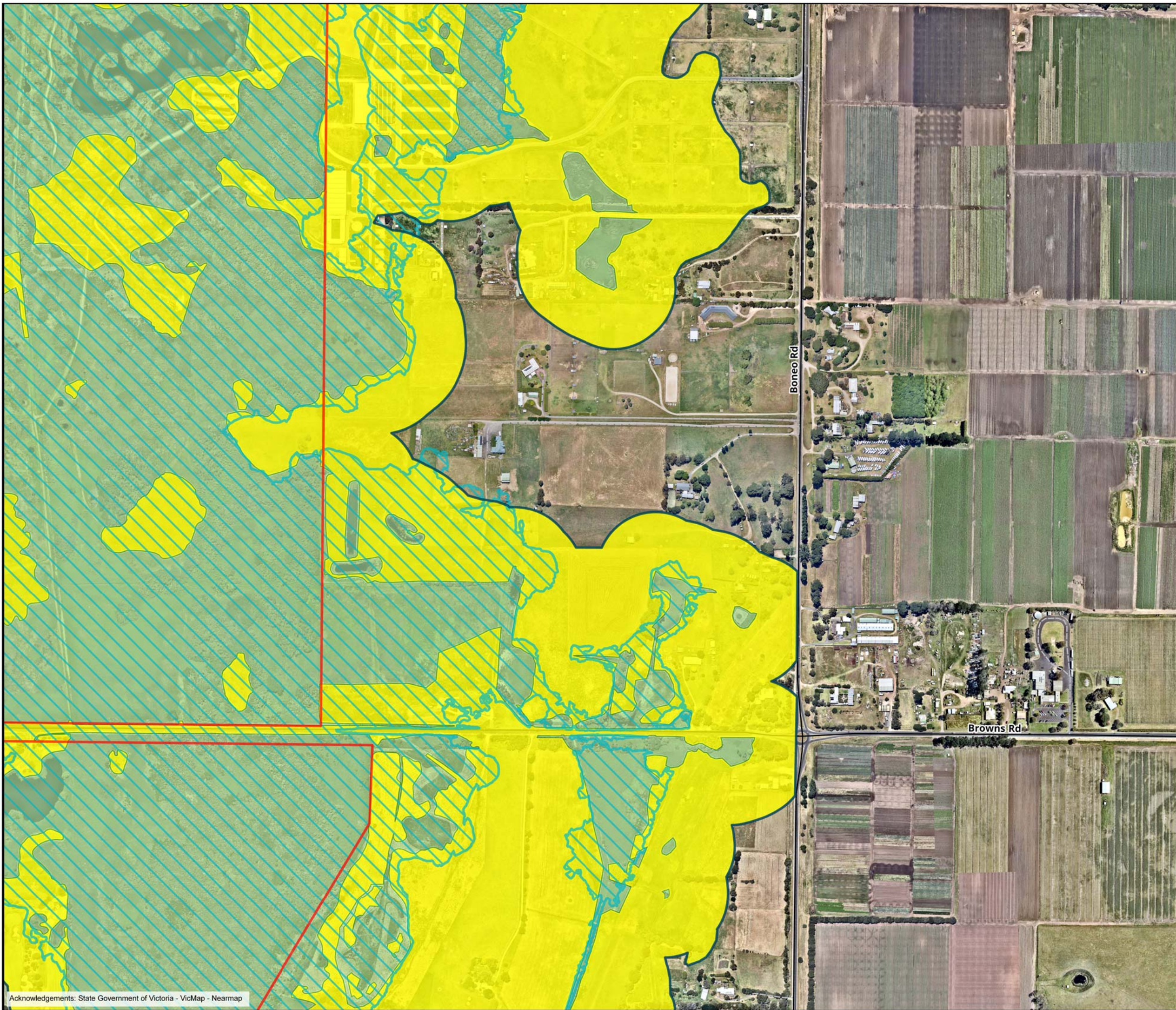
- Legend**
- Current ESO30
  - LSIO
  - Buffer zone
  - Current wetland extent
  - Proposed ESO

**Map 6d: Current extent of Tootgarook Wetland, buffer zone and proposed ESO - Detail**



Acknowledgements: State Government of Victoria - VicMap - Nearmap

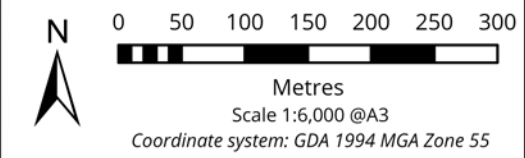
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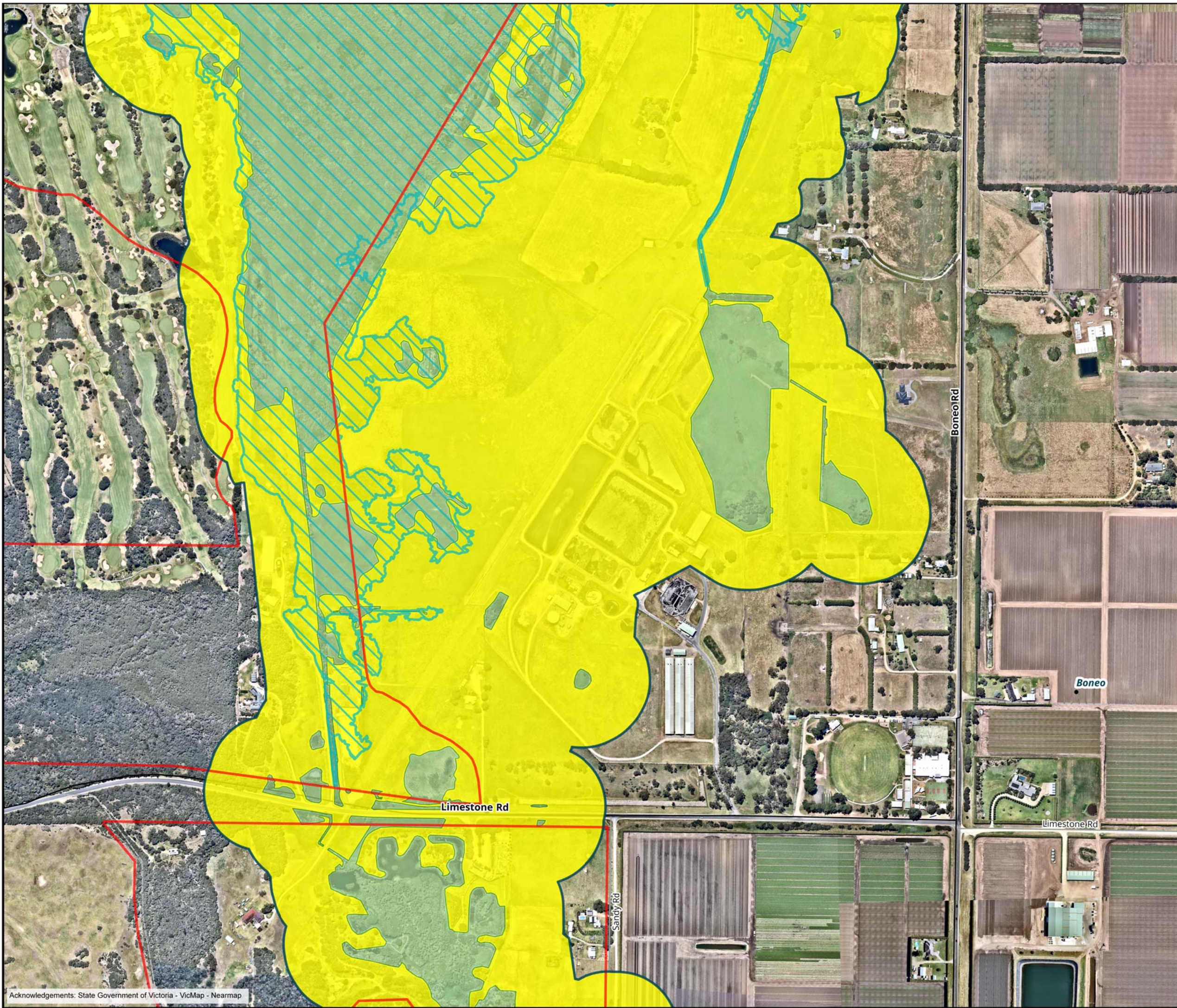


**Legend**

- Current ESO30
- LSIO
- Buffer zone
- Current wetland extent
- Proposed ESO

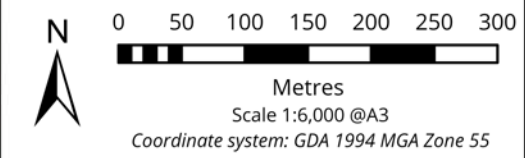
**Map 6e: Current extent of Tootgarook Wetland, buffer zone and proposed ESO - Detail**





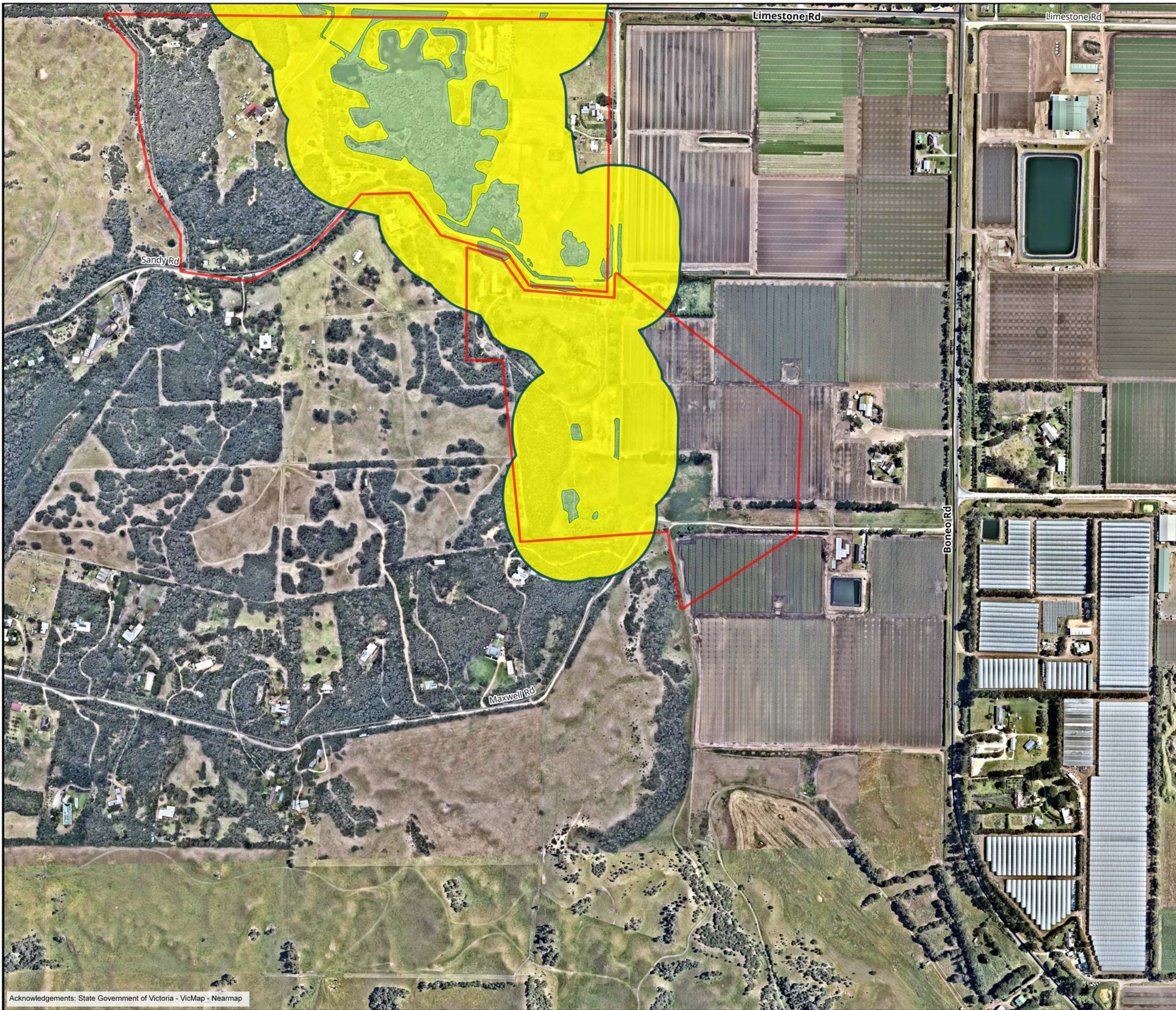
- Legend**
- Current ESO30
  - LSIO
  - Buffer zone
  - Current wetland extent
  - Proposed ESO

**Map 6f: Current extent of Tootgarook Wetland, buffer zone and proposed ESO - Detail**



Acknowledgements: State Government of Victoria - VicMap - Nearmap

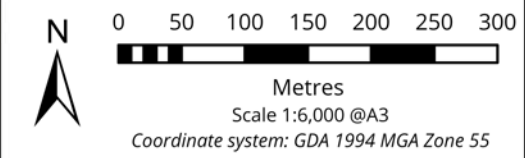
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**Legend**

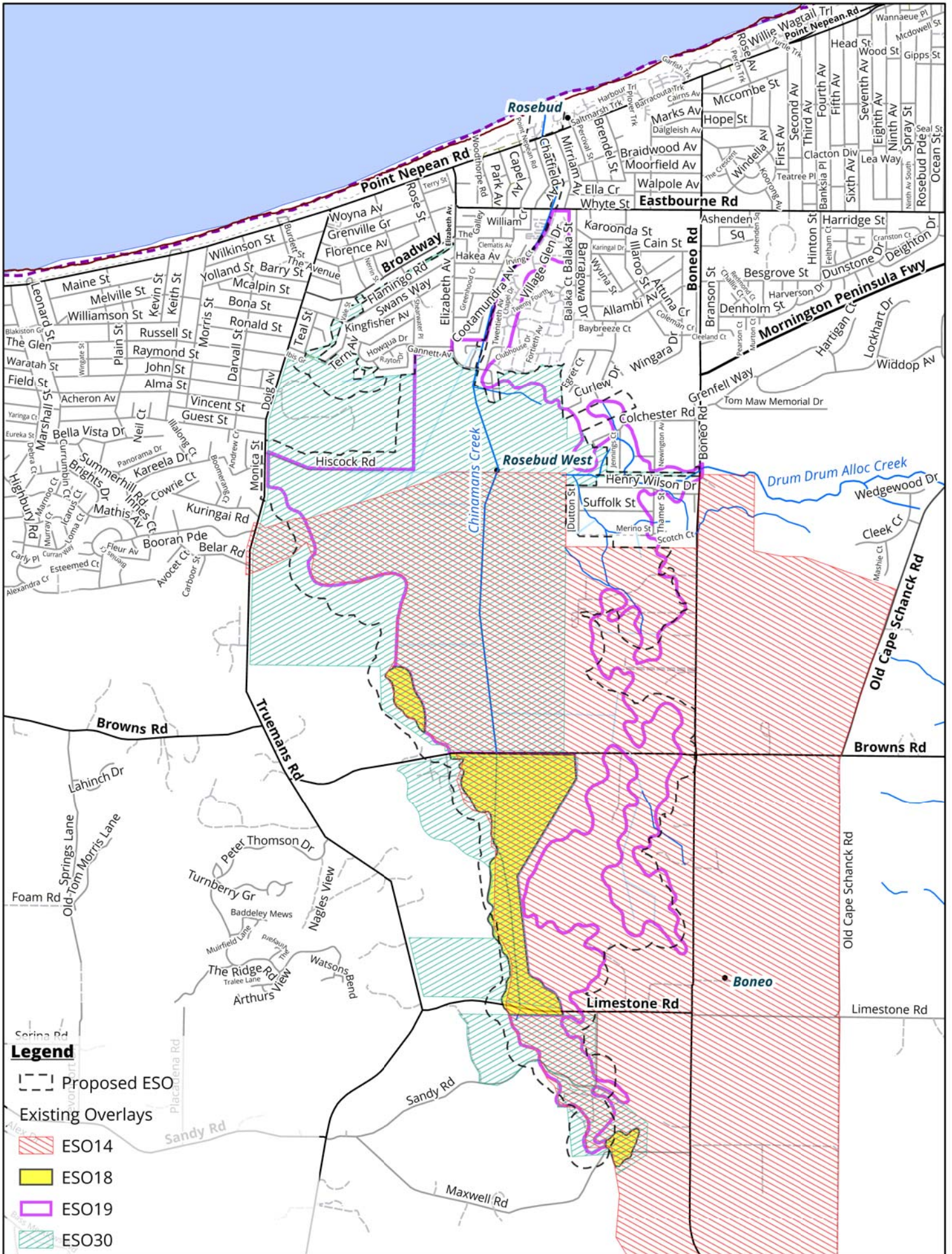
- Current ESO30
- Buffer zone
- Current wetland extent
- Proposed ESO

**Map 6g: Current extent of Tootgarook Wetland, buffer zone and proposed ESO - Detail**



## Map 7. Existing and proposed Environmental Significance Overlays

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**Legend**

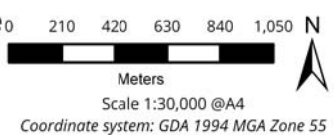
--- Proposed ESO

Existing Overlays

- ESO14
- ESO18
- ESO19
- ESO30

**Map 7: Existing and proposed Environmental Significance Overlays**

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 Location: P:\28400s\28411\Mapping\28411\_Project\28411\_Project.aprx  
 Acknowledgements: Vicmap ©State of Victoria, Nearmap



Scale 1:30,000 @A4  
 Coordinate system: GDA 1994 MGA Zone 55

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## Appendix C. Stakeholder Engagement Outcome Report

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# Extent of Tootgarook Wetland Stakeholder engagement outcome report

Prepared for Mornington Peninsula Shire

8 May 2019

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# 1. Introduction

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Biosis has been commissioned by Mornington Peninsula Shire to:

- Produce an accurate map of Tootgarook Wetland (the wetland).
- Identify ecological threats to the wetland.
- Use that map to review the Environmental Significance Overlay 30 (ESO30) and related controls in the Mornington Peninsula Planning Scheme (Planning Scheme).
- Consult with stakeholders in relation to the map and revised planning controls.

This report summarises the stakeholder's submissions in relation to the Project and responds to matters raised by submitters.

Key matters raised in submissions include:

- Concerns about the accuracy of the map produced and methodology used.
- Concerns in relation to the extent of the buffer around the wetland.
- Implications of the revised planning controls on land use and development opportunities within the mapped areas.

In response to the submissions the following changes have been made:

- Minor revisions to the extent map and commensurate changes to the proposed ESO map.

## 1.1 Stakeholder engagement process

Consultation was undertaken in accordance with the process set out in *Defining the Extent of Tootgarook Wetland: Stakeholders Engagement Plan* (Biosis, 2019a).

### 1.1.1 Purpose of the process

The stakeholder engagement process was aimed to:

- Inform the community of the key issues, risks and threats to the wetland's values and discuss the potential solutions to overcome/prevent the identified problems.
- Provide an opportunity for knowledge sharing and gaining insights from different stakeholders that will contribute to the outcome.
- Build trust between Council and the stakeholders through open, consistent and timely communication of information.
- Demonstrate how the input from stakeholders will be utilised to shape the outcomes of the Project.

### 1.1.2 Key stages in the process

On 23 October 2018 the following agencies were contacted for technical information:

Agency	Comments
<b>Melbourne Water</b>	Response was received on 23, 25 and 29 October including a number of technical documents related to ecology and hydrology.
<b>South East Water</b>	No response has been received.
<b>Southern Rural Water</b>	No response has been received.
<b>DELWP</b>	Response was received on 24 October 2018 including technical background information and a document related to ecology.

Technical information received from the agencies was used to define the extent of the wetland and buffer zone and has been incorporated into the draft *Extent of Tootgarook Wetland, Mornington Peninsula, Victoria* Report (Biosis, 2019b) (the 'Draft Extent Report').

On 19 February 2019 an invitation letter was sent to all affected landowners. A copy of the Draft Extent Report was made available on Council website on the same date (19 February).

On 20 March 2019 three public information sessions were held, providing stakeholders an opportunity to ask questions about the Project. A total of 25 people attended the sessions.

Submitters were invited to make written submission.

A total of 10 submissions were received during the consultation period which closed on 5 April 2019.

## 1.2 Summary of issues raised

During the engagement process several concerns and questions were raised by different stakeholders including landowners, government agencies and non-government organisations. These concerns are grouped into a number of themes and discussed below.

A detailed overview of the submissions and response to each of the issues raised is included in Table 1.

### 1.2.1 Proposed extent of the wetland

Concerns were raised regarding the accuracy of the map of the wetland, including concerns in relation to the methodology used.

- **Key issue 1 (hydrogeological assessment)**

That there is a hydrogeological disconnection between the land in the south and east of the mapped wetland and more central areas of the wetland.

- Response

Tootgarook Wetland has a descending gradient from south to north with several levels leading to the central area, and is not all at one level like a lake. Swamp Scrub is a wetland ecological vegetation class (*A field guide to Victorian wetland ecological vegetation classes for the index of wetland condition* (DSE 2012) which links the

various levels. It was the dominant vegetation type in the south and east of the mapped wetland although most is now cleared, emphasising the need for protection of the remnants there in the future.

- **Key issue 2 (Boneo Maze and Mini Golf amusement park)**

Inclusion of the Boneo Maze and Mini Golf within the mapped wetland given that they are artificially made tourist attractions.

- Response

From the ecological assessment it was determined that most of the Boneo Maze site supports current wetland, mostly in the form of natural Swamp Scrub with some wetlands excavated into the original wetland surface at the north end. It is noted that the carpark, reception centre, maze and mini golf course are not within the mapped current wetland. Consistent with the approach taken elsewhere around Tootgarook Wetland in the Green Wedge Zone, land within 100 metres of the wetland is proposed to be included within the buffer zone that aims to protect the wetland from the identified ecological threats.

- **Key issue 3 (methodology)**

Recommendation to use an established wetland delineation method such as the Queensland Government system to identify the accurate extent of the wetland.

- Response

The Queensland method is not useful as it states 'The biotic-plants criterion in the wetland definition is met when the abundance of wetland indicator plants in the ecologically dominant layer (EDL) is >50 per cent of the total.' We used 25% as the threshold, in line with DELWP's definition of native vegetation patches. The Queensland method would produce a smaller, undermapped current wetland.

Furthermore the Queensland method states 'Where the EDL is not clear and there is a mixture of wetland and non-wetland plants, quantitative abundance data must be collected. Crown cover should be measured at a plot using the crown intercept method'. With a wetland perimeter of 62 km, this would be extremely time consuming and expensive in relation to the size of wetland, unprecedented at this scale, and also unnecessary. The wetland extent boundary can be determined readily and rapidly by visual cover estimation.

## 1.2.2 Proposed buffer zone

Concerns regarding the extent of the buffer zone in the mapping.

- **Key issue 1 (extent of the buffer zone)**

Extension of the buffer zone over Sandy Road in Fingal, given the existing physical barriers, small sizes and fragmented nature of the remnant vegetation patches in the area.

- Response

The proposed buffer zone has been developed in accordance with ecological and hydrogeological investigations. The buffer zone comprises the following three categories:

- Original wetland outside patches of current wetland (as identified in the Draft Extent Report) because:
  - (a) The current wetland receives water directly from the original wetland area due to local topography controlling surface and groundwater flow, making it highly sensitive to this immediate catchment,
  - (b) The current wetland is likely to share some shallow aquifer perching with the original wetland due the clay-rich aquitard swamp deposit, making the current wetland highly sensitive to disturbance in this area such as deep excavations rupturing the aquitard or pollution events,

- (c) The larger herbaceous and woody native wetland flora, such as Common Reed *Phragmites australis*, Swamp Paperbark *Melaleuca ericifolia* and Woolly Tea-tree *Leptospermum lanigerum*, can still grow in this area, unlike on the dry land immediately beyond the original extent where they never grew,
  - (d) The original wetland has cultural and historical links with the current wetland.
- Islands and peninsulas within the current wetland because:
    - (a) The islands and peninsulas form a complex mosaic with the wetland and are likely to shelter fauna during flood events, making them integral to the wetland ecological complex,
    - (b) Many of the islands and peninsulas support highly significant native grassland vegetation,
    - (c) The islands and peninsulas are integral to the landscape character of the wetland.
  - Areas within 100 metres of a current wetland because:
    - (a) Based on literature review, this a minimum width and less than some recommendations,
    - (b) Wetland birds can be highly sensitive to humans and domestic animals visible within 100 metres,
    - (c) The buffer zone provides protection for wildlife accessing the Wetland,
    - (d) Groundwater within the buffer zone flows towards the wetland regardless of surface topography,
    - (e) The wetland is highly sensitive to change in landscape character within 100 metres, even if a building base level is behind a gentle ridge the building may be visible.

The remoteness, small sizes and fragmented nature of the remnant vegetation patches at the southern end of the buffer zone (south side of Sandy Road) indicates an increased need for protection of the wetland in this area.

Physical barriers (including roads) do not necessarily play the role of a buffer zone for the purpose of wetland protection. Roads and fences do not mitigate against all impacts potentially arising from within or beyond the buffer zone, on the contrary they are impacts in themselves with disturbing wildlife and fences impeding wildlife movement and therefore these barriers do not substitute for a buffer zone.

### 1.2.3 Proposed Environmental Significance Overlay (ESO)

Concerns were raised regarding the potential implications of the proposed ESO on the existing land uses (particularly agricultural activities).

- **Key issue 1 (existing uses)**

Potential prohibition of the existing permitted uses following the approval of the proposed ESO.

- Response

The ESO does not contain any restrictions for existing lawful development and uses. It only applies if new development is proposed. The proposed ESO intends to protect the wetland and buffer zone against the ecological threats that were identified in the Draft Extent Report.

Provisions of the proposed ESO (including permit requirements) aim to prevent the future inappropriate developments from adverse impacts on the wetland. This will be implemented through permit requirements for new application (for buildings, works and native vegetation removal) as well as the decision guidelines in the proposed ESO.

- **Key issue 2 (protection under the existing covenant)**

Unnecessary inclusion of the land covered under the existing Trust for Nature covenants within the proposed ESO since the covenants provide enough protection for the wetland.

- Response

The proposed ESO intends to provide appropriate protection for the wetland and buffer zone against the identified threats in the Draft Extent Report via the planning system. The covenants may provide protection for the wetland outside of the planning system.

The Trust for Nature covenants only apply to three parcels on northern area of the wetland. The geological swamp deposit supporting remnants of wetland vegetation such as Swamp Scrub extends southwards nearly to Maxwell Road.

#### 1.2.4 Other

Some matters have been raised that are not relevant to the scope of this Project.

- **Key issue 1 (Freeway extension)**

Request to retain the existing Public Acquisition Overlay (PAO) for the potential extension of the Mornington Peninsula Freeway through the wetland.

- Response

The Draft Extent Report does not make any recommendation regarding the removal or retention of the existing PAO. The scope of works for this Project is listed below:

- Refine the geographic extent of Wetland
- Identify the (ecological) threats to the wetland
- Review the relevant planning controls (ESO14, ESO18, ESO19 and ESO30)
- Make recommendations on the planning controls and prepare management guidelines (addressing the ecological threats)

If the Mornington Peninsula Freeway proceeds in the future, further assessment of the impacts of those works would be required. At that time the project would be assessed against the relevant planning controls and would be required to comply with all relevant legislative requirements (e.g. *Environment Effects Act 1978*).

- **Key issue 2 (Assessment independency)**

Concerns raised regarding the independent nature of the report outcomes.

- Response

Biosis is an independent organisation and has been commissioned by the Council to define the extent of the wetland, propose a buffer zone and review the current planning controls as relevant to the wetland. This assessment has been undertaken on a scientific basis and independent from Council.

**Table 1 Detailed response to online submissions**

No.	Comment from submitter	Response
<b>Submitter 01 (No property address available)</b>		
1.1	<ul style="list-style-type: none"> <li>Should building an eco-class facing the wetland which would give schools the ability to take focus groups to the wetland, observe, study, and build an appreciation for the area at a young age, any season.</li> </ul>	<ul style="list-style-type: none"> <li>This submission is not considered relevant to the scope of this assessment. Council may consider to implement this idea.</li> </ul>
<b>Submitter 02 (No property address available)</b>		
2.1	<ul style="list-style-type: none"> <li>Potential impacts of a rail bridge that may cross over the wetland in the future (as part of proposed freeway extension?).</li> </ul>	<ul style="list-style-type: none"> <li>This submission is not considered relevant to the scope of this assessment. Any future infrastructure projects would need to be assessed on their own merits at the time they are proposed.</li> </ul>
<b>Submitter 03 (81 Sandy Road, Fingal) – submission received both by Council and Biosis (direct email to Biosis)</b>		
3.1	<ul style="list-style-type: none"> <li>The current physical barriers on south-west edge of the wetland (incl. a continuous sand ridge, a paling fence, Sandy Road and a residential property) offer an appropriate level of protection for the wetland. Whereas, developing a buffer zone on residential and agricultural areas will not as such contribute the protection of the wetland.</li> <li>The vast majority of the area within this section of proposed buffer is commercial vegetable gardens or grazed, slashed, and fertilized farm land.</li> <li>In proposing the buffer in this area, there appears to be no significant benefit to the main body of the wetland that would outweigh the socio-economic impact on the</li> </ul>	<ul style="list-style-type: none"> <li>The buffer zone has been developed following scientific investigations. Physical barriers cannot necessarily play the role of a buffer zone.</li> <li>The proposed buffer zone for the wetland comprises the following three categories.               <ul style="list-style-type: none"> <li><b>Original wetland (as currently reflected in the Planning Scheme) outside patches of the current wetland (as proposed in the Draft Extent Report):</b> <ul style="list-style-type: none"> <li><b>(a)</b> The current wetland receives water directly from the original wetland area due to local topography controlling surface and groundwater flow, making it highly sensitive to this immediate catchment,</li> <li><b>(b)</b> The current wetland is likely to share some shallow aquifer perching with the Original wetland due the clay-rich aquitard swamp deposit, making the current wetland highly sensitive to disturbance in this area such as deep excavations rupturing the aquitard or pollution events.</li> </ul> </li> </ul> </li> </ul>

No.	Comment from submitter	Response
	<p>long term established agricultural operations on these “Agriculturally zoned” properties.</p>	<p>(c) The larger herbaceous and woody native wetland flora, such as Common Reed <i>Phragmites australis</i>, Swamp Paperbark <i>Melaleuca ericifolia</i> and Woolly Tea-tree <i>Leptospermum lanigerum</i>, can still grow in this area, unlike on the dry land immediately beyond the original extent where they never grew.</p> <p>(d) The original wetland has cultural and historical links with the current wetland.</p> <p>– <b>Islands and peninsulas within the current wetland:</b></p> <p>(a) The islands and peninsulas form a complex mosaic with the wetland and are likely to shelter fauna during flood events, making them integral to the Tootgarook wetland ecological complex.</p> <p>(b) Many of the islands and peninsulas support highly significant native grassland vegetation.</p> <p>(c) The islands and peninsulas are integral to the landscape character of the wetland.</p> <p>– <b>Areas within 100 metres of a current wetland</b></p> <p>(a) Based on literature review, this a minimum width and less than some recommendations.</p> <p>(b) Wetland birds can be highly sensitive to humans and domestic animals visible within 100 metres.</p> <p>(c) The buffer zone provides protection for wildlife accessing the wetland.</p> <p>(d) Groundwater within the buffer zone flows towards the wetland regardless of surface topography.</p> <p>(e) The wetland is highly sensitive to change in landscape character within 100 metres, even if a building base level is behind a gentle ridge the building may be visible.</p>
3.2	<ul style="list-style-type: none"> <li>In some areas, the proposed wetland either does not have a buffer zone or has a narrower buffer zone (i.e. less than 20 metres).</li> </ul>	<ul style="list-style-type: none"> <li>Within the Green Wedge the wetland has a uniform buffer zone of 100 metres. The buffer zone does not include highly developed areas (industrial and dense residential areas) and therefore may be less than 100 metres up to this developed edge in some areas</li> </ul>
3.3	<ul style="list-style-type: none"> <li>Utilising the alignment of the current ESO14 and ESO19 as a basis for the alignment of any future overlays pertaining to wetland is inappropriate.</li> </ul>	<ul style="list-style-type: none"> <li>The proposed ESO boundary is not based on the current ESO14 and ESO19. The boundary of the ESO has been determined on the basis of:</li> </ul>

No.	Comment from submitter	Response
		<ul style="list-style-type: none"> <li>- Review original wetland extent as reflected in the Planning Scheme (i.e. geology maps, historical survey plans, historical aerial photography and Lidar digital elevation model)</li> <li>- Literature review</li> <li>- Field survey</li> </ul>
3.4	<ul style="list-style-type: none"> <li>• The actual physical attributes of the property should be taken into consideration and the proposed ESO should be aligned with the top of the sand ridge to the south of the man-made wetlands within the Boneo Maze and Mini Golf amusement park.</li> </ul>	<ul style="list-style-type: none"> <li>• Some of the proposed ESO is behind a ridge but the buffer protective role still applies to this land:               <ul style="list-style-type: none"> <li>- groundwater within the buffer zone flows towards the wetland</li> <li>- the buffer zone provides protection for wildlife accessing the wetland</li> <li>- even when a building base level is behind a ridge the building may be visible from the wetland.</li> </ul> </li> </ul>
3.5	<ul style="list-style-type: none"> <li>• Activities within the Boneo Maze and Mini Golf amusement park are completely inconsistent with the recommended management objectives for the wetland.</li> </ul>	<ul style="list-style-type: none"> <li>• As outlined in 1.7 the Boneo Maze and Mini Golf support current wetland.</li> <li>• The planning controls are prospective and address future land use and development. The management guidelines are designed to manage the current land uses.</li> </ul>
<b>Submitter 04 (45 Sandy Road, Fingal)</b>		
4.1	<ul style="list-style-type: none"> <li>• The inclusion of the property in the buffer zone will not contribute to the biodiversity conservation of the wetland because of the small broken patches of environmentally diminished wetland to the extreme South.</li> </ul>	<ul style="list-style-type: none"> <li>• The remoteness, small sizes and fragmented nature of the remnant vegetation patches at the southern end of the buffer zone indicate an increased need for protection of the wetland in this area.</li> </ul>
4.2	<ul style="list-style-type: none"> <li>• It is unreasonable that the proposed ESO covers the property.</li> </ul>	<ul style="list-style-type: none"> <li>• The proposed ESO has been developed to protect the wetland and its buffer zone as identified in the ecological assessment. The property is within the buffer zone and therefore the proposed ESO applies to it.</li> </ul>

No.	Comment from submitter	Response
4.3	<ul style="list-style-type: none"> <li>Concerns regarding the existing permitted uses (i.e. agricultural activities) to be prohibited as a result of the new ESO.</li> </ul>	<ul style="list-style-type: none"> <li>The proposed ESO does not contain any permit requirement related to use. The existing lawful uses in the wetland can continue if the new ESO is introduced.</li> </ul>
4.4	<ul style="list-style-type: none"> <li>Concerns regarding further restrictions on the property and landowner.</li> </ul>	<ul style="list-style-type: none"> <li>The new ESO would only apply if a permit was sought. Management guidelines are voluntary and the landowners would need to agree to any proactive management activities on their land.</li> </ul>
4.5	<ul style="list-style-type: none"> <li>The wetland boundary should be realigned to the north side of Sandy Road.</li> </ul>	<ul style="list-style-type: none"> <li>The proposed extent of the wetland and buffer zone has been refined following an ecological and hydrogeological assessment. The following methodology has been used to identify the extent of the wetland:               <ul style="list-style-type: none"> <li>Review original wetland extent as reflected in the Planning Scheme (i.e. geology maps, historical survey plans, historical aerial photography and Lidar digital elevation model)</li> <li>Literature review</li> <li>Field survey</li> </ul> </li> <li>The reasoning in the submission to realign the wetland/buffer zone boundary do not represent a strong scientific justification (i.e. existing physical barriers). Roads and fences do not mitigate against all impacts potentially arising from within or beyond the buffer zone, on the contrary they can have impacts on wildlife movement, these 'barriers' do not substitute for a buffer zone. Furthermore fences are non-permanent structures and a permit is not required to remove one, so any presumed benefit from a fence is not permanently in place.</li> </ul>
<b>Submitter 05 (61 Sandy Road, Fingal)</b>		
5.1	<ul style="list-style-type: none"> <li>The correspondence from Council in 2018 did not clarify the potential impacts of the proposal on the property or lifestyle.</li> </ul>	<ul style="list-style-type: none"> <li>Prior stakeholder engagement communications are outside the scope of this report.</li> </ul>
5.2	<ul style="list-style-type: none"> <li>An explanation of the changes of the planning controls was requested in the consultation session. A response was not received to date when this submission was made.</li> </ul>	<ul style="list-style-type: none"> <li>An email response was sent to the submitter on 29 March 2019.</li> </ul>

No.	Comment from submitter	Response
5.3	<ul style="list-style-type: none"> <li>Biosis has had extensive and ongoing relationship with both the Council and the State Government.</li> <li>Concerns regarding the independent nature of the report outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>Biosis is an independent organisation and has been commissioned by the Council to complete the Project.</li> <li>This assessment has been undertaken on a scientific basis and independent from Council.</li> </ul>
5.4	<ul style="list-style-type: none"> <li>The Boneo Maze and Mini Golf is an artificially made tourist attraction and should not be included in the wetland.</li> <li>The property should not be designated as buffer zone.</li> </ul>	<ul style="list-style-type: none"> <li>Following the Biosis ecological assessment (i.e. field survey), it was determined that majority of Boneo Maze supports current wetland and is in the form of natural Swamp Scrub. Therefore it has been mapped within the current extent of the wetland and the properties within 100 metres of the wetland are proposed to be included within the buffer zone that aims to protect the wetland from the identified ecological threats.</li> </ul>
5.5	<ul style="list-style-type: none"> <li>The Council representative did not articulate the likely effects of changes to the planning controls on the property and stated that any future use/development will be considered on a case by case basis by Council.</li> </ul>	<ul style="list-style-type: none"> <li>Council is required to assess any new permit application on its merits against the requirements in the Planning Scheme at the time the application is made.</li> </ul>
5.6	<ul style="list-style-type: none"> <li>The Draft Extent Report has been completed regardless of the input from the community.</li> </ul>	<ul style="list-style-type: none"> <li>The report is still in draft form and will be reviewed in response to submissions received during consultation.</li> </ul>
5.7	<ul style="list-style-type: none"> <li>It remains unclear why the extent of the designated wetland has been extended south of Limestone Road.</li> </ul>	<ul style="list-style-type: none"> <li>The assessment has identified that the ecological/hydrological characteristic of the wetland is present south of Limestone Road.</li> </ul>
5.8	<ul style="list-style-type: none"> <li>It is unclear why Sandy Road would not be considered an adequate buffer zone given that many other parts of the existing wetland have no buffer zone at all.</li> <li>General Residential Zone (GRZ) versus Green Wedge Zone (GWZ) land – why buffer is not extended over GRZ land but it is for GWZ.</li> </ul>	<ul style="list-style-type: none"> <li>Biosis identified the need to develop a buffer to protect the wetland. The current features of Sandy Road (i.e. gravel, slashed verges and two fence lines) degrade the quality of the buffer zone and justify the need for 100 metre width of buffer zone. For the same reason the buffer zone extends across Truemans Road to include all of the road reserve up to the General Residential Zone.</li> <li>The buffer zone is in Green Wedge Zone but not General Residential Zone. In dense residential areas, each property is too small for an individual development proposal to impact on the wetland significantly, so there is no ecological reason to include these properties. Furthermore, an ESO over these properties would unnecessarily involve</li> </ul>

No.	Comment from submitter	Response
		hundreds of properties and thus impose an unnecessary burden on planning permit applicants and the Shire in consideration of planning permit applications.
5.9	<ul style="list-style-type: none"> <li>There is no environmental value in declaring vastly modified agricultural and residential property as part of the wetlands overlay.</li> </ul>	<ul style="list-style-type: none"> <li>The buffer zone has been proposed around the wetland to protect the wetland from the ecological threats identified in the Draft Extent Report. The buffer zone includes agricultural land (within Green Wedge Zone) and not zones that are highly developed (mostly dense residential or industrial). Despite its modification, agricultural land within the buffer zone still serves to protect the wetland.</li> </ul>
5.10	<ul style="list-style-type: none"> <li>Inclusion of the properties south of Sandy Road in the buffer zone does not increase sustainability of the Wetland.</li> </ul>	<ul style="list-style-type: none"> <li>The properties include remnants of the wetland and/or the wetland buffer zone. The Biosis study has identified the need to develop a buffer zone around the current wetland to protect the wetland from the identified ecological threats.</li> <li>The buffer zone is on three properties, two of which are partly behind a ridge. The buffer protective role still applies, for example groundwater within the buffer zone flows towards the wetland, the buffer zone provides protection for wildlife accessing the wetland, and buildings can still be visible from the wetland depending on their height.</li> </ul>
5.11	<ul style="list-style-type: none"> <li>The Project does not contribute to the management objectives and vision for the wetland (as outlined in the Tootgarook Wetland Management Plan (BMT, 2018) and does not address the future management of Wetland.</li> </ul>	<ul style="list-style-type: none"> <li>Tootgarook Wetland Management Plan (BMT, 2018) identified the need to appoint a professional ecologist/hydrogeologist to review the wetland extent and boundary of ESO30. Therefore, the assessment has been undertaken in line with the objectives of the management plan. The recommendations contained in the assessment include changes to the planning controls as well as the proposed management guidelines.</li> </ul>
<b>Submitter 06 (Save Tootgarook Swamp)</b>		
6.1	<ul style="list-style-type: none"> <li>Concerns regarding the poor funding of the Project and that more logical techniques could have been used if more funding was available.</li> </ul>	<ul style="list-style-type: none"> <li>The methodology that has been utilised in the Draft Extent Report to define the extent of the wetland and buffer zone is considered logical and the outcome is valid.</li> </ul>
6.2	<ul style="list-style-type: none"> <li>The mapping extent has been carried out in the driest year in the wetland since the Millennial drought broke in 2011.</li> </ul>	<ul style="list-style-type: none"> <li>2015 was drier than 2019 at Rosebud. The winter before the mapping received 84% of average rainfall (BOM data).</li> </ul>

No.	Comment from submitter	Response
6.3	<ul style="list-style-type: none"> <li>Recommends that the Biosis should have used an already established wetland delineation methods such as the Queensland Government system.</li> </ul>	<ul style="list-style-type: none"> <li>The Queensland method is not useful as 'The biotic-plants criterion in the wetland definition is met when the abundance of wetland indicator plants in the ecologically dominant layer (EDL) is &gt;50 per cent of the total.' We used 25% as the threshold, in line with DELWP's definition of native vegetation. The Queensland method would produce a smaller, undermapped current wetland.</li> </ul> <p>Furthermore the Queensland method states 'Where the EDL is not clear and there is a mixture of wetland and non-wetland plants, quantitative abundance data must be collected. Crown cover should be measured at a plot using the crown intercept method'. With a wetland perimeter of 60 km, this would be extremely time consuming and expensive in relation to the size of Tootgarook Wetland, unprecedented at this scale, and also unnecessary. We can determine the wetland extent readily and rapidly by visual cover estimation.</p>
6.4	<ul style="list-style-type: none"> <li>The current Wetland should have been mapped at the 2.47 AHD level using Lidar.</li> </ul>	<ul style="list-style-type: none"> <li>Like other major peat wetlands, such as the former Kooweerup and Carrum Swamps, the wetland is large and has a surface gradient, in this case from south down to the north, which means that a single height level is not useful in wetland delineation. As stated in the Draft Extent Report, a single level in the Lidar model cannot be used to define the wetland extent since there is a two metre fall in the wetland outer boundary from 4.5–5.0 metres ASL in the south to 2.5–3.0 metres ASL in the north. With a fall of approximately 0.4 metres per kilometre, the wetland cannot and never did hold one continuous standing body of water. The wetland is effectively a large sponge with water slowly moving through, with increased surface flows during floods. During floods, a temporary lake would form at the lower end (possibly at 2.47 metres ASL) but it would not always extend to the upper end which would be a saturated swamp deposit only.</li> </ul>
6.5	<ul style="list-style-type: none"> <li>Tall Fescue should be included within the current wetland extent.</li> </ul>	<ul style="list-style-type: none"> <li>There appears to be a misunderstanding that all Tall Fescue has been left off the current wetland map. The current wetland map includes much Tall Fescue dominated grassland provided 'characteristic wetland species provide <math>\geq 25</math> per cent of total plant cover'. Tall Fescue can provide up to 75% of the cover and be mapped as current wetland.</li> </ul>

No.	Comment from submitter	Response
		<p>Tall Fescue is not confined to wetlands and so is generally not useful in wetland delineation. It dominates many damp pastures in southern Victoria including some dairy farms, and is listed as a high threat weed in non-wetland ecological vegetation classes in the Gippsland Plain bioregion by DELWP: Plains Swampy Woodland and Sedgy Swampy Woodland. Consistent with this, our project hydrologist Pat Condina who is an expert on Tootgarook Wetland is of the view that Tall Fescue is not restricted to wetlands and should not be used to define current extent of Tootgarook Wetland.</p> <p>Sites further out from the current wetland and still dominated by Tall Fescue have little (less than 25% of the total cover) or no characteristic wetland species cover. In our analysis, these sites are either (a) original wetland, noting that the wetland has been lowered Chinamans by Creek drain, or (b) original grassland that never had characteristic wetland species. It is the ability of Tall Fescue to colonise adjacent non-wetland vegetation types such as grassland that limits its use in mapping the wetland.</p> <p>Importantly, Tall Fescue has been deliberately sown on ploughed former Poa grasslands associated with Tootgarook Wetland where it now thrives with dryland weeds, so this species is not useful in current wetland delineation. Tall Fescue tends to straddle and obscure the wetland boundary. It is invasive within upper wetland and highly invasive in adjacent grassland.</p> <p>We note that prior to mapping STS was consulted on this issue in October 2018 and it was agreed that Tall Fescue is a damp pasture species rather than a wetland indicator and is not useful in delineating the wetland, particularly as it is widespread and invasive on the islands where it has been in many cases deliberately sown after ploughing and elimination of Poa grassland. STS have since changed their position in Tall Fescue without informing us until we received their submission.</p>
6.6	<ul style="list-style-type: none"> <li>• Recommends some refinements to the proposed extent of the wetland.</li> </ul>	<ul style="list-style-type: none"> <li>• It is acknowledged that the mapped current wetland boundary could receive minor refinements as per the submission. The highly complex wetland has a boundary of 60 km which includes many islands and peninsulas (which all support grassland, either Poa or Tall Fescue). We have accepted most of the proposed changes in the wetland boundary, as below.</li> </ul>

No.	Comment from submitter	Response		
		<i>Site</i>	<i>Response</i>	<i>Comment</i>
		1	Accepted	Wetland
		2	Accepted	Poa grassland
		3	Accepted	Poa grassland
		4	Accepted	Wetland
		5	Accepted	Wetland
		6	Accepted	Wetland
		7	Accepted	Wetland
		8	Accepted	Wetland
		9	Accepted	Wetland
		10	Accepted	Wetland
		11	Accepted	Wetland
		12	Accepted	Wetland
		13	Not accepted	Unclear what is meant
		14	Accepted	Wetland
		15	Not accepted	Complex vegetation pattern is necessarily simplified on map
		16	Accepted	Wetland
		17	Accepted	Wetland

No.	Comment from submitter	Response		
		18	Accepted	Wetland
		19	Not accepted	Does not appear to be current wetland, possible drainage works since 2012
		20	Accepted	Wetland
		21	Accepted	Wetland
		22	Accepted	Wetland
		23	Accepted	Wetland
	<p>However these adjustments make no difference to the ESO boundary or schedule apart from Ruyton Avenue Reserve, Capel Sound which is in the existing ESO30 and is now also included in the proposed ESO (site 1).</p> <p>The proposed maps of the wetland is current as of April 2019. Including several revisions proposed by Save Tootgarook Swamp and accepted. It is considered as the most detailed, accurate and comprehensive map of the wetland yet produced. Accordingly the Draft Extent Report is fit for purpose in providing a basis for the proposed ESO.</p>			
<p><b>Submitter 07 (National Trust for Australia)</b></p>				
7.1	<ul style="list-style-type: none"> <li>Can Council specify the extent of the buffer zone within the landscape (i.e. a marker, of the beginning of the buffer so that the public can be confident that within one hundred metres of that identification the wetlands begin)</li> </ul>	<ul style="list-style-type: none"> <li>Council may decide to implement this idea once the proposed changes (incl. the extent of the buffer zone) are approved.</li> </ul>		
7.2	<ul style="list-style-type: none"> <li>Questions how an inappropriate development is defined and if it is subject to change in future.</li> </ul>	<ul style="list-style-type: none"> <li>In context of the wetland protection, inappropriate development refers to any type of development that could potentially result in one or more of the ecological threats to the wetland identified in the Draft Extent Report. Council will assess any proposed</li> </ul>		

No.	Comment from submitter	Response
		development that requires a permit on a case by case basis, and will identify any potential impacts on the wetland.
<b>Submitter 08 (370 Boneo Road, Boneo)</b>		
8.1	<ul style="list-style-type: none"> <li>The Draft Extent Report has identified that the current planning controls address the ecological threats.</li> <li>Therefore, there is no need to propose any change to the current overlay controls (i.e. inclusion of the property in the proposed ESO).</li> </ul>	<ul style="list-style-type: none"> <li>Whilst there are already a number of planning protections in place, the layers of ESOs are complicated and duplicate requirements. The Planning Panel (Amendment C188 Part 2 of Planning Scheme, August 2015) recommended this should be reviewed to create a more streamlined and transparent level of control.</li> </ul>
8.2	<ul style="list-style-type: none"> <li>The Draft Extent Report has a significant number of unknowns and requires further investigation.</li> </ul>	<ul style="list-style-type: none"> <li>Biosis was engaged to undertake the following work:               <ul style="list-style-type: none"> <li>Refine the geographic extent of wetland</li> <li>Identify the (ecological) threats to the wetland</li> <li>Review the relevant planning controls (ESO14, ESO18, ESO19 and ESO30)</li> <li>Make recommendations to the planning controls and prepare management guidelines (addressing the ecological threats)</li> </ul> </li> </ul> <p>The Draft Extent Report has completed these tasks. The assessment has found out that there are some tasks outside the scope of this Project which may require further investigation by Council. For instance, if Council seeks to retain prescriptive controls in the new ESO (e.g. prescribing a building height over which a permit is required), it may need to undertake further investigation in relation to the rationale for any prescriptive requirements.</p>
8.3	<ul style="list-style-type: none"> <li>The duplication of planning controls is not the case for this property. The owners do not support an increase in the extent of controls across their property.</li> </ul>	<ul style="list-style-type: none"> <li>The property is currently affected by ESO14 and ESO19. The Draft Extent Report found a significant duplication between ESO14, ESO18, ESO19 and ESO30. The Draft Extent Report has recommended to replace all those four ESOs with one single control which can adequately address the ecological threats to the wetland and buffer zone. The western portion of the property is within the proposed extent of the wetland and buffer zone and covered by the proposed ESO.</li> </ul>

No.	Comment from submitter	Response
8.4	<ul style="list-style-type: none"> <li>Any change to the controls must not impact or affect existing uses lawfully conducted on the Land.</li> </ul>	<ul style="list-style-type: none"> <li>The proposed ESO does not contain any restrictions regarding the existing uses.</li> </ul>
8.5	<ul style="list-style-type: none"> <li>The broader management plans and guidelines that would sit outside the planning framework which may impact upon the use and development of the property are not supported.</li> </ul>	<ul style="list-style-type: none"> <li>The broader management guidelines relate to the ecological threats that cannot be addressed through the planning controls. Those guidelines will not impose any statutory obligations to control the use and development. However, Council may decide to encourage the landowners to proactively comply with those management guidelines as appropriate.</li> </ul>
8.6	<ul style="list-style-type: none"> <li>It is not clear how the recommendations will reduce the administrative burden for permit applicants.</li> </ul>	<ul style="list-style-type: none"> <li>As discussed in Item 8.3, the proposed ESO will replace four existing ESOs (ESO14, ESO18, ESO19 and ESO30). This will reduce the administrative burden for permit applicants as all permit requirements (as relevant to the wetland and buffer zone) will be in one single control.</li> </ul>
<b>Submitter 09 (Boneo park)</b>		
9.1	<ul style="list-style-type: none"> <li>The real wetland is a groundwater dependent ecosystem.</li> </ul>	<ul style="list-style-type: none"> <li>The Draft Extent Report states that the wetland is groundwater dependent and that this water enters the wetland as groundwater laterally from higher ground on the sides. However the wetland also receives a considerable proportion of its water from Drum Drum Alloc Creek and from direct rainfall.</li> </ul>
9.2	<ul style="list-style-type: none"> <li>The wetland area is nearer to 250 ha than the 319 ha as identified in the Draft Extent Report.</li> </ul>	<ul style="list-style-type: none"> <li>The extent of the wetland has been determined by using the following methodology:             <ul style="list-style-type: none"> <li>Review original wetland extent (as reflected in the Planning Scheme)                 <ol style="list-style-type: none"> <li>Geology maps</li> <li>Historical survey plans</li> <li>Historical aerial photography</li> <li>Lidar digital elevation model</li> </ol> </li> <li>Literature review</li> <li>Field survey</li> </ul> </li> </ul>

No.	Comment from submitter	Response
9.3	<ul style="list-style-type: none"> <li>The large amount of land to the south and east of the main wetland is higher than the highest ever flood level in the wetland and is not hydrogeologically connected to the main wetland. This land has never been considered 'wetland' by any authority</li> </ul>	<ul style="list-style-type: none"> <li>Swamp Scrub is a wetland ecological vegetation class (EVC) in <i>A field guide to Victorian wetland ecological vegetation classes for the index of wetland condition</i> (DSE 2012). It is widespread and locally abundant on the geological swamp deposit which extends nearly to Maxwell Road in the south. Away from the covenanted area which is in the north-west of Tootgarook Wetland, to the south and east, Swamp Scrub was the dominant vegetation type although most is now cleared, emphasising the need for protection of the remnants there.</li> </ul>
9.4	<ul style="list-style-type: none"> <li>The discussion in the Draft Extent Report about the hydrogeology and groundwater is inconsistent and contains too many errors.</li> </ul>	<ul style="list-style-type: none"> <li>The summation does not specify all of the entire claimed errors in the Draft Extent Report. A number of concerns (or errors as called in the submission) have been listed in the Appendix to the submission which will be addressed hereafter.</li> </ul>
9.5	<ul style="list-style-type: none"> <li>There is no threat to the fresh water supply and no significant threat to the wetland's vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>The Draft Extent Report has identified a list of ecological threats to the wetland. In particular, the wetland has dried out considerably due to drainage. The widespread presence of peat in the northern area at least indicates that it was once permanently inundated there, which is not the case now. It is not in hydrologically natural condition and a destructive peat fire could occur.</li> </ul>
9.6	<ul style="list-style-type: none"> <li>A considerable extent of the wetland (90%) is under Trust for Nature conservation covenant which provides more appropriate protection for the wetland than what has been suggested in the Draft Extent Report.</li> </ul>	<ul style="list-style-type: none"> <li>The proposed ESO intends to provide appropriate protection for the wetland and buffer zone against the identified threats in the Draft Extent Report via the planning system. The covenant may provide protection for the wetland but it sits outside the planning system. It is common for covenants to exist on land in addition to environmental overlay controls.</li> </ul>
9.7	<ul style="list-style-type: none"> <li>The freeway reserve which crosses through the wetland should be removed.</li> </ul>	<ul style="list-style-type: none"> <li>This specific concern is outside the scope of this assessment.</li> </ul>

No.	Comment from submitter	Response
9.8	<ul style="list-style-type: none"> <li>The land to the west of the real wetland (mostly Trust for Nature land) is mostly very porous sand, so no water lies around, and there can be no suggestion that this is wetland.</li> </ul>	<ul style="list-style-type: none"> <li>This land has not been mapped as wetland.</li> </ul>
9.9	<ul style="list-style-type: none"> <li>The wetland as defined in the Draft Extent Report does not reflect the real extent of the wetland ('Fantasy Wetland') due to the following:             <ul style="list-style-type: none"> <li>It contains perched water, not groundwater.</li> <li>No public authority has ever considered it part of the Tootgarook Wetland.</li> <li>It is not part of the huge groundwater aquifer of the Tootgarook Wetland.</li> <li>All of this land is above the highest ever recorded flood level of the Tootgarook Wetland.</li> <li>Much of this fantasy wetland consists of puddles which form after rain on the impervious ground.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>The assertions regarding a fantasy wetland are considered incorrect and seem to arise from a perception that the extent of the wetland is at one level. While this may be the case for lakes it is not the case for large complex wetlands. A lake is at one level at any point in time and all water is contiguous. A wetland may have partially connected areas at different levels, in a series of descending steps. For example East (1935) notes that the former 5200 ha Carrum swamp area was by no means level, with the elevation varying from 5 feet (1.5 m) above low water mark, Port Phillip Bay, immediately behind the coastal sand ridge, to 50 feet (15.2 m) above that level where the Dandenong Creek entered the swamp. Similarly with the Koo Wee Rup Swamp. The 40,000 ha Swamp as found by Thwaites in 1860 stretched from the Dandenong/Bunyip Ranges in the north to Western Port Bay to the south, and from the steep Heath Hill ridge to the east and a gradual rise towards Cranbourne to the west. The Swamp was not one vast body of shallow water. It consisted of many discrete shallow and deep marsh areas often separated by very low sandy rises, with a complex maze of disconnected channels throughout. The change in elevation of the swamp was from virtually sea level to 40 metres above sea level.</li> </ul> <p>The Tootgarook Wetland is not an aquatic system at one level. Its original extent of some 484 ha as shown on the 1877 map included swampland as high as 10 m above sea level. Draining and development have reduced this area but some 300 ha still remain.</p> <p>In relation to the views of public authorities, 'Tootgarook Management Plan' (BMT, 2018) which is an environmental management plan adopted by Council contains a similar map for the wetland as the Draft Extent Report.</p>

No.	Comment from submitter	Response
		<p>Regarding the groundwater aquifer, it is not level and extends underneath both the wetland and areas well outside the wetland.</p> <p>Regarding the relation between flood levels and wetland, flood levels may define the extent of the Land Subject to Inundation Overlay (LSIO) but they do not define the extent of the wetland because of the substantial slope from its southern to northern extent. The proposed extent of the wetland has remnant patches of Swamp Scrub. Swamp Scrub is naturally inundated for short periods only, and with drainage of the swamp is even less likely today. The numerous Swamp Scrub remnants are wetland now, and the intervening areas are original wetland. Progressive clearing and fragmentation of the Swamp Scrub can be seen on historical aerial photography.</p>
9.10	<ul style="list-style-type: none"> <li>Boneo Park has a long term history of non-wetland uses and has not been considered a wetland.</li> </ul>	<ul style="list-style-type: none"> <li>The proposed extent of the wetland has been refined in accordance with scientific investigations. Majority of Boneo Park is deemed to be historically part of the original wetland (as mapped in the Draft Extent Report) which now appears as farmland. Scattered, fragmented remnants of Swamp Scrub are also present, these being current wetland.</li> </ul>
9.11	<ul style="list-style-type: none"> <li>100% of Boneo Park (towards Boneo Rd) from the equestrian centre is above the highest flood level ever recorded in the real swamp.</li> </ul>	<ul style="list-style-type: none"> <li>This area has remnant patches of Swamp Scrub which is wetland. Swamp Scrub is naturally inundated for short periods only, and with drainage of the swamp is even less likely today.</li> </ul>
9.12	<ul style="list-style-type: none"> <li>Boneo Park is not directly hydrologically connected to the real wetland (as defined in the submission).</li> </ul>	<ul style="list-style-type: none"> <li>The land appears to be hydrologically connected. The shallow groundwater table still persists here even though surface hydrology has been modified.</li> </ul>
9.13	<ul style="list-style-type: none"> <li>The submission refers to some examples to justify the extent of the real wetland (as defined in the submission).</li> </ul>	<ul style="list-style-type: none"> <li>The responses to the examples are contained in the above items.</li> </ul>

No.	Comment from submitter	Response
9.14	<ul style="list-style-type: none"> <li>The proposed extent of Wetland (called 'Fantasy Wetland' in the submission) has been farmland for a long time and does not reflect the real extent of the Wetland.</li> </ul>	<ul style="list-style-type: none"> <li>Current Wetland (as identified in the Draft Extent Report) is defined in Methodology as an area of characteristic wetland vegetation, consisting of vegetation where characteristic wetland species provide <math>\geq 25</math> per cent of total plant cover. This definition was applied to all of Boneo Park, where on the eastern side there are remnants of Swamp Scrub (current wetland) and intervening areas of former Swamp Scrub inferred from historical aerial photography (original wetland), consistent with the management plan (BMT, 2018).</li> </ul> <p>The 'real wetland' and 'fantasy wetland' are essentially the inner swamp (herbaceous non-woody vegetation in the wettest areas) and the outer swamp (woody vegetation such as Swamp Scrub in less flood-prone areas) as described in the Draft Extent Report. All major wetlands in the region have or once had inner and outer swamp sections.</p>
9.15	<ul style="list-style-type: none"> <li>Analysis of the ecology is very useful, but not relevant for the specified aim of the study.</li> </ul>	<ul style="list-style-type: none"> <li>The ecology is very relevant because it is the most powerful indicator of the actual extent of swamp vegetation and swamp vegetation defines swamp extent because it integrates the influence of both groundwater and surface water.</li> </ul>
9.16	<ul style="list-style-type: none"> <li>Do acid sulphate soils exist in the Wetland?</li> </ul>	<ul style="list-style-type: none"> <li>Existence of acid sulphate soils has not been investigated as it is not a consideration in defining wetland extent.</li> </ul>
9.17	<ul style="list-style-type: none"> <li>The groundwater has never been at 2.5 m. The ground level in the Fantasy Wetland (as defined in the Draft Extent Report) is above 2.5 m, so much less than 90% would be inundated.</li> </ul>	<ul style="list-style-type: none"> <li>There has never been an assertion that the groundwater level is at 2.5 m. This is the water level in a significant flood event when large volumes of surface water flow into the swamp.</li> </ul>
9.18	<ul style="list-style-type: none"> <li>Questions whether the Wetland really provides critical flood storage.</li> <li>Suggested that the Melbourne Water's methodology for its 1 in 100 year to be invalid.</li> </ul>	<ul style="list-style-type: none"> <li>The Tootgarook Management Plan (BMT, 2018) states: <i>The wetland's value for providing flood storage, minimising the flood risk to Capel Sound has long been established. Detailed flood modelling of the Tootgarook catchment has recently been undertaken; confirming the wetland's importance in regulating floodwaters by acting as a natural "retarding basin", protecting the downstream urban area even in large flood events (Engeny Water Management 2012). This function will be important to mitigate the impacts of climate change, which is expected to increase the intensity of storm events.</i></li> </ul>

No.	Comment from submitter	Response
		<ul style="list-style-type: none"> <li>Melbourne Water has not informed Biosis of any change in their model. Their modelling is supported by others and generally indicates both the critical storage function and a 100 year level of from 2.7 to 2.9 m AHD. There seems to be some misunderstanding of what happens in a flood event extending over several days. In such circumstances very high volumes enter the swamp and must then exit the swamp via the small capacity downstream channel. The volume lost to the groundwater over this short time period is insignificant compared to the surface water volumes flowing in and flowing out.</li> </ul>
9.19	<ul style="list-style-type: none"> <li>The groundwater has never been above about 2.3 m AHD and additional rain seems to have little impact on groundwater levels.</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater levels and surface water levels are different. The swamp is a product of both.</li> </ul>
9.21	<ul style="list-style-type: none"> <li>The underground storage seems far more important than the above ground storage.</li> </ul>	<ul style="list-style-type: none"> <li>Both groundwater and surface water are important to wetland extent and integrity. In flood events surface water determines wetland conditions for a period of time. The levels in Chinamans creek and Tootgarook Wetland are strongly related to previous rainfall patterns. High levels are recorded after significant rainfall events but such levels persist only for a few days in the absence of follow up rain. For example it is estimated on 21 July 1996 following 44.6 mm of rainfall in the previous 48 hours, the swamp at Browns Rd reached a level of 2.30 metres, but levels had dropped to 2.1 m AHD within the following week.</li> </ul>
9.22	<ul style="list-style-type: none"> <li>Questions Chinaman Creek drain and suggested that it does not have function within Boneo Park.</li> </ul>	<ul style="list-style-type: none"> <li>The description of the geological deposit is 'peat' throughout. Peat could not have formed without permanent inundation which does not happen today, indicating the wetland has dried out.</li> </ul>
9.23	<ul style="list-style-type: none"> <li>Concerns regarding the impacts of the sea level rise on the groundwater.</li> </ul>	<ul style="list-style-type: none"> <li>The proposed extent of the Wetland is mapped as per quantitative criteria in Methodology: Area of characteristic wetland vegetation, consisting of vegetation where characteristic wetland species provide <math>\geq 25</math> per cent of total plant cover. This is independent of past and future effects of sea level rise.</li> </ul>

No.	Comment from submitter	Response
9.24	<ul style="list-style-type: none"> <li>Concerns regarding the impact of rain on groundwater.</li> </ul>	<ul style="list-style-type: none"> <li>The Draft Extent Report has considered the seasonal variation in groundwater levels in the assessment.</li> </ul>
9.25	<ul style="list-style-type: none"> <li>Most of the catchment's rain in fact travels slowly underground, mostly to Port Phillip. Evapotranspiration and Chinamans Creek are the minority.</li> </ul>	<ul style="list-style-type: none"> <li>It is agreed that the groundwater pathway should also have been mentioned in the related section of the Draft Extent Report (Section 4.1). On an annual basis over the catchment a significant proportion of the rainfall (perhaps about 30%) percolates into the ground and becomes groundwater and we estimate groundwater recharge over the surface catchment to be about 8800 ML/annum. In a flood event surface water runoff volumes are greater than volumes entering groundwater. For the swamp itself the water balance is very complex but we estimate that on an annual basis 3500 ML enters as rainfall and 6200 ML enters as surface inflow. Evapotranspiration would amount to about 4800 ML/annum and flow out of the swamp is about 3600 ML/annum. Thus surface flow groundwater flow and evapotranspiration are both important from a water balance viewpoint.</li> </ul>
<b>Submitter 10 (VicRoads)</b>		
10.1	<ul style="list-style-type: none"> <li>Intends to retain the existing Public Acquisition Overlay (PAO) for a possible future extension of Mornington Peninsula Freeway.</li> </ul>	<ul style="list-style-type: none"> <li>The Draft Extent Report does not make any recommendation regarding the removal or retention of the existing PAO. The scope of works for this Project is listed below:               <ul style="list-style-type: none"> <li>– Refine the geographic extent of wetland</li> <li>– Identify the (ecological) threats to the wetland</li> <li>– Review the relevant planning controls (ESO14, ESO18, ESO19 and ESO30)</li> <li>– Make recommendations to the planning controls and prepare management guidelines (addressing the ecological threats)</li> </ul> </li> </ul> <p>If the Mornington Peninsula Freeway proceeds in the future, further assessment of the impacts of those works would be required. At that time the project would be assessed against the relevant planning controls and would be required to comply with all relevant legislative requirements (e.g. <i>Environment Effects Act 1978</i>).</p>

## References

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Biosis 2019a. Defining the Extent of Tootgarook Wetland: Stakeholders Engagement Plan. Report to Mornington Peninsula Shire, Biosis Pty Ltd, Melbourne.

Biosis 2019b. Extent of Tootgarook Wetland, Mornington Peninsula, Victoria. Report to Mornington Peninsula Shire, Biosis Pty Ltd, Melbourne.

BMT 2018. Tootgarook Wetland management plan. Plan prepared for Mornington Peninsula Shire, BMT Pty Ltd, Melbourne.