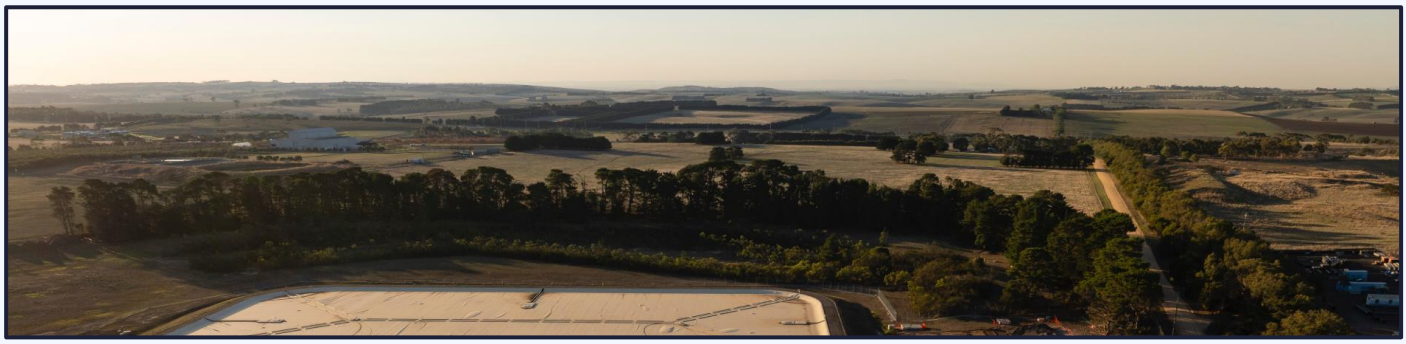
Growling Grass Frog Offset and Management Plan

Pettavel Basin Augmentation Project

EPBC Number: EPBC 2024/09840
Address: Pettavel Basin Water Storage Facility, cnr Draytons Road and Reservoir Road, Waurn Ponds
Prepared for: Barwon Regional Water Authority and nominated consultants (CMP Consulting Group Pty Ltd.)
Date: 27 May 2026







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Document Control

Document Type	Growling Grass Frog Offset and Management Plan
Project Title	Pettavel Basin Augmentation Project
Project Number	30049187
File Location	Projects\300491\30049187 - Pettavel Basin Augmentation Project (Basin No. 03)\300 VAR09 Add. Ecology (Approvals)\Growling Grass Frog Management Plan\Report
Revision Number	9

Revision History

Revision No.	Date	Prepared By	Reviewed By	Approved for Issue By
1	25/01/2024	Clio Gates Foale, Andrew Taylor	Dan Weller	Andrew Taylor
2	20/03/2024	Clio Gates Foale	Andrew Taylor	Andrew Taylor
3	2/10/2024	Andrew Taylor	Clio Gates Foale	Andrew Taylor
4	18/10/2024	Brigette Gwynne	Andrew Taylor	Andrew Taylor
5	19/09/2025	Andrew Taylor	Barwon Water, DCCEEW	Andrew Taylor
6	02/12/2025	Clio Gates Foale, Andrew Taylor	Barwon Water, DCCEEW	Andrew Taylor
7	13/03/2026	Clio Gates Foale, Andrew Taylor	Barwon Water, DCCEEW	Andrew Taylor
8	26/05/2026	Andrew Taylor	Barwon Water, DCCEEW	Andrew Taylor
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Ecological Limitations

The site assessment was undertaken in November and December 2023. This is considered to be an optimal time of year for conducting flora and fauna surveys as many ephemeral flora species are flowering and visible. Targeted Growling Grass Frog surveys at this time is also optimal for species detected during the species breeding period (September to February).

Use of Databases

The Victorian Biodiversity Atlas (VBA) database and other databases can be used to search a defined geographical area to produce species lists of flora and fauna that have been previously recorded within the search area. The database lists are only as accurate as the quality and quantity of data that have been recorded and documented from the area. The use of the database in a desktop assessment has the following limitations:

- Location details for many records (typically older records) have a relatively low degree of accuracy (≤ 1km). Thus, the database search may not pick up some records of species that were made within the site historically.
- These datasets are not exhaustive given many locations locally and across Victoria have low or in some instances no documented survey effort for one or more groups of flora and fauna. During field surveys, it is not uncommon to find species at locations for which there are few or no previous nearby database records.
- Professional experience and judgement are used through the assessment process to assess the potential for previously unrecorded threatened flora and fauna to be present within and adjoining the study site. Threatened flora and fauna records that are dated ≤1980 have been removed from our data analysis as they are not considered to provide an accurate representation of the species likely to occur within the site at present (unless stated otherwise in this report).

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1. Declaration of accuracy

EPBC Act Declaration

EPBC number	2024/09840
Project name	Pettavel Basin Augmentation Project
Proponent / ABN	Barwon Water / 86 348 316 514
Proposed action	Construct and operate a new water storage basin and overflow area as a first party offset site at the Pettavel Basin site.
Location of the action	210-240 Reservoir Road, Waurn Ponds, Victoria

Declaration of accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed: 

Full name: Giles Flower

Organisation: Barwon Water

Date 27 / 05 / 2026

2. Introduction

2.1 Background

SMEC Australia Pty Ltd (SMEC) was commissioned by CMP Consulting Group Pty Ltd (CMP) to develop a Growling Grass Frog Offset and Management Plan (GGF OMP) for the Pettavel Basin Augmentation Project, servicing the greater Geelong region in Victoria (the Project). The Project includes the construction of a new 100ML basin (Basin No.3). The new basin footprint displaces an existing artificial wetland, which supports a breeding population of Growling Grass Frog (*Ranoidea raniformis*).

The Project was referred to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 30 May 2024 (EPBC 2024/09840) due to impacts on Growling Grass Frog and the Project was deemed a controlled action on 28 June 2024. The Project is to be assessed by Preliminary Documentation – Further Information (PDFI) (requested by DCCEEW on 7 August 2024).

This GGF OMP has been developed to detail the offset strategy to mitigate the loss of 2.81 ha of Growling Grass Frog habitat, by outlining management actions for the creation and protection of 3.23 of Growling Grass Frog habitat at a First Party Offset Site.

The information contained in this plan will be incorporated into a Construction Environment Management Plan (CEMP) for the Project (SMEC 2025), and is to be reviewed concurrently by the civil contractor engaged to complete construction activities. A suitably qualified ecologist must be engaged to implement any specific actions described in this plan.

2.2 Project description

The Project aims to increase the water storage capacity of the existing Pettavel Basin water storage facility through the construction of a new 100 ML covered drinking water storage basin (Basin No.3) to augment the existing supply, directly adjacent to the existing water supply Basins No.1 and No.2 that total 100ML (56ML +46ML). This new 100ML water storage basin (Basin No.3) is required to meet future demand of the growing populations of Armstrong Creek, Leopold the Bellarine Peninsula and the Surf Coast. Basin No.3 will be situated on a 25-ha parcel of Barwon Water owned land on the corner of Draytons Road and Reservoir Road, Waurn Ponds. The land has been used as a water storage facility by Barwon Water for over 105 years. A site layout of the proposed works is provided in Appendix 2.2.

The location for the new Basin No.3 is currently occupied by an artificial wetland that formed in an excavation hole known as a 'borrow pit'. Targeted surveys were undertaken in the borrow pit wetland as part of the environmental assessment completed for the Project and a breeding population of Growling Grass Frog was detected (SMEC 2024a). The species is listed as Vulnerable under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Project requires the removal of the borrow pit wetland to replace it with the new Basin No.3. To compensate for this impact, a new designated Growling Grass Frog wetland and vegetated swale will be created on the property and protected as a First Party Offset Site. The new Growling Grass Frog wetland and the southern extent of the vegetated swale will be constructed and fully established prior to excavation of the borrow pit wetland (Impact Site), providing replacement habitat for the frogs when the borrow pit wetland is removed. Growling Grass Frogs will be captured at the Impact Site prior to its removal and relocated to the Offset Site. The northern extent of the vegetated swale will be constructed following the completion of Basin No.3.

A detailed description of the Impact Site and Offset Site is provided in Section 2. The below headings provide further background and details about other components of the Project.

2.2.1 Basin No. 3

Basin No. 3 is a 100ML above ground water retaining structure and includes the following functional requirements. Refer to Appendix 2.2 for the work in progress revision of the Stage 2 site layouts.

- Installed adjacent to Basin No.2. The inlet and outlet pipework into the new basin will connect directly into the drinking water transfer network along the eastern and western embankments, respectively.
- Earthen embankments utilising site won material will be used preferentially. Engineered material (i.e. crushed rock) will be imported if the existing earthen clay (site won) material does not achieve sufficient maximum dry density (MDD) ratio, min. optimum moisture content (OMC) or the minimum bearing capacity during compaction. The new 100ML basin will be constructed in accordance with the prevailing Dam Safety standards (ANCOLD Guidelines) and best practice to avoid risk of catastrophic dam failure.
- Geomembrane liner and cover material across the basin will be used to protect the treated drinking water from contamination and risks to human health, as well as prevent volumetric losses (seepage) to the surrounding soil.
- New crushed rock access track on the eastern side of the site will be constructed with imported material. The new access track will connect to the existing internal access track inside the Project site.
- Geosynthetic underlay and underdrainage pipework to facilitate, groundwater, drainage and to protect the liner.
- Extension of sealed road surface around the crest of the new 100ML basin along the top of the embankments.
- Construction of the new above ground pipework manifold including the control valves, fittings, MSCL pipe manifolds, telemetry and acoustic shelters on a new concrete hardstand.
- An overflow weir structure with both an underground pipework and earthen swale component to discharge to the 12ML overflow detention storage.

2.2.2 Overflow detention storage basin

A dry earthen 12ML storage (shown in Appendix 2.2) is required to detain a controlled volume release of water in the event of an emergency discharge from Basin No,3, as well as during a storm event when infiltration exceeds ground water recharge and the excess overland flows are directed to the Overflow Detention Storage Basin.

The Overflow Detention Storage Basin will receive flows from natural hydrology catchments external from the Project site. Refer to Section 3.2.5 for further information related to the hydrological management of the Project site. Designated maintenance tracks of mown grass will surround the top of embankments of the Overflow Detention Storage Basin.

The Overflow Detention Storage Basin will not be protected as part of the Offset Site because it is an operational component of Basin No.3 and Dam Safety protocols if a controlled release of treated water is required. However, it will be maintained as an open grassed area that can be used by Growling Grass Frog as secondary terrestrial habitat. The area will be accessible to Growling Grass Frog at the completion of all construction works and in perpetuity.

2.3 Objectives

The objective of this management plan is to provide detailed measures to ensure the Project will not have a significant impact to an important population of Growling Grass Frog. This management plan provides guided steps to meet this objective through the protection, enhancement, and ongoing management of a newly constructed Growling Grass Frog wetland.

The objectives of this management plan include:

- Provision of a detailed map to represent the construction stages of the project (Stage 1 and Stage 2 works), and location of future infrastructure, particularly the designated Growling Grass Frog wetland;
- Provision of detailed management actions to minimise impacts to Growling Grass Frog during the construction phase;

- Provision of detailed habitat design standards for the construction, establishment and maintenance of designated Growling Grass Frog wetland;
- An overview of monitoring, maintenance and reporting requirements during the post-construction phase; and
- Providing DCCEEW with adequate information to assess and approve the PDFI request for this Project (EPBC 2024/09840).

2.4 Accompanying documents

The Growling Grass Frog offset and management plan must be read in conjunction with the following reports:

- SMEC 2025. Pettavel Basin Augmentation Project – Construction Environmental Management Plan. Report prepared for Barwon Water.
- SMEC 2024a. Pettavel Basin Augmentation Project – Targeted surveys for Growling Grass Frog and Latham's Snipe. Technical memo prepared for CMP Consulting Group Pty Ltd.
- SMEC 2024b. Pettavel Basin Augmentation Project – Detailed Flora and Fauna Assessment Report prepared for CMP Consulting Group Pty Ltd.

2.5 Key terms

The following key terms are essential to the interpretation of this document:

- **The Impact Site:** The Impact Site is the location at which a new 100ML basin (**Basin No.3**) is proposed. The Basin No.3 footprint displaces an existing **borrow pit wetland**, which supports a breeding population of Growling Grass Frog. Basin No. 3 is described in Section 2.2.1 and the borrow pit wetland is described in Section 3.1.1.
- **The Offset Site:** To compensate for impacts to Growling Grass Frog, a new Growling Grass Frog wetland and vegetated swale will be created on the property and protected as a First Party Offset Site. The Offset Site comprises:
  - **Growling Grass Frog wetland:** A purpose-built wetland that provides high-quality breeding habitat for the Growling Grass Frog. The wetland will be constructed in the south-western corner of the property, and will comprise an aquatic habitat zone surrounded by a terrestrial habitat zone.
  - **Vegetated swale:** The Growling Grass Frog wetland will connect to a vegetated swale extending along the western and northern boundary of the property. The vegetated swale will consist of terrestrial habitat, incorporating several ephemeral inline ponds, appropriate native vegetation, and habitat features designed specifically for Growling Grass Frog.
  - The Growling Grass Frog wetland and the southern extent of the vegetated swale will be constructed during Stage 1 of works. The northern extent of the vegetated swale will be constructed after the completion of Basin No. 3, in Stage 3 of works.
- **Overflow Detention Storage Basin:** The Overflow Detention Storage Basin is required to detain water in the event of an emergency discharge from Basin No,3, or to receive excess overland stormwater during a storm event. The Overflow Detention Storage Basin will not be protected as part of the Offset Site because it is an operational component of Basin No.3. However, it will be maintained as an open grassed area that can be used by Growling Grass Frog as secondary terrestrial habitat.

2.6 Staging of works

The Project will be split into three stages. Refer to Appendix 2.2 for the Tender Issue of the Stage 1 works drawings and the work in progress revision of the Stage 2 works site layouts. Works to be actioned in each stage are described below:

2.6.1 Stage 1

Stage 1 includes:

- Construction and establishment of the southern components of the **Offset Site**:
  - **Growling Grass Frog wetland**.
  - **Southern extent of the vegetated swale and an inline pond**.
- Construction of the **Overflow Detention Storage Basin** and embankment which separates the storage from the Growling Grass Frog wetland.

A **minimum establishment period of 12 months** is allowed to give the Growling Grass Frog wetland vegetation and habitat time to become ecologically established before relocating Growling Grass Frog from the Impact Site.

2.6.2 Stage 2

Stage 2 includes:

- Dewatering and removal of the borrow pit wetland (**the Impact Site**).
- Capture and relocation of the Growling Grass Frog from the **Impact Site** to the **Offset Site**.
- Construction of **Basin No.3**. This includes:
  - All bulk earthworks to regrade and remove fill material from inside the borrow pit in preparation for building the new earthen embankments of the new 100ML basin occupying the same footprint with site won or new engineered material fill prior to compaction. One of the embankments will sit hard up against the existing 56ML (Basin No.2) and share an embankment wall.
  - Construction of the new earthen embankments, base and wingwalls of the new 100ML storage basin. Post performance testing of the earthen embankments, the internal surface of the 100ML storage will be lined with a HDPE liner to prevent seepage, contamination and ensure sufficient operational volume can be achieved, before the cover (over high water mark) is placed.
  - Associated DN1800 mild steel cement lined (MSCL) pipework and associated valves, fittings, pits and control systems to provide operational control of treated water in and out from the basin.
- Minor regrading of swales and installing new subsurface pipes and pits to reroute site drainage lines to suit the removal of the borrow pit wetland and ensure overland flows reach the **Overflow Detention Storage Basin**.

2.6.3 Stage 3

Stage 3 includes**:**

- Construction and establishment of the northern component of the **Offset Site**:
  - **the northern extent of the vegetated swale and an inline pond**.

2.7 Timing of works

The appropriate timing and order of construction activities is essential to the success of the Project. The Offset Site must be constructed well before the excavation of the Impact Site to ensure that there is alternative Growling Grass Frog habitat available on site when the Impact Site is removed. The process is summarised in Table 1.

Table 1: Timing of works. Vertical green hatch indicates Growling Grass Frog activity season for relocation.

Year	Action	Duration	Start	End
	Pre-construction Phase:			
2026	A suitably qualified ecological restoration sub-contractor will be used for plant procurement in preparation of wetland planting.	0	Apr-26	Apr-26
	EPBC Act approval	1	Apr-26	Jun-26
	Civil contractor mobilisation on-site	0	Jul-26	Jul-26
	Stage 1:			
2026	Install temporary frog exclusion fencing (1) around Impact Site to prevent frogs from accessing construction site	1	Jul-26	Jul-26
	Civil construction of the Growling Grass Frog wetland, the Overflow Detention Storage Basin and the southern extent of the Vegetated Swale (approx. 3 months duration)	3	Jul-26	Sep-26
	Vegetation planting and habitat installation of the southern components of the Offset Site: the Growling Grass Frog wetland and the southern extent of the vegetated swale (*approx. 1 month duration*)	3	Sep-26	Dec-26
	Practical Completion of Stage 1A of Offset Site (see Section 3.2.4.1)	0	Dec-26	Dec-26
	Remove temporary frog exclusion fencing (1) from Impact Site to allow unrestricted movement between the Impact Site and the Offset Site	0	Dec-26	Dec-26
	Stage 2:			
2027	Assessment of Offset site to confirm whether it meets targets for Final Completion (min. 12 months after Practical Completion)	0	Dec-27	Dec-27
	Final Completion of Stage 1A Offset Site (see Section 3.2.4.2)	0	Dec-27	Dec-27
	Install temporary frog exclusion fencing (2) around Offset Site and overflow basin to prevent frogs from accessing construction site after relocation	0	Dec-27	Dec-27
	Growling Grass Frog relocation prior to Impact Site removal	0	Dec-27	Dec-27
	Growling Grass Frog relocation during Impact Site dewatering	1	Dec-27	Jan-28
2028	**Impact Site removal and GGF relocation**	1	Jan-28	Feb-28
	Basin No.3 and associated construction works commence (*approx. 14 months duration*)	18	Feb-28	Aug-29
2029	Install permanent exclusion fencing around Offset Site. Ensure fencing still allows free movement of frogs.	0	Aug-29	Aug-29
	Basin No.3 now complete and operational	0	Aug-29	Aug-29
	Stage 3:			
2029	Civil construction of the northern component of the Offset Site (the northern extent of the vegetated swale)	0	Feb-29	Feb-29
	Vegetation planting and habitat installation of the northern component of the Offset Site (the northern extent of the vegetated swale)	1	Aug-29	Sep-29
	Offset Site complete	0	Sep-29	Sep-29



2.8 Options assessment

The Project was unable to avoid impacts to the Impact Site. A 100ML storage is required at the Barwon Water Project site to allow Barwon Water to continue to reliably supply safe drinking water across its network to the Greater Geelong and Bellarine Peninsula region, with increasing population, climatic demands with obligations under the Safe Drinking Water Act. Alternative options to the proposed layout have been explored, and the following outlines key rationale for the chosen option.

- The chosen layout:
  - Protects drinking water quality. The layout allows a regular basin geometry, with the inlet and outlet at opposite ends. This allows for a consistent 'contact time' with sufficient log reduction to manage pathogen disinfection in the transfer network and basins.
  - Allows Basin No.3 to share an embankment and keyed into the 56ML basin (Basin No.2) and connect the new inlet and outlet pipework into the existing drinking water pipeline, ensuring adequate hydraulic flows to supply each basin. This allows for a more cost-effective design.
  - Is more conducive to the geomembrane liner and cover basin design. The regular geometry of the layout offers more effective and safer design, installation, operation and maintenance of the asset.
  - Has the most efficient cut and fill earthworks balance compared with all other alternatives, and more certainty in regard to useable onsite clay material for the embankment.
  - Allows the new wetland to be constructed adjacent to and work in conjunction with the site hydrology.
- The only remaining area within the Project site is located toward the western boundary and southwest corner. Alternative options in this area:
  - Still encroach on the existing borrow pit / wetland and would still require EPBC Act Referral and associated mitigation of the works.
  - Require irregular geometry to service the 100ML volume and create risk of stagnated water and inefficient mixing to maintain water quality, not in line with industry best practice.
  - Would change the hydrology of the site which would likely impact the current Growling Grass Frog wetland habitat suitability.
- No locations outside the Project site land parcel are technically feasible. In addition, any offsite location would require Translocation of the Growling Grass Frog further than 100m which is not currently supported in Victoria under the Threatened Fauna Translocation Evaluation Panel (TEP). Whilst Barwon Water has considered a third party offset site this does not align with the businesses values and would result in the loss of localised habitat for Growling Grass Frog.

Swapping the wetland and overflow detention storage could place the wetland further from Project site operation and maintenance works. This has not been progressed due to the following reasons:

- The Growling Grass Frog wetland needs to be to the east of the overflow detention storage (and adjacent to the western basin edges) because it the intent is for it to function in conjunction with the site drainage network. This arrangement could not service site stormwater requirements if the two asset layouts were swapped.
- The existing drainage pipework is intended to surcharge to the Growling Grass Frog wetland, which receives wet weather/ stormwater overland flows and retains a seasonal 'normal water level' within the wetland submergent zone. The standard operating conditions for the overflow detention storage is that it will run dry for much of the year and is expected to only be partially filled for a short duration a few times each year before it is directed out via the water cycle (evaporation, groundwater) or it gravitates to the wetland via the DN150 pipe. In extremely rare emergency events will the overflow detention basin be 100% full of water to the high-water mark.
- The overland detention basin will provide Growling Grass Frog secondary terrestrial habitat for foraging and refuge.

Temporary frog exclusion fencing 1:
To be installed prior to and
maintained during construction of GGF wetland and detention storage.

Overflow Detention Storage Basin

Eastern laydown overflow area, if required (during construction)

Site access for Stage 1 works

Site access for operations for Basin No.1 and No.2

DRAYTON ROAD

RESERVOIR ROAD

N

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ABN 47 065 475 149

0 25 50 75 100
Metres

Scale:1:2,400 @ A3
GDA2020 MGA Zone 55

LEGEND

- Site boundary
- Construction zone - early works
- Site compound stage 1 (and stockpile area)
- Won stockpiles stage 1 (if required)
- Temporary frog exclusion fencing 1
- No-go zone
- Constructed Swale Drain
- Semi-permanent connectivity waterbodies
- Maintanence tracks
- Overflow detention storage basin

Growling Grass Frog wetland (Stage 1)

- Submergent vegetation zone
- Emergent vegetation zone
- Terrestrial zone

Vegetated swale

- Terrestrial zone (stage 1)
- Not in scope for referral (Operational drinking water basins, to remain operational)

KEY MAP
1:1,800,000



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PROJECT:	Pettavel Basin Augmentation Project
PROJECT NO:	30049187
FIGURE NO:	1
FIGURE TITLE:	Stage 1 Construction Plan
CREATED BY:	RS17486
DATE:	29/05/2026
VERSION:	7



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0 20 40 60 80 100
Metres

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LEGEND

- Study Site
- Maintanance Tracks
- Temporary Construction Access Track
- Construction Works - Stage 2
- West laydown
- Site compound (temporary only)
- Wash-down bay and disinfection station
- Stockpiles
- Constructed Swale Drain
- Semi-permanent connectivity waterbodies
- Overflow Detention Storage Basin
- Aquatic/Emergent Vegetation Zones
- Basin no. 3
- Terrestrial Zone (Stage 3)
- Temporary frog exclusion fencing 2
- No-go fencing
- No-go zone
- Not in scope for referral (Operational drinking water basins, to remain operational)

KEY MAP
1:1,785,627



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PROJECT:	Pettavel Basin Augmentation Project
PROJECT NO:	30049187
FIGURE NO:	2
FIGURE TITLE:	Stage 2 Construction Plan
CREATED BY:	RS17486
DATE:	29/05/2026
VERSION:	7



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Meters

Scale:1:2,000 @ A3
GDA2020 MGA Zone 55

LEGEND

- Study Site
- Maintenance Tracks
- Overflow Detention Storage Basin (Stage 1)
- Basin No. 3 (Stage 2)

Growling Grass Frog wetland (Stage 1)

- Submergent Vegetation Zone
- Emergent Vegetation Zone
- Terrestrial Zone

Vegetated swales

- Terrestrial Zone (Stage 1)
- Terrestrial Zone (Stage 3)
- Constructed Swale Drain
- Semi-permanent connectivity waterbodies
- Frog Saunas
- Permanent frog exclusion (rabbit proof) fence
- Not in scope for referral (Operational drinking water basins, to remain operational)

KEY MAP



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PROJECT:	Pettavel Augmentation Project
PROJECT NO:	30049187
FIGURE NO:	3A
FIGURE TITLE:	Growling Grass Frog Proposed Offset Site Map
CREATED BY:	RS17486
DATE:	27/05/2026
VERSION:	7

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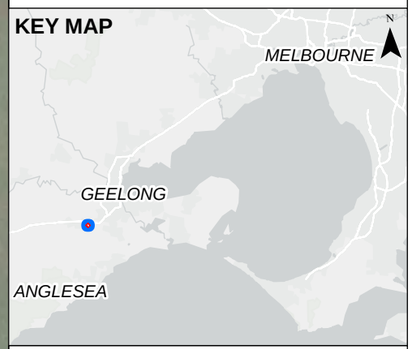
LEGEND

- Study Site

Growling Grass Frog Habitat Impacted

- Aquatic/Emergent Vegetation Zone
- Terrestrial Zone
- Not in scope for referral (Operational drinking water basins, to remain operational)

KEY MAP



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PROJECT:	Pettavel Augmentation Project
PROJECT NO:	30049187
FIGURE NO:	3B
FIGURE TITLE:	Growling Grass Frog Habitat Impact Map
CREATED BY:	RS17486
DATE:	27/05/2026
VERSION:	5

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3. Offset suitability

The following sections provide an overview of the habitat values to be removed by construction at the Impact Site and Offset Site.

3.1 Impact site

3.1.1 Site Description

The Project site was historically an open-air earthen reservoir storing raw water since the early 1920s. The earthen reservoir was drained sometime between 1992 and 1998 to transition the site to a potable water storage facility. Basin No.1 was constructed in 1998 before construction of Basin No.2 in 2014.

The walls of the two basins were constructed using site won soil and clay material excavated directly from an area behind the water basin, north of the site. This excavation left a residual hole that was never backfilled, known as a 'borrow pit'. With little disturbance in 20 years, the borrow pit has developed into a wetland system fringed with native vegetation. The Impact Site supports some native flora and fauna species, including a breeding population of the EPBC Act-listed Growling Grass Frog.

The remainder of the site is primarily mown pasture or introduced grasses, with planted pine trees along the western and northern boundary.

3.1.2 Growling Grass Frog habitat

The following describes the habitat identified and to be impacted for Growling Grass Frog (SMEC 2024a, 2024b).

3.1.2.1 Size

To calculate the extent of habitat at the Impact Site, a buffer was applied to the open water zone of the borrow pit wetland to encompass the planted acacia woodland. On the balance of initial findings (SMEC 2024a; SMEC 2024b), and secondary assessment (Wild Research Pty Ltd 2026), additional areas of potential shelter habitat were identified as providing potential habitat for Growling Grass Frog.

Overall, a total of **2.81 ha** of combined aquatic and terrestrial Growling Grass Frog habitat is proposed to be removed (Figure 3B), comprising:

- Aquatic habitat (**0.51 ha**):
  - An open water zone supporting submergent and floating vegetation.
  - An emergent littoral zone with fluctuating water levels supporting emergent and fringing aquatic vegetation.
- Terrestrial habitat (**2.3 ha**):
  - Terrestrial vegetation immediately surrounding the wetland in the form of planted acacia woodland and small areas of native and modified pasture grasses.
  - Native grassland and shelter habitat located in the understorey of the planted pine trees that lie to the north.

3.1.2.2 Aquatic vegetation

Aquatic vegetation within the Impact Site can be broadly described as a mosaic of Ecological Vegetation Classes (EVCs); Tall Marsh – Plains Sedgy Wetland, with patches of Tall Marsh characterised by tall (> 1 m high) emergent graminoids including Narrow-leaf Cumbungi (*Typha domingensis*), Tall Spike-rush (*Eleocharis sphacelata*) and River Club-sedge (*Schoenoplectus tabernaemontani*) often forming dense monoculture patches at the transitional zone between shallow and deeper water. In shallow regions, small aquatic graminoids and aquatic herbs were dominant with the dominant species being Small Spike-sedge (*Eleocharis acuta*) (SMEC 2024b).

A significant portion of the wetland (40%) comprises open water and also supports submerged vegetation such as Blunt Pond Weed (*Potamogeton ochreatus)*. Aquatic herbs such as Water-milfoil (*Myriophyllum crispatum*), Water Ribbons (*Cycnogetum procerum*), Creeping Brookweed (*Samolus repens*), Poison Lobelia (*Lobelia pratioides*) and Lesser Joyweed (*Alternanthera denticulata*) were also common, and extending to the margins. Weed cover was low with no aquatic weed species recorded. Despite the margins of the wetland often being comprised of bare ground only scattered annual weed species such as Hillmans Panic (*Panicum hillmanii*) and Rough Sow-thistle (*Sonchus asper*) were present (SMEC 2024b).

Aquatic vegetation provides a high cover of emergent vegetation but low levels of submerged and floating vegetation are present, and a medium overall average cover of aquatic vegetation. The Impact Site was estimated to provide a total mean aquatic vegetation of 36% cover, comprising 51% emergent, 50% submergent and 7% floating vegetation (SMEC 2024a; Heard *et al*. 2010).

3.1.2.3 Terrestrial vegetation and refuge

Acacia woodland

Terrestrial habitat beyond the margins of the wetland primarily comprises open bare ground and an understorey of modified pasture grasses scattered amongst a planted acacia woodland. The wetland edges are partially shaded by the adjacent acacia woodland, with average woodland vegetation ranging between 2-4 m in height. The planted acacia woodlands are considered to provide low-quality terrestrial habitat due to a lack of species preferred refuge habitats (i.e. rocks, logs and low growing tussock-forming vegetation). However, open areas may provide opportunistic foraging habitat for the species in areas void of vegetation. With the exception of modified pasture grasses within the planted acacia woodland, refuge habitat is more likely to be associated with the emergent littoral zone when water levels subside after summer (as observed during a site inspection in May 2024, see Appendix 3.2).

This area is included in the calculation of terrestrial habitat for Growling Grass Frog.

Modified pasture grasses

Vegetation surrounding the outer edge of planted acacia woodlands supports modified pasture grass areas that are regularly maintained by Barwon Water. It is assumed that Growling Grass Frog have the ability to forage around the edges of the wetland. However, the species was not observed using this habitat during targeted species surveys (SMEC 2024a).

This area is not included in the calculation of terrestrial habitat for Growling Grass Frog.

Planted pine trees

Planted pine trees line the boundary of the site to the north and west of the Impact Site. At their closest point the planted pine trees are approximately 38.5 m from the northern edge of the borrow pit wetland. Pine plantations provide poor habitat, with reduced invertebrate prey, simplified ground layers, limited understory, and low light, all of which constrain species diversity and reduce the likelihood that Growling Grass Frog rely on the area as habitat. Therefore, the pine trees themselves do not provide habitat for Growling Grass Frog. An independent review of the pine tree area by Wild Research (2026) agreed with this assessment, and states that for these reasons Growling Grass Frog are unlikely to preferentially use the planted pine tree area as terrestrial habitat, including for overwintering or foraging.

The planted pine trees themselves are not included in the calculation of terrestrial habitat for Growling Grass Frog. However, within the understorey of the planted pine area there is a swale drain, small patches of native grassland and shelter habitat. These are specifically addressed in the following sections.

Swale drain

A swale drain runs around the boundary of the site, offset at different points between approx. 5m to 15m off the existing property boundary fence line. The swale drain is unlikely to provide habitat (including overwintering habitat) for Growling Grass Frog because it is predominantly dry year-round (outside major rain events) due to bunding from overland flows along the northern edge and lacks aquatic vegetation or any suitable habitat features, such as logs, rocks, cracking soils or tussock grasses.

This area is not included in the calculation of terrestrial habitat for Growling Grass Frog.

Native grassland

Small patches of native grassland and scattered tussock grasses lie in the vicinity of and in the understorey of the pine trees. These areas are unlikely to provide habitat for Growling Grass Frog because grasses present are small, scattered *Rytidosperma* species with thin, sparse growth and low vegetative density. Their open structure provides little microclimatic buffering or thermal refuge and lacks the robust, tussock-forming structure typical of higher-quality tussock grasses such as *Poa*. Despite these areas being unlikely to provide habitat, Barwon Water have taken the conservative approach and included areas of native grasses in the calculation of terrestrial habitat for Growling Grass Frog.

This area is included in the calculation of terrestrial habitat for Growling Grass Frog.

Shelter habitat

The planted pine trees support some potential shelter habitat in the understorey. The independent review of the pine tree area (Wild Research 2026) found 33 potential shelter sites of varying quality for Growling Grass Frog in the form of fallen logs, branches and rocks, with eight of these determined to be moderate quality and the remainder lower quality. Eighteen of the sites were considered to be low or very low quality and less likely to be used. Whilst the review stated that the pine tree area as a whole is unlikely to be used by Growling Grass Frog, it concluded that occasional use of some shelter sites by Growling Grass Frog cannot be discounted, most likely the moderate quality sites during dispersals between the borrow pit wetland and neighbouring sites within 300 m to 500 m. Despite the majority of sites being very low or low quality, the independent review regardless recommended including all 33 sites plus a 5 m buffer around each site as terrestrial habitat for Growling Grass Frog, a total of 0.28 ha. Barwon Water have adopted this conservative approach and included all 33 sites in the calculation of terrestrial habitat impacted for Growling Grass Frog.

This area is included in the calculation of terrestrial habitat for Growling Grass Frog. Shelter habitat has been captured by buffering the discreet shelter points by 5 m and combining it with the understorey "native grassland" as mapped by SMEC (2024).

3.1.2.4 Invasive species

One introduced fish species, Eastern Gambusia (*Gambusia holbrooki*), was detected within the Impact Site (SMEC 2024a). Mosquito Fish is listed as a key threat to the species due to predation on Growling Grass Frog, (DCCEEW 2025). However, Growling Grass Frog can co-exist with high densities of Eastern Gambusia when adequate aquatic vegetation is present, suggesting that vegetation provides protection for the development of tadpoles as observed at the Impact Site.

European Rabbit (*Oryctolagus cuniculus*) warrens were identified throughout the understorey of the planted pine trees to the north of the Impact Site (SMEC 2024a).

3.1.2.5 Water Quality

Water quality parameters at the time of the original assessment as follows (SMEC 2024a):

- Temperature: 20.7°C
- PH: 8.5 (alkaline)
- NTU: 50.7 (low to moderate)

Water quality parameters will be reassessed prior to the removal of the borrow pit wetland.

3.1.2.6 Hydroperiod (0-3)

The Impact Site is a permanent wetland (score of 3), with expansion and reduction of shallow marsh areas during extended rainfall and/or extended high temperatures during summer (SMEC 2024a).

3.1.3 Connectivity

Overall, current connectivity at the Impact Site is constrained by the following factors:

- Isolation of wetlands beyond effective dispersal thresholds;
- Grazed terrestrial habitat lacking suitable refuges for overland dispersal;

- Surrounding roads, farmland, rail, and quarry operations acting as barriers; and
- Limited moist linear habitats in the form of waterways, drainage or swale drains.

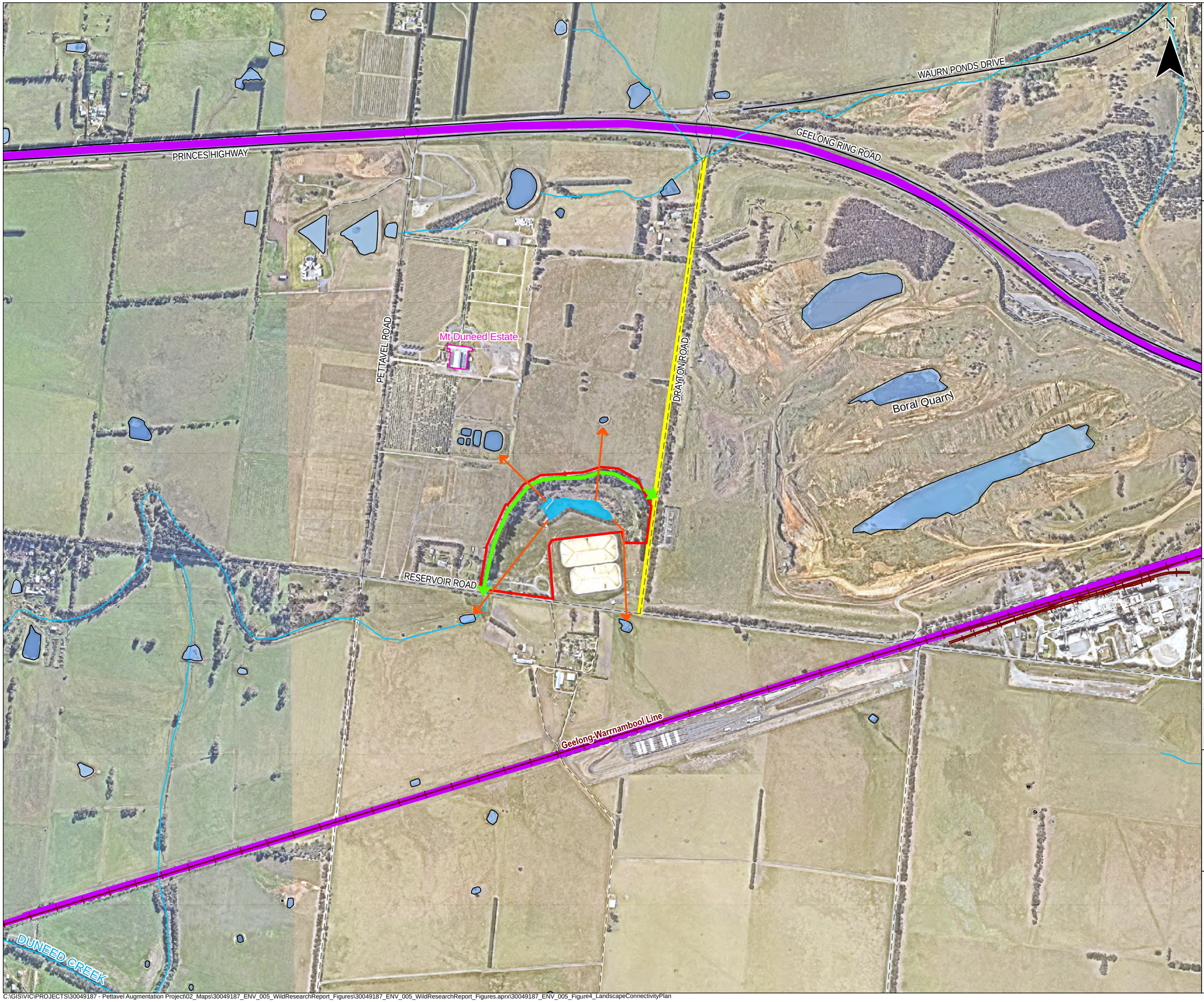
Growling Grass Frog occur as a classical metapopulation, where long-term persistence depends on a network of suitable wetlands that are close enough for individuals to disperse between them. This concept is described in both the Growling Grass Frog Conservation Advice (DCCEEW 2024) and Recovery Plan (DSE 2009), along with Heard *et al*. (2004; 2010) and Garvey (2022). Both Heard and Garvey demonstrate that connectivity is highly distance-limited: colonisation probabilities are highest when wetlands are within 200-300 m, decline rapidly beyond 300 m, and dispersal beyond 500 m is rare and usually contingent on high-quality terrestrial habitat. At landscape scales, interaction between wetland clusters becomes weak once they are separated by more than ~1 km (Heard 2012; Garvey 2022).

The Impact Site exhibits poor functional connectivity to adjoining wetlands in the local area. The nearest cluster of waterbodies lies approximately 220 m north-west of the site (see Figure 4), but there are no vegetated stepping-stone habitats or wildlife corridors linking the two areas. As a result, dispersal is limited to opportunistic overland movements during wet, suitable conditions (Figure 4).

This is further constrained by the heavily grazed paddocks immediately north of the Impact Site. Grazing removes tussock cover and low vegetation used as shelter and movement corridors, and it also reduces humidity at ground level and removes microhabitats required to regulate desiccation risk. Garvey (2022) specifically identifies the quality of the terrestrial matrix of grass cover, log refuges, moist microhabitats being a primary control on whether frogs attempt or succeed in dispersing between wetlands.

Multiple landscape-scale barriers are also identified as significant constraints in Garvey (2022) which compound these limitations. For example, surrounding agricultural land reduces permeability, with tracked farmland and slashed pastures shown in Garvey's behavioural datasets to substantially reduce frog movement rates. The Princes Highway (approximately 1 km north) is a four-lane road representing a near-total barrier, consistent with Garvey's finding that even two-lane sealed roads substantially reduce crossing success. To the south, the Geelong–Warrnambool railway (approximately 650 m) forms another barrier to dispersal, and to the east, the active quarry presents steep, unvegetated embankments and high operational noise, conditions that Garvey's movement modelling identified as highly avoidance-inducing. Together, these features isolate the Impact Site and reduce the likelihood of recolonisation from neighbouring subpopulations.

In this context, the vegetated verge along Draytons Road may represent one of the few semi-permeable movement corridors in the landscape. Garvey (2022) also found that frogs preferentially disperse along moist linear habitats with partial cover such as roadside swales, drainage depressions and grassy verges. This is because these features provide humidity, vegetation structure, and reduced predation risk. Garvey's habitat selection analyses show that eucalypt woodland and mixed native tree cover serve as important summer and overwintering refuges due to higher humidity, shade, stable microclimate and abundant shelter. The native woodland habitat east of the Impact Site along Draytons Road therefore represents a potential higher-quality dispersal, overwintering and terrestrial refuge area.



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LEGEND

- Study site
- Mt Duneed Estate
- Waterbodies
- Borrow pit wetland
- Stream
- Major road
- Minor road
- Rail line
- Improved connectivity to overwintering habitat in eucalyptus woodland along Draytons Road
- Major barriers to dispersal (Princes Hwy and Geelong-Warrnambool Railway)
- Potential opportunities for overland dispersal to nearby wetlands
- Improved connectivity (open swale drain)

KEY MAP
1:2,000,000



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PROJECT:	Pettavel Augmentation Project
PROJECT NO:	30049187
FIGURE NO:	4
FIGURE TITLE:	Landscape Connectivity Plan
CREATED BY:	RS17486
DATE:	27/05/2026
VERSION:	2

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3.2 Offset site

3.2.1 Description of the First Party Offset Site

To compensate for impacts to Growling Grass Frog, an Offset Site will be established on the property and protected as a First Party Offset Site.

The Offset Site will comprise a purpose-built **Growling Grass Frog wetland** and an associated **vegetated swale** designed to support breeding, refuge and dispersal habitat. A comparison of the habitat present within the Offset Site and Impact Site is provided on Figure 3A and Figure 3B, while Appendix 2 shows the proposed wetland design within the broader layout of Basin No. 3 and the Project site.

3.2.1.1 Size

The Offset Site will provide a total habitat area of **3.23 ha** (see Figure 3A), and includes:

- **Growling Grass Frog wetland**
  - *Aquatic habitat zone*: 0.63 ha.
  - *Terrestrial habitat zone*: 0.56 ha.
- **Vegetated swale**
  - *Total terrestrial habitat zone*: 2.04 ha.
  - *Southern extent (0.86 ha)*: constructed during Stage 1 of works, alongside construction of the Growling Grass Frog wetland.
  - *Northern extent (1.18 ha)*: constructed in Stage 3 of works, after completion of Basin No. 3.

3.2.1.2 Growling Grass Frog wetland

The Growling Grass Frog wetland is a purpose-built wetland that provides high-quality breeding habitat with carefully selected vegetation for the species to thrive. The wetland will be constructed in the south-western corner of the property, and will comprise an aquatic habitat zone surrounded by a terrestrial habitat zone.

The wetland design aligns as far as feasible with best practice design standards, primarily *Growling Grass Frog Habitat Design Standards: Melbourne Strategic Assessment* (DELWP 2017) and *Design, construction and establishment of constructed wetlands: design manual* (Melbourne Water 2017). The design standards are detailed in Section 3.2.2.

The wetland has been designed to maintain a permanent hydroperiod and submergent zone, ensuring sufficient water resources are available year-round to support the breeding of Growling Grass Frog. This is achieved by receiving runoff from the natural catchment, as well receiving the cover stormwater discharge from the nearby water storage basins. Refer to Section 3.2.5 for further information related to the hydrological management of the Growing Grass Frog wetland.

3.2.1.3 Vegetated swale

The Growling Grass Frog wetland will connect to a vegetated swale extending along the western and northern boundary of the property. The vegetated swale will consist entirely of terrestrial habitat, incorporating several ephemeral inline ponds, appropriate native vegetation, and habitat features designed specifically for Growling Grass Frog. An expert in Growling Grass Frog habitat will be engaged (by Barwon Water) to be available and guide best practice of the construction of the swale, localised semi-permanent water body and vegetation during construction works.

The vegetated swale and terrestrial habitat zone will enhance habitat connectivity across the site and provide refuge and overwintering habitat for frogs. The swale drain will create a vegetated, moist corridor facilitating movement from the Offset Site toward neighbouring sites and dams within 300 m of the property (Figure 4).

By enhancing humidity, providing vegetated cover, and establishing a continuous linear habitat feature, the vegetated swale will likely increase the probability that frogs can safely disperse between wetlands within the critical ≤300 m range, which may also improve broader metapopulation connectivity within 1 km.

The southern extent of the vegetated swale will be constructed during Stage 1 of works, alongside the construction of the new Growling Grass Frog (offset) wetland. The northern extent of the vegetated swale will be constructed in Stage 3 of works, after the completion of the new 100ML basin (Basin No. 3).

3.2.1.4 Other

The **Overflow Detention Storage Basin** will act as a secondary terrestrial buffer zone. While this area is not included within the Offset Site, it will support approximately 1.1 ha of secondary terrestrial habitat, which will be maintained as an open grassed area. The Overflow Detention Storage Basin cannot be utilised as an offset site because it forms an operational component of Basin No. 3 once constructed and will therefore be managed accordingly, including through regular mowing.

A **designated maintenance zone** will also be established outside the Offset Site. This area will consist of mown grass and will surround the terrestrial habitat zone along the western and southern perimeter fencing. The maintenance zone is intended to support fire safety management while maintaining access around the Offset Site (Figure 3A).

3.2.2 Offset Site habitat design

The Growling Grass Frog wetland will align as far as feasible with the best practice design standards, primarily *Growling Grass Frog Habitat Design Standards: Melbourne Strategic Assessment* (DELWP 2017) and *Design, construction and establishment of constructed wetlands: design manual* (Melbourne Water 2017), along with habitat requirements described in the Growling Grass Frog Conservation Advice (DCCEEW 2024) and Recovery Plan (DSE 2009). Table 2 summarises the Growling Grass Frog habitat design standards (DELWP 2017) and describes how the Offset Site design responds to those standards. A detailed landscape plan outlining the different habitat zones, flora species and planting densities is provided in Appendix 2.1 (Henry Landscape Design 2025).

A suitably qualified civil and planting contractor with experience in wetland creation will be responsible for constructing the Growling Grass Frog wetland. The planting of aquatic and terrestrial plants and habitat installation with oversight by a suitably qualified ecologist (engaged by Barwon Water). Barwon Water proposed to engage Wild Research (Dr. Matt West) as an independent adviser with experience in the creation of habitat for Growling Grass Frog to inspect and monitor planting works to ensure adherence to habitat creation best practices during construction works.

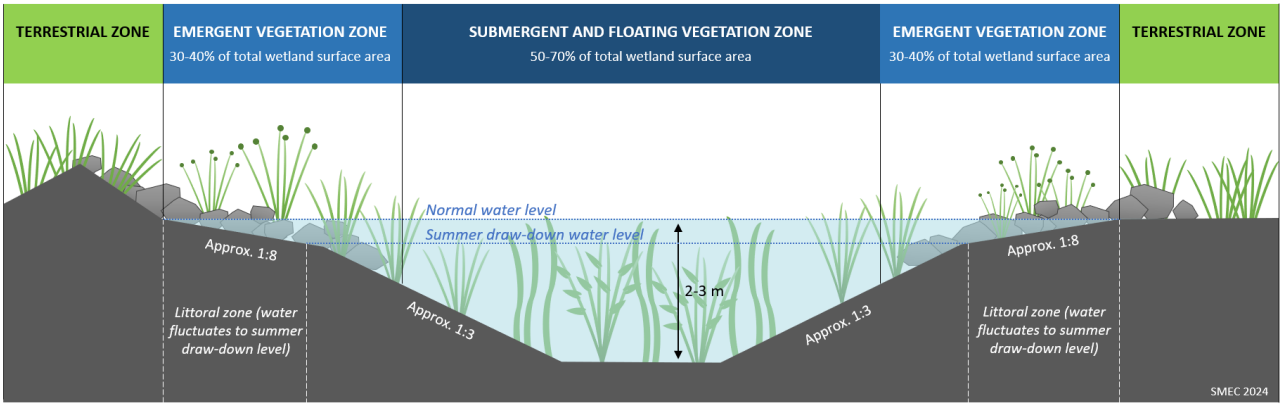
Table 2: Growling Grass Frog habitat design standards

Design feature	Summary of design standard (DELWP 2017)	Proposed Project design
Size	Constructed wetlands should be designed to be as large as is practicable taking into account the physical constraints of each site. The surface area of the wetland should be **at least 0.3 ha, preferably >0.7 ha**. Where space is limited the surface area can be reduced to 0.15 ha, however this is not ideal.	**Design meets DELWP (2017) standard** The proposed new wetland has total wetland surface area of 0.63 ha.
Shape	Wetlands should generally be shaped to **maximise the area of deep water** for submerged and floating vegetation, while providing extensive vegetated and/or rocky margins. Wetlands must be **wide enough to meet the required slope and depths**.	**Design meets DELWP (2017) standard** As shown in Figure 3A, the wetland is shaped to maximise the area of deep water.
Depth and gradient	Wetland must incorporate a variety of slopes and depths to achieve the following zones (Figure 6): **Submergent and floating vegetation zone:** • Water depth must be at least 1.5–2 m (greater depth is preferred if there is a risk that water levels will reduce significantly through summer). The excavated depth may need to be 3 m or more to	**Submergent and floating vegetation zone:** • **Design meets DELWP (2017) standard** • Water depth is at least 2m. • Slope approx. 1:3.

Design feature	Summary of design standard (DELWP 2017)	Proposed Project design
	ensure the water depth is maintained over time, to address sedimentation, evaporation, etc. • Slope approx. 1:3 to achieve appropriate depth. • Should constitute at least 50% (preferably 60–70%) of the total wetland surface area. Opportunities to provide rockery and basking habitat on the edge of this zone will be provided in this zone in consultation with a suitably qualified contractor.	• Submergent vegetation zone is 0.49 ha, constituting 77% of total wetland area.
	Emergent vegetation zone: • Includes a littoral zone with fluctuating water levels (i.e., dropping to summer draw-down level). This zone will include species refuge habitat (i.e. rocks, logs and vegetation). • Slope at bank approx. 1:8, increasing to approx. 1:3. Bank slope of 1:8 should be wide enough to accommodate the summer draw-down water level. • Should constitute approx. 30-40% of the total wetland surface area.	**Emergent vegetation zone:** • **Design meets DELWP (2017) standard** • Includes refuge habitat and fluctuating water levels. • This zone will include species refuge habitat (i.e. rocks, logs and vegetation). • Slope 1:8. • Emergent vegetation zone is 0.14 ha, constituting 22% of total wetland area. This total area would be approximately 30% when considering summer draw down levels within the emergent vegetation zone (Figure 6).
	Terrestrial zone: • Remains dry year-round.	**Terrestrial zone:** • **Design meets DELWP (2017) standard** • Terrestrial zone buffer surrounding the wetland, plus additional terrestrial habitat associated with the vegetated swale, designed to remain dry year-round with the exception of the two semi-permanent waterbodies. • Secondary terrestrial zone buffer associated with the overflow detention storage basin *(this is not included in the Offset Site)*.
Hydroperiod	Should have a permanent hydroperiod (i.e., maintains appropriate water depth year-round). At a minimum should hold appropriate water depth over the breeding season (September to February). *A permanent hydroperiod is important for a wetland constructed at Pettavel Basin as the wetland is isolated and there is no alternative habitat with a permanent hydroperiod in the local area.*	**Design meets DELWP (2017) standard** The wetland is expected to have a permanent hydroperiod. The proposed new wetland receives all site overland surface flows from north and west of the site. The Offset Site will maintain a permanent submergent zone at all times during the Growling Grass Frog breeding period (September-February). A hydrology assessment and sub catchment plan is provided in Appendix 2.
Wetland lining	Clay liner to prevent leakage. Topsoil to enable vegetation planting.	**Design meets DELWP (2017) standard** The proposed new wetland will have a clay liner placed and compacted in max. 150mm thick layers to achieve 98% MDD. Topsoil (min. 200mm thick) will be laid on top of the liner to enable vegetation planting.
Water source	A supply of suitable water (e.g., groundwater, treated stormwater, directed overland flows) must be identified to ensure appropriate water levels are maintained.	**Design meets DELWP (2017) standard** See information above about *Hydroperiod*. Water quality will meet standards required in the EPA Victoria Freshwater

Design feature	Summary of design standard (DELWP 2017)	Proposed Project design
	Water supply options must meet water quality standards in Table 2 of DELWP (2017) and must prevent the introduction of predatory exotic fish (such as Eastern Gambusia).	Environmental Quality Objectives (State Environment Protection Policy – Waters) to support healthy frog populations and their food base (EPA 2025).
Aquatic habitat	Wetlands must be vegetated with a variety of emergent, submergent and floating species. A suggested species list and planting densities is provided in DELWP (2017). Plants should be indigenous to the local area and where possible of local provenance. Planting density should result in establishment of dense (target 50%) cover of submergent/floating vegetation and patches of emergent vegetation. As a guide, planting densities to create patches of emergent vegetation are generally 4-6 plants per square metre. Planting densities for patches of submergent vegetation can be lower. Littoral and shallow water areas should include extensive rock piles. At least 20% of the perimeter of constructed wetlands should be rocky.	**Design meets DELWP (2017) standard** Species chosen for wetland plantings will be based on those noted in DELWP (2017) and as advised by Australian Ecosystems (2017; Appendix 2.1). Specific consideration will be given to the local conditions and plants local to the Geelong region, with plantings guided by qualified ecologists with specific expertise in wetland habitat establishment. A target of 50% planting density is included in the Completion Criteria for the Offset Site.
Terrestrial habitat	Terrestrial zone immediately surrounding the wetland should include extensive rock piles. At least 20% of the perimeter of constructed wetlands should be rocky. Vegetation within 10 m of wetland should be tussock-forming grasses and sedges. Plants should be indigenous to the local area and where possible of local provenance. Vegetation between 10-100 m of wetland should be short, mown grass with an open structure (e.g., 20% cover). The following buffers should be maintained: • Development (roads, buildings) should be >50 m from wetland. • Paths, recreation areas, minor infrastructure should be >30 m from the wetland. • No mulch within 50 m of the wetland. • No shrubs within 10 m of the wetland. Shrub cover of <10% within 100 m of wetland.	**Design meets DELWP (2017) standard** Design includes a terrestrial zone surrounding the wetland, plus an additional terrestrial zone associated with the vegetated swale (Figure 3A). The terrestrial zone will include rocks and tussock-forming grasses and sedges to meet the standard described in DELWP (2017). Vegetation associated with maintenance tracks along the western and eastern boundary fence and overflow detention storage basin will be kept short, and mown or slashed (when required). Areas surrounding the overflow detention storage basin to the south, north and west of the wetland will be planted with terrestrial zone habitats and will provide important terrestrial foraging and refuge habitat for the species (Figure 3A).

Figure 6: Growling Grass Frog habitat design (based on Figure 2 in DELWP 2017)



3.2.3 Offset Site establishment

The Growling Grass Frog wetland within the Offset Site is expected to reach Final Completion and be fully functional and able to be occupied by Growling Grass Frog within 12 months. The Growling Grass Frog wetland is expected to continue to mature and consolidate habitat components with active management, and a robust wetland system is anticipated within 4-5 years. Potential degradation will be addressed through active management during the first five years. By the end of this period, the wetland is expected to be robust and self-sustaining.

The presence of the existing wetland (Impact Site) is a testament to the ability of the site to support a self-sustaining artificial wetland. The Impact Site began as an excavation hole and gradually reached its current condition without any active management. The Offset Site will be purpose-built to support Growling Grass Frog, with active management measures in place, and is expected to deliver substantially higher habitat quality than the existing wetland. The local Growling Grass Frog population has demonstrated resilience, persisting in sub-optimal habitat and poor water quality, indicating a strong likelihood of successful establishment in the higher-quality Offset Site.

3.2.3.1 Wetland establishment

The following outlines the anticipated timeframes for the establishment of the constructed wetland.

Early Habitat Establishment (12 months):

Evidence from constructed wetland monitoring and technical guidance indicates that wetlands can achieve basic ecological functionality within 12 months of construction. Melbourne Water monitoring shows that substantial emergent vegetation establishment and hydrological function typically occur during the first year, with systems transitioning from engineered basins to vegetated wetlands well before the end of the formal two-year establishment period (Hatt, 2024). National and state guidance for treatment wetlands similarly identifies the first year as sufficient for initial vegetation establishment and stabilisation of core water quality processes, provided active management is undertaken (Queensland Government, 2026).

Medium-Term Establishment (Years 2-3):

By years two to three, constructed wetlands generally demonstrate increased vegetation cover, improved structural complexity, and more reliable water quality performance. Monitoring data from Victorian stormwater wetlands indicate continued vegetation infill and consolidation during the second year post-construction, with variability reducing as systems mature (Hatt, 2024). Water Sensitive Urban Design (WSUD) guidance identifies the first two years as the critical establishment phase, after which wetland vegetation communities become increasingly stable and less reliant on intensive intervention, supporting the expectation that wetlands are functionally established by years two to three (Government of South Australia, 2010).

Long-Term Consolidation (Years 4-5):

Long-term consolidation of constructed wetlands occurs over years four to five, as vegetation communities mature and ecological processes stabilise. Technical guidance consistently recognises that while wetlands become functional early, full ecological resilience develops over multiple years through succession and ongoing management (Government of South Australia, 2010). Continued maintenance during this period supports long-term water quality performance and habitat complexity, resulting in a robust and self-sustaining wetland system by years four to five (Queensland Government, 2026).

3.2.3.2 Growling Grass Frog colonisation of constructed wetlands

Appendix 6 provides a case study of the successful establishment of a Growling Grass Frog wetland in a short timeframe. The wetland was planted in September 2019, and plants were in an advanced state of establishment by April 2020 (information supplied by Australian Ecosystems).

The following are additional examples where Growling Grass Frog rapidly colonised constructed wetlands, often within one year of the completion of construction, demonstrating that purpose-built wetlands can provide suitable habitat for frogs within 12 months of construction:

- **Pakenham Bypass Wetlands, Pakenham, Victoria.** The wetlands were constructed around 2008–2009 and Growling Grass Frog was detected within ~1 year (2009/10) after completion. These purpose-built ponds varied in size and were designed as part of a regional strategy to support the species (EHP 2009).
- **Rockbank North Wetland, Kororoit Creek, Aintree Estate, Victoria.** The wetland was constructed in 2019–2020 and Growling Grass Frog was first found by spring 2020 (indicating colonisation within less than 1 year) with breeding recorded by February 2021(Renowden 2022; Healthy Waterways 2021).
- **Moomba Park Wetland, Fawkner, Victoria.** The wetland system was constructed from March 2021 with completion in May 2023 and Growling Grass Frog was detected breeding by February 2024, showing colonisation within under 1 year of completion (Sustainable Fawkner 2024; Climate Action Merribek 2023; MCMC 2025).
- **MSA Wetland Restoration Trial (Confidential site), Whittlesea, Victoria.** Hydrology was reinstated between Oct 2024–Mar 2025 and Growling Grass Frog was detected with 160+ individuals in late 2025, demonstrating colonisation within under 1 year of wetland water being restored (Melbourne Water 2025).

3.2.3.3 Responsibilities

The Offset Site will be constructed and vegetated by separate entities:

- The construction, vegetation planting and habitat establishment of the Growling Grass Frog Wetland and the terrestrial habitat zone immediately surrounding the wetland will be implemented by a suitably qualified ecological restoration sub-contractor in accordance with the *Growling Grass Frog Habitat Design Standards: Melbourne Strategic Assessment* (DELWP 2017), but will also comply with the *Aquatic Plant Supply Standard*' prepared by Melbourne Water (Melbourne Water 2025). The habitat design specifications and planting densities are provided within the detailed landscape plan (Henry Landscape Design 2025; Appendix 2.1).
- The construction, vegetation planting and habitat establishment of the terrestrial habitat zone associate with the swale will be undertaken by civil and planting contractors (engaged by Barwon Water) under the guidance of an independent expert to ensure best practices are being implemented and adhered to.

3.2.4 Offset Site completion

3.2.4.1 Practical Completion

Practical Completion of the Stage 1 components of the Offset Site is reached when construction of the Growling Grass Frog wetland and the southern extent of the vegetated swale is finished and all planting of habitat and vegetation has been completed. At this point, the wetland is structurally in place and ready to start the 12-month Early Habitat Establishment period.

3.2.4.2 Final Completion

Final Completion of the Stage 1 components of the Offset Site is achieved once the Growling Grass Frog wetland has undergone the Early Habitat Establishment period of 12 months following Practical Completion and meets the offset site completion criteria specified below. At this stage, the wetland is considered ecologically established and ready to support Growling Grass Frog.

Hold Point

The Stage 1 components of the Offset Site cannot reach Final Completion, and frogs cannot be introduced to the site until the Growling Grass Frog wetland has met the *Offset Site completion criteria* specified below.

The suitability of the Offset Site must be verified by a qualified ecologist with expertise in Growling Grass Frog (engaged by Barwon Water), who must attend site to physically examine the wetland against the *Offset Site completion criteria* for. If the Growling Grass Frog wetland meets the criteria, the ecologist will supply a letter report demonstrating that the Offset Site has met these targets, which is to be submitted to DCCEEW for approval before relocation can proceed.

3.2.4.3 Offset Site completion criteria

The following Offset Site completion criteria are the vegetation and habitat establishment targets used to determine whether the wetland is ready for frog introduction:

- **Aquatic vegetation:** Planting zone density will result in establishment of cover target of 50% for submergent / floating vegetation and patches of emergent vegetation (as per DELWP 2017 requirements for Aquatic Habitat) (Table 2).
- **Terrestrial vegetation:** Planting zone density will result in establishment of planting densities of terrestrial vegetation in accordance with Appendix 2.1(Henry Landscape Design 2025), and as per DELWP 2017 requirements for Terrestrial Habitat (Table 2).
- **Survival:** 80% survival for aquatic and terrestrial planted vegetation. Plants lost during the establishment period which impact on the cover of vegetation must be replaced by a suitably qualified ecological restoration sub-contractor under the guidance of Barwon Water.
- **Weeds:** <5% perennial weeds in the submergent and floating vegetation zone, emergent vegetation zone and terrestrial zones.
- **Hydrological Capacity:** Water depth, surface area and hydroperiod must match the breeding requirements of Growling Grass Frogs. It is expected given the ability to manipulate water levels (see Section3.2.5), that the wetland will sustain the wetland habitat submergent zone at all times to provide permanent inundation for breeding and tadpole development.
- **Water quality**: Water quality meets temperature, dissolved oxygen, conductivity, pH, turbidity and salinity and nutrient levels within the EPA Victoria Freshwater Environmental Quality Objectives (State Environment Protection Policy – Waters) to support healthy frog populations and their food base (EPA 2025). Water testing to be conducted by independent contractor and NATA accredited laboratory results submitted for review to ensure water quality is within the acceptable water quality thresholds.
- **Biological indicators**: Evidence of supporting biological indicators will also be considered prior to relocation of Growling Grass Frog, this may include but is not limited to the presence of locally common frog species and the presence of food sources (invertebrates and macroinvertebrates).
- **Predators and competitors**: Confirm absence of invasive fish species (i.e. Eastern Gambusia) and other aquatic or terrestrial predators that could significantly reduce egg or tadpole survival.
- **Human disturbance:** Demonstrate site security and a vegetated buffer managed to remove any human disturbance to protect water quality and habitat structure once planted and established.

3.2.5 Hydrological management

The Growling Grass Frog wetland (Offset Site) has been designed to be an integral part of the Project site drainage network (allowing surplus water from the Overflow Detention Basin or the basin covers to feed into the wetland)to maintain a permanent submergent zone at all times during the Growling Grass Frog breeding period (October-February).

This submergent zone of the wetland is expected to have a permanent hydroperiod which is directly comparable to the borrow pit wetland (Impact Site). The upstream swale modifications and site works that will be implemented to ensure the site hydrology is maximised is detailed below.

Site grading and timing:

- During Stage 1, localised grading will occur around the new Growling Grass Frog wetland and the Overflow Detention Storage Basin to prepare the wetland to receive clean surface water (overland) runoff.
- The remaining grading for Basin No.3 will only occur after the Offset Site has been established and the Growling Grass Frogs have been relocated.

- This staged approach ensures that the landform is shaped so water naturally flows downslope preferentially into the Growling Grass Frog wetland from surrounding areas with higher invert levels that are uphill.

Water sources supplying the wetland:

- Roof runoff from the basin covers: Rainfall runoff from the roofs of Basins No.1 and No.2, and later Basin No.3, will flow via gravity into the wetland and provide a reliable and clean primary water source.
- Potable (treated drinking) water: The Growling Grass Frog wetland can be connected via pipework to the mains water reticulation system just outside the property boundary, with the ability for potable water top-ups if the need arises. A spring-loaded hydrant will be in place to allow a new metered standpipe to be connected to fill the wetland via a lay flat pipe.
- Internal site drainage: Two inlet points will collect rain and surface runoff from the slopped embankments and internal drains and direct it into the new wetland. These will be constructed during Stage 1 so the wetland can begin receiving water immediately.
- Overflow Detention Storage Basin: The Overflow Detention Storage Basin will temporarily store water in the event of an emergency discharge (controlled release) from Basin No.3, as well as any excess overland flows during a storm event. The water is then released at a controlled, slowed rate into the wetland through pipework. This will provide steady supplementary inflows and prevent sudden high-flow impacts.
- Northern swale capturing hillside flows: An upgraded swale along the northern boundary will intercept natural overland flows from the slope above the Project site. This swale will direct water within the terrestrial habitat zone and into two small semi-permanent waterbodies, but does not connect directly to the Overflow Detention Storage Basin or the Growling Grass Frog wetland. The northern swale will eventually connect to the southern swale, will a grade and width that is similarly matched.

Water level management:

- The wetland outlet will be set at a pre-defined height to maintain a permanent shallow-water zone and regulate discharge so the wetland does not dry out during seasonal low-flow periods.
- Rip-rap and rock beaching will be installed where needed to slow fast-moving water and reduce erosion.

3.3 Offset Strategy

The strategy to offset the impacts of the Project involves the creation and protection of Growling Grass Frog habitat at a First Party Offset Site. The Offset Site will be of a similar size but contain higher quality habitat to that being removed from the Impact Site. This section provides details of the Impact Site, the suitability of the Offset Site and outlines EPBC Act Environmental Policy offset calculations for the impact and offset sites.

The EPBC Act Environmental Offsets Policy specifies a range of offset principles to guide the development of strategies to offset for residual impacts which are detailed below. An assessment of the Impact Site and Offset Site against the Environmental Offsets principles is provided in Appendix 4.

A summary of losses and offset targets to compensate for proposed impacts to Growling Grass Frog is provided in Table 3.

Table 3: Summary of losses and offsets associated with proposed impacts to Growling Grass Frog.

MNES	Habitat	Proposed impacts	Proposed offset	% of target met
Growling Grass Frog	Aquatic habitat	0.513 ha	0.63 ha	99.88%
	Terrestrial habitat	2.3 ha	2.6 ha	182.80%
Total		**2.81 ha**	**3.23 ha**	

3.3.1 Site security

The Offset Site will be managed for the purposes of conservation and will be protected under a Section 173 Agreement made pursuant to the *Planning and Environment Act 1987* and administered by the City of Greater Geelong Council (CoGG).

Table 4: Security and Management Responsibility

Offset Security and Management Responsibility	Details
Who is liable/responsible for meeting offset requirements?	Barwon Water
Type of security mechanism	Section 173 Agreement made pursuant to the *Planning and Environment Act 1987*
Agreement or Planning Permit Number (ID)	TBC
Date 10-year offset management to commence	Upon completion of construction of the Offset Site (Final Completion – see Section 3.2.4.2)
Date for targets and performance indicators within this management plan to be met	Five years following Final Completion of the Offset Site, or otherwise as specified within this plan (whichever occurs first)
Management of site following 5-year anniversary of this plan	Maintain habitat values at or above conditions achieved upon 5-year anniversary
Offset site management responsibility (i.e., Landowner, Authority Name)	Barwon Water
Offset Monitoring Responsibility (i.e., Responsible Authority)	Barwon Water

3.3.2 EPBC Act Environment Offsets Policy

The EPBC Act offset calculator was used to determine the extent and quality targets that the Offset Site must meet to adequately compensate for the proposed impacts. The assumptions that guide the inputs to the calculator are described in Table 5.

Table 5: EPBC Act Offset calculator

Criteria	Aquatic	Terrestrial	Guidance Notes
IMPACT SITE			
Area of impact (ha)	0.51	2.3	Total area (hectares) of aquatic and terrestrial Growling Grass Frog habitat proposed for removal. Total combined area is 2.81 hectares.
Quality (scale of 0 – 10)	6	3	Appendix 4.1 provides a detailed description of how the habitat quality score of the Impact Site was determined.
Total quantum of impact	0.31	0.69	*EPBC Act Offset Calculator output*
OFFSET SITE			
Offset area (ha)	0.63	2.6	The total area (hectares) of dedicated Growling Grass Frog habitat (ha) to be secured as a First Party Offset Site.
Time until ecological benefit	5	5	The Offset Site is expected to be fully functional and able to be occupied by Growling Grass Frog within less than 1-2 years.

Criteria	Aquatic	Terrestrial	Guidance Notes
			Appendix 6 provides a case study of the successful establishment of a Growling Grass Frog wetland within less than 1-2 years. However, a precautionary 5-year establishment period has been applied to the offset calculator to allow additional time for confirmation of establishment and any contingency works that may be deemed necessary to ensure aquatic and terrestrial zones are met to industry standards (DELWP 2017).
Time over which loss is averted	20	20	The offset is located on private property and protected in perpetuity.
Start quality (scale of 0 – 10)	0	0	The location for the Offset Site currently does not support any habitat for Growling Grass Frog. The proposed site comprises mowed pasture grass, herbaceous weeds and open areas of bare ground.
Future quality without offset	0	0	Without creation of a wetland and management as an Offset Site, the location for the Offset Site would continue to be mowed pasture grass that does not support habitat for Growling Grass Frog.
Future quality with offset	7	7	Appendix 4.1 provides a detailed description of how the habitat quality score of the Offset Site was determined.
Risk of loss (%) without offset	0%	0%	Without the creation of a new wetland and management as an Offset Site, the location for the Offset Site would either remain as-is or would be used for development and expansion of the Barwon Water facility.
Risk of loss (%) with offset	0%	0%	The EPBC Act offset for Growling Grass Frog will be secured on private land owned and managed by Barwon Water. The offset will be protected by permanent site fencing (around the site perimeter and internally) to remove accidental access to the wetland by site vehicles and personnel. With active management, monitoring and establishment of the wetland in accordance with this plan there is no risk that the offset will be lost in the future.
Confidence in results (start area)	70%	70%	There is a high level of confidence that the offset area will be met given the Offset Site will be implemented with detailed specifications by experts in wetland construction and management.
Confidence in results (ecological benefit)	70%	70%	Given the tested success of wetland establishment by an industry leading ecological restoration company, Australian Ecosystems (Appendix 6), and routine land management undertaken by the proponent (Barwon Water), there is a high-level of confidence the expected targets within this management plan will be met.
% of impact offset	**99.88%**	**182.80%**	

4. Offset Site Management

4.1 Roles and responsibilities

To ensure effective implementation of this management plan, the following responsibilities have been assigned to the key project personnel. It is essential that all personnel comply with the requirements of this management plan and all applicable environmental legislation, regulations, codes of practice and standards.

The responsibilities of the contractor **Project Manager** include (but are not limited to):

- Confirm with Barwon Water that all relevant environmental permits are obtained and in place for the Project;
- Ensure all relevant environmental permits are obtained for the Project;
- The Barwon Water accepted Site Environmental Plan (SEP) is adhered to and followed in accordance with Barwon Water contract requirements and polices.
- Barwon Water personnel will conduct regular inspections with the Project Manager to ensure compliance with permit conditions and project documentation.
- Investigate and report incidents and non-conformance and ensure corrective and preventive action is taken and is effective;
- Has the authority to stop a particular task or activity in circumstances of potential environmental harm or potential non-conformance with management plans as a result of Project works; and
- Reporting environmental incidents in a timely manner.

The responsibilities of the **Site Supervisor** include (but are not limited to):

- Provide site inductions (Principal Contractor and Barwon Water) and environmental awareness training to ensure all staff and contractors engaged to work on the Project are appropriately inducted and trained in the requirements of this management plan;
- Maintaining a register of all staff and contractors that have undertaken the inductions and environmental awareness training;
- Ensure all relevant environmental procedures are prepared, reviewed and approved, and fully accessible to staff, contractors and sub-contractors;
- Overseeing all environmental management aspects of the Project works;
- Being the primary contact for internal and external communication in relation to environmental matters; and
- Reporting environmental incidents and near misses to the Project Manager and Barwon Water in a timely manner.

The responsibilities of the **contractors** and **sub-contractors** include (but are not limited to):

- Meeting the objectives of the detailed Growling Grass Frog wetland design specifications outlined within Section 3 and presented in Appendix 2.1 (Henry Landscape Design 2025);
- Compliance with the requirements of this management plan;
- Coordination of site resources and personnel to implement the requirements of this management plan;
- Participation in pre-start site inductions and environmental training, regular toolbox meetings and refresher training, (as required by Barwon Water and the Principal Contractor; and
- Reporting any potential environmental non-compliance (incidents) or near misses to the Site Supervisor and Barwon Water in a timely manner.

4.2 Site induction

Site inductions must be completed to the satisfaction of Barwon Water prior to any construction works commencing on site. Daily pre-start toolboxes will be run before works commence each day to confirm all staff and site personnel are inducted to the site and understand the requirements of the Project.

All site personnel (including sub-contractors) are required to attend a compulsory site induction that includes an environmental component prior to commencing work on-site.

This is so all personnel involved in the Project are aware of sensitive environmental values present on site, specifically Growling Grass Frog and its habitat. Records of all environment inductions will be maintained and kept on-site. The Site Supervisor may authorise amendments to the induction at any time, as well as refresher training with Barwon Water to be notified. Permissible reasons to legitimise a change to the site induction includes a material change to the project scope, or legislative change, or as part of corrective actions following an incident.

4.3 Fencing and access

4.3.1 General

Temporary and permanent fencing must be installed to prevent human disturbance. Signage will be installed to provide a visual warning and to educate personnel on important species habitat. Fencing and signage will be maintained to prevent littering and unauthorised entry.

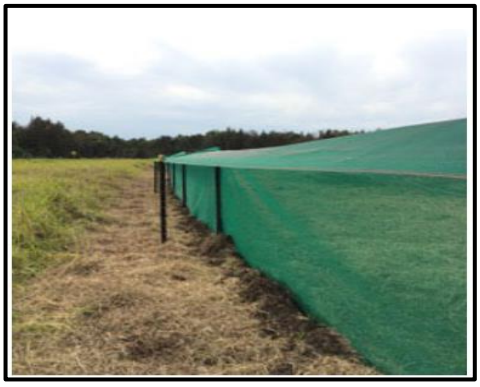


Image 2: Example of temporary frog fencing, Hindsite Siltation Solutions 2025).

4.3.2 Temporary frog exclusion fencing

Temporary frog exclusion fencing 1 must be installed around the Impact Site prior to construction of new Growling Grass Frog Offset Site and Overflow Detention Storage Basin to prevent fauna from accessing Stage 1 works (Figure 1).

A designated '*rest period'* where no temporary exclusion fencing between the Impact Site and Offset Site will be implemented during establishment of the wetland. This is designed to allow unrestricted movement between the Impact Site and Offset Site, and prior to dewatering and the capture and relocation of frogs by an Ecologist.

Temporary frog exclusion fencing 2 must be installed around the Offset Site and perimeter of the overflow basin after they have been constructed and prior to capture and relocation of frogs and borrow pit removal (Figure 2).

These two fencing requirements will be implemented to mitigate harm to frogs during the construction or removal of habitat associated. The following describes the requirements for frog fencing:

- Frog fencing must be at least 0.5 m high (up to 1 m where possible) and have an overhanging lip (between horizontal to 45° downwards) of at least 100 mm on the side facing the wetland, to prevent frogs from climbing over the fence.
- Star pickets with caps are installed at 3 m centres in two rows to create an overhang with three wire strands running through the star pickets.
- The bottom of the fence must be buried at least 100 mm into the soil.
- The frog fence must consist of a single piece of material from the top of the lip to the bottom of the buried section to ensure there are no holes through which frogs could pass.
- Temporary frog fencing must use standard sediment fencing (i.e. geotextile/silt fence).

4.3.3 Permanent exclusion fencing

Permanent ('rabbit proof') exclusion fencing must be installed at the completion of Stage 1 civil construction works around the newly constructed Growling Grass Frog wetland as per Figure 1. However, the aperture in the bottom 1/3 of the exclusion fence, must be modified to allow large female Growling Grass Frog passage once habitat establishment is complete, while continuing to support rabbit control measures. The permanent fence will remove direct internal access between the water supply basins and the new Growling Grass Frog wetland. Access for maintenance vehicles and site personnel will be through the separate dedicated site gates, one for the wetland and one for the water basins and around the outside perimeter of the offset site (Figure 1).



Image 3: Example of permanent fencing (All Seasons Fencing 2025).

The selected mesh wire material of the rabbit proof exclusion fence will allow movement by frogs but excludes entry by rabbits. The location for permanent fencing is also shown in Figure 2.

The following describes the requirements for permanent fencing:

- Permanent exclusion fencing will use an open rabbit proof mesh to a height of 1 m above ground level. The mesh to be secured to the DN100-150 treated pine stays, steel pickets complete with plastic end caps.
- The base of the fence will be anchored and/or buried to avoid rabbits digging under the fence. The 300mm mesh skirt will be pinned down close to the base of the fence.
- Frogs will be able to pass through the mesh wire and through modified openings (slots) every 10 to 20 metres along the mesh setback away from vegetation or structures on site. The setback is important as the fence must be avoided to minimise predators (i.e. feral or domestic cats) climbing over the fence:
  - Vegetation within one metre of the fence must be kept lower than 0.5 m in height. Only low-growing grasses will be planted at this location or ideally supporting no vegetation.
  - Structures or refugia (e.g. logs or rock piles) must be placed at least one metre away from the fence.
  - Litter or other debris caught in fencing will be removed as it could assist predators to climb over.
- Permanent fencing will be stand-alone.

4.4 Management of Chytrid fungus

Chytrid fungus poses a serious threat to frog populations, causing severe health issues. The risk of spreading the disease through movement of contaminated soil, water, or animals. Hygiene protocols, such as cleaning plant, vehicles, equipment, footwear and using gloves during the handling of Growling Grass Frog, must be enforced during all phases of construction and post-construction monitoring to minimise the potential risk of disease transmission.

Given the overall site works will be undertaken in an area with a known population of Growling Grass Frog, the potential for humans and associated equipment to aid in the transmission and spread of diseases, specifically Chytrid fungus (*Batrachochytrium dendrobatidis*), must be treated with appropriate caution. The following hygiene information has been developed using recommendations and associated reference documents (Phillott *et al*. 2010; Murray *et al*. 2011). The following hygiene precautions are required to minimise the possibility of transfer of disease from personnel, footwear, equipment and/or vehicles.

4.4.1 Training

All workers and sub-contractors must be fully committed to implementing the following controls. All workers and sub-contractors will undergo inductions and awareness training to ensure compliance with these protocols.

4.4.2 Sites and duration

All sites within the wetland must be treated individually with respect to hygiene protocols, the movement of personnel or equipment must implement the methods outlined below and applies during pre-construction, construction and site rehabilitation phases at each site. Wetlands or streams separated by dry land will be considered separate sites. Any obvious break, barrier or change in habitat must be treated as a separate site.

4.4.3 Soil and water

The availability of reticulated mains water for construction works is an appropriate measure to reduce the risk of chytrid transfer between sites. This will also apply to use of topsoil on site: any soil extracted must be re-used at the same site or removed completely. Any topsoil needed for landscaping works must be from a source free of chytrid fungus. Clothing and footwear

Staff and equipment must arrive on site at the commencement of works free of any soil or mud. This basic hygiene protocol must also be undertaken when travelling or relocating between sites. Hands, arms, knees etc. will be cleaned to remove debris and washed or wiped with a suitable disinfectant. The Principal Contractor's Management Plans will commit to abiding by this requirement with surveillance from Barwon Water.

All site personnel must clean and disinfect their footwear before entering and exiting each site at the boot-wash station. That is, direct removal of any soil and using a foot dip station soaked for 1 minute in water and disinfectant solution (1% bleach or 0.075% phytoclean) (Phillott *et al*. 2010; Murray *et al*. 2011). Footwear cleaning and biosecurity measures must be undertaken daily every time a person arrives or departs a site. Clothing that has significant contact with the environment must also be changed and cleaned before reuse at site (i.e. machine washed for 30 mins at 60°C).

4.4.4 Vehicles, plant and equipment

All vehicles, plant and equipment must be cleaned of all soil, vegetation and debris, and disinfected prior to entering and/or exiting site. Disinfection will include tracks or wheels, wheel arches and any other part of the vehicle that may come in contact with soil.

No construction machinery or site personnel are to enter site once established unless appropriate biosecurity measures have been implemented.

Once washed, vehicles will then be considered 'clean' for the duration of the works, if they leave then they will be required to re-wash on the next time of entry to the site (or between sites). Any equipment (tools) that are used must be wiped clean of any mud or soil and disinfected with water and disinfectant solution (1% bleach or 0.075% phytoclean) before starting at a given site (and cleaned again between sites). Disinfection must be carried out at a safe distance from water bodies to minimise the risk of chemical contamination.

The Principal Contractor's Management Plans will commit to abiding by this requirement with surveillance from Barwon Water.

4.4.5 Frog saunas

Additional chytrid preventative structures will be installed within the offset site through the creation of 'frog saunas' which are known to reduce chytrid risk and can also provide additional shelter for the species. These saunas use simple heat-retaining structures, such as black-painted masonry bricks or enclosed refuges under small greenhouse-style covers, which allow frogs to raise their body temperature above the thermal tolerance of the fungus. Studies have shown that warmer microhabitats can significantly reduce fungal infection loads and may improve immunity and survival in susceptible frog species (Tugwell 2026; Readfearn 2024). This work is highly relevant to Growling Grass Frog conservation and may provide future opportunities for disease management surrounding the Offset Site.

4.4.6 Records

All plant and vehicle wash-downs must be recorded in a wash-down logbook for compliance purposes. Regular compliance checks and spot checks for adherence to the above hygiene controls must be undertaken by the Site Supervisor, Environmental Manager or nominated site auditor.

4.5 Growling Grass Frog capture and relocation

The procedures for Growling Grass Frog capture and relocation are described below. Frogs will be captured in the **Impact Site** (the borrow pit wetland) and relocated to the **Offset Site** (the Growling Grass Frog wetland).

4.5.1 Before–After Impact Study (BAIS)

Following further consultation between Barwon Water and Wild Research Pty Ltd, a Before–After Impact Study (BAIS) was identified as a suitable additional study to increase the opportunities presented by the creation of a new Growling Grass Frog wetland (Wild Research Pty Ltd 2026). In addition to the presence-absence survey described above, the BAIS study will include genetic sampling or marking of individuals to assess population size, genetic diversity and population connectivity before and after construction. This will also assist with monitoring the effectiveness of the Offset Site, site usage and breeding success by Growling Grass Frog over time.

Given this study will require detailed planning discussions, the BAIS is proposed to be a condition of approval and will be planned and agreed upon with Barwon Water, DEECA and DCCEEW prior to the relocation of Growling Grass Frog into the Offset Site. This will be undertaken under appropriate research and animal ethics permits and must be implemented by an independent Growling Grass Frog expert and biostatistician to ensure the program is scientifically robust and capable of detecting population responses over time.

4.5.2 Capture and release requirements

The following actions must be undertaken prior to any capture and relocation activities:

- The suitability of the Offset Site to support Growling Grass Frog must first be verified by a suitably qualified ecologist before any capture and relocation of Growling Grass Frog can proceed. Section 3.2.4.3 details the completion criteria and targets for Growling Grass Frog habitat and water quality in the new wetland that must be met before frogs can be relocated there.
- Obtain necessary permits and approvals:
  - Approval to capture, collect and relocate Growling Grass Frog will be required from the Department of Energy, Environment and Climate Action (DEECA) under the Victorian *Wildlife Act 1975*.
  - DEECA must be informed at least three business days prior to the translocation of Growling Grass Frog.

4.5.3 Capture, hold and release procedures

The following capture, hold and release procedures must be followed at all times during the capture and relocation of Growling Grass Frog. This may also be applied to construction personnel where Growling Grass Frog are detected incidentally during construction works within the construction zone:

- Capture and relocation must be undertaken by a suitably qualified and experienced ecologist when present on site (i.e. during scheduled capture and relocation events, refer to Section 4.5 in full).
- The ecologist will actively search soil, vegetation and other ground debris (e.g. rocks and logs). Any frogs found will be captured by hand.
- Single-use gloves will be used for all frogs to prevent the transfer or pathogens during capture and handling.
- Captured frogs must be held in secure containers or plastic sample bags with adequate air supply for as short a period as possible.
- Captured frogs must be re-located as soon as possible to the recipient wetland. As only on-site relocation will be undertaken, frogs will then be transported on foot in their container or sample bags to the recipient wetland.
- Frogs must be released into suitable habitat in the recipient wetland margins, within or adjacent to sheltering habitat such as dense vegetation, rocks or logs.

- All frogs will be visually monitored after release to ensure that they do not show signs of stress or injury. If individuals show such signs, they will continue to be monitored until adequate recovery is evident. If recovery does not become apparent the individual may be re-captured and transported to a veterinarian or wildlife carer for further assessment.
- Conservation dogs may be used for the detection of Growling Grass Frog where feasible. Where a frog is detected by a conservation dog, it will be captured by hand by a suitably qualified ecologist. Any proposed use of conservation dogs will be undertaken in consultation with DEECA and DCCEEW prior to implementation. If an ecologist is not present on site (i.e. incidental finding of a Growling Grass Frog during construction works), the Site Supervisor, Barwon Water and project ecologist must be notified to confirm the species identification and recommended next steps with lines of communication established to notify the nominated ecologist.
- All site sheds will contain a species fact sheet and suitable equipment to handle and relocate frogs in accordance with best practice hygiene protocols (Murray *et al*. 2011).

4.5.4 Capture and relocation prior to Impact Site removal

The following describes the capture and relocation actions that must be undertaken prior to the removal of habitat:

- The capture, hold and release procedures described in Section 4.5.3 must be followed at all times.
- To ensure the safe relocation of as many frogs as possible, the preliminary capture and relocation of Growling Grass Frog must be undertaken during the active period of Growling Grass Frog, and approximately two weeks prior to the scheduled removal of the source habitat.
- Three days must be spent looking for and capturing adult and sub-adult frogs within the Impact Site. Each survey will be conducted for a minimum of 90 minutes and occur when the temperature is above 13ºC and preferably within 24 hours of rain. The survey must consist of nocturnal spotlight searches and daytime searches of habitat and shelter sites (e.g., under dense vegetation, under logs and rocks).
- Immediately following the above relocation actions (i.e., within 24 hours), the Impact Site must be dewatered to capture any remaining individuals.

4.5.5 Capture and relocation during Impact Site dewatering

The following describes the capture and relocation actions that must be undertaken during dewatering of the Impact Site:

- Wetland dewatering of the Impact Site must be undertaken immediately after capture and relocation has been completed (Section 4.5.3).
- Prior to commencement of dewatering, appropriate water filters must be fitted to the hoses to prevent aquatic fauna, including frogs, tadpoles and fish, from being sucked up. This could be a mesh placed over or around the water pump inlet and/or hose to effectively exclude fauna.
- Where possible, water will be extracted from close to the water's surface and at least 5 m away from submerged aquatic vegetation to reduce the likelihood of fauna being extracted into the pump.
- The depth of the wetland must be lowered in stages (approx. 15 cm increments). At each stage, the ecologist will actively search soil, vegetation and other ground debris to capture frogs and other fauna, and will use a dip net to capture aquatic fauna as the water is reduced. The ecologist will complete a final rigorous search once the wetland is empty.
- Dewatering must cease when frogs and/or tadpoles are detected and only commence after capture by a qualified ecologist.
- Once empty, the wetland must be left for two weeks before habitat can be removed. This will give remaining fauna an opportunity to self-relocate.
- If rains partially refill the wetland, the water must be immediately pumped out. If the substrate beneath the wetland is permeable soils, an excavator on bog mats can be used dig or scrape a hole at the wetland's deepest point to breach the clay liner, enabling rainwater to drain into the ground.

- The capture, hold and release procedures described in Section 4.5.3 must be followed at all times.

4.5.6 Capture and relocation during Impact Site removal

The following describes the actions that must be undertaken during the removal of the Impact Site, which includes the borrow pit wetland (Impact Site) and any vegetation within 30 m of the wetland:

- The removal of the habitat must be undertaken no less than two weeks after wetland dewatering.
- The vegetation and topsoil must be carefully removed by an excavator operator who will be briefed by the ecologists on salvage methods. The excavation of the wetland will involve removing terrestrial habitat in the following stages:
  - Prior to commencement of excavation, the ecologist will actively search soil, vegetation and other ground debris (e.g. rocks and logs) for frogs and other fauna.
  - The excavator will scrape the vegetation such that plants are uprooted, enabling the ecologist to search for frogs at the base of plants. The excavator will lift any large rocks and/or logs surrounding the wetland, allowing the ecologist to conduct a thorough search beneath these refugia.
  - The excavator will then scrape the topsoil to a depth of approximately 30 cm, with the ecologist observing closely for excavated or disturbed frogs. The excavator will spread or sprinkle the excavated material in an adjacent area to allow the ecologist to search for frogs in the material. Bog mats will be used underneath the excavator tracks to avoid the excavator sinking into the soft soil and becoming bogged.
  - If removal of habitat is expected to take more than one day, a search of habitat and stockpiles will be undertaken each morning before excavation of vegetation and topsoil removal begins.
- Excavation must cease when frogs and/or tadpoles are detected and only commence after capture by a qualified ecologist.
- The capture, hold and release procedures described in Section 4.5.3 must be followed at all times.

4.6 Artificial filling and dewatering of wetland

4.6.1 Filling

Artificial filling of the wetland will only be required for the following scenarios:

- Initial Growling Grass Frog wetland fill.
- Maintaining a permanent submergent zone at all times during the Growling Grass Frog breeding period (September-February). The associated internal Project site and external catchment diversions into the wetland can only be completed following construction of Basin No.3.
- Extreme dry periods, although this is considered unlikely given the Impact Site has never been witnessed to be dry.

The new Growling Grass Frog wetland is proposed directly west of the existing water retaining basins (No. 1, No.2 and No.3) at the Project site. Barwon Water can provide a temporary connection from the pressurised water main via a spring hydrant as required for any of the above three scenarios. The water quality of this supply is drinking water quality and considered suitable for the new Growling Grass Frog Offset Site. Chlorine residual within the drinking water supply is not expected to exceed 0.2 mg/L which is not considered to be a health issue for the Growling Grass Frog. Barwon Water has the option to implement additional controls to reduce the chlorine residual even lower, if required.

4.6.2 Dewatering

Dewatering of the Growling Grass Frog wetland will be avoided wherever possible. However, it will be required in the following scenarios:

- For wetland maintenance to remove the build-up of solids/silt from the base at 10 -15 year intervals, if required.

- In severe cases of contamination.
- Based on the advice of an ecologist if the wetland is not functioning as intended.

This could be achieved by the following options:

- Desludging pump arrangement set up on the wetland bank to drain down and excavate solids (this method would be used if predatory fish such as Eastern Gambusia were confirmed to be impacted populations of Growling Grass Frog).
- Floating desludging arrangements are becoming more common to removal solids from earthen storages without completely dewatering the storage.

A suitably qualified ecologist must be engaged at the time to manage protection of the Growling Grass Frog so that capture and relocation measures can be implemented in accordance with Section 4.5.3 (if necessary).

If draining the Growling Grass Frog wetland (Offset Site) is deemed necessary, this must be implemented during the Growling Grass Frog inactive period (June-August). The wetland must then be manually refilled prior to commencement of the species core breeding period (October- February). This purpose of this timing is to reduce potential impacts on the Growling Grass Frog breeding season, and to avoid direct impacts on tadpoles and metamorphs.

4.7 Weed management

Weed management within the Offset Site is important to ensure that the Growling Grass Frog habitat maintains the characteristics necessary to support the population. Excessive weed growth has the potential to reduce habitat quality through smothering aquatic vegetation, limiting dispersal opportunities, reducing basking and refuge habitat, and altering wetland hydrology and water quality. Weed invasion may also inhibit the establishment and persistence of indigenous vegetation required to support breeding, foraging and sheltering habitat for Growling Grass Frog.

Weed management within the site will be undertaken by suitably qualified personnel from Barwon Water's Barwon Asset Solutions (BAS) team, or an approved contractor under the direction of BAS, with experience in environmentally sensitive weed control techniques within wetland environments. Weed management activities will be undertaken bi-annually throughout the construction phase and Years 1-5 of the Project and on at least an annual basis for the following ten (10) years. All weed management during the five (5) year monitoring period will be undertaken in consultation with a project ecologist and suitably qualified ecological restoration sub-contractor (as relevant to different construction stages) to identify any threatening weeds that may be emerging.

As the Offset Site is a future Barwon Water asset, all future weed management beyond the five (5) year monitoring period will be managed by BAS, or an approved contractor under the direction of BAS. Therefore, a site-specific Weed Management Plan is not proposed and reference to Sections 6.6 and 6.7 within Barwon Water's Environmental Handbook (2026) will be adhered to during all stages of the project life cycle in addition to the controls noted below.

Several techniques can be used to manage weeds including physical removal, brush cutting and herbicide application. BAS, or an approved contractor under the direction of BAS, will implement all weed management, especially for areas within 30 m of the Offset Site. The specialist must have a clear understanding of the sensitivity of the Offset Site to ensure there are no inadvertent impacts.

Weed management must be undertaken throughout the construction phase of the Project and on at least an annual basis for the following ten (10) years.

The following controls apply to all on-site weed management:

- Weed management must be undertaken throughout the Offset Site, with particular attention given to vegetated areas that are not subject to routine maintenance.
- Routine slashing (monthly) must be undertaken during daylight hours to keep the Overflow Detention Storage Basin maintained to the required standard (i.e. short mown grass).
- Any weed control works must be completed in a manner that minimises soil disturbance.
- Herbicide use must be minimised to avoid adverse effects on frogs and invertebrates.

- Where herbicide application is necessary, waterway sensitive products such as Roundup Bioactive®, Weedmaster Duo® or Weedmaster 360® must be employed, without the addition of surfactant.
- Where herbicides are used, selective application is preferable to broad area application.
- Ensure that any weed control works using herbicides are both targeted (i.e. spot spraying) and undertaken at the right time of the year to manage the relevant weed species.
- Non-residual herbicides must not be used.

The following species are particularly vigorous natives that ***must not*** be introduced into the Offset Site to avoid the wetland becoming choked with vegetation: Narrowleaf Cumbungi (*Typha domingensis*), Broadleaf Cumbungi (*Typha orientalis*), Common Reed (*Phragmites australis*) and Tall Spike-rush (*Eleocharis sphacelate*). If these species are detected within the Offset Site, then Barwon Water must be notified, and a specialist contractor must be engaged to remove these species. A suitably qualified ecologist must be notified prior to removal so that appropriate Growling Grass Frog capture and relocation activities can be implemented if deemed necessary.

4.8 Pest animal management

In accordance with the principles and management objectives outlined in the Barwon Water's Environmental Handbook (2026), the management of terrestrial pest animals within the broader Pettavel site will be important to minimise disturbance, predation pressure and habitat degradation within areas retained and created for the Offset Site. Pest animal impacts may include grazing and degradation of vegetation, soil disturbance, increased erosion, and direct predation on frogs and dispersing individuals.

Pest animal management activities within the site will also be coordinated by BAS, who maintain the operational capability and resources to undertake pest animal control and land management activities across the broader Barwon Water landholding.

BAS will implement the following management measures as required:

- Undertake bi-annual inspections during the construction phase and Years 1-5 of the Project and on at least an annual basis for the following ten (10) years for evidence of pest animal activity, including; burrows, scat, tracks, grazing and digging disturbance;
- Maintenance of fencing and exclusion infrastructure to minimise unauthorised access by pest species;
- Undertake targeted pest animal control where monitoring identifies ongoing habitat degradation or predation risk is identified;
- Management of excessive burrowing, grazing or trampling impacts affecting revegetation success or refuge habitat quality;
- Waste and litter management practices to avoid attracting pest species into habitat areas; and,
- Rehabilitation and revegetation of disturbed areas where pest animal impacts are identified within the five-year monitoring period.

All pest animal management works undertaken within or adjacent to Growling Grass Frog habitat will be planned and implemented to avoid unnecessary disturbance to frogs, refuge habitat and dispersal corridors. Monitoring outcomes will inform adaptive management responses within the five-year monitoring period, in which additional control measures can be applied where pest animal impacts are identified as compromising habitat condition or the long-term viability of the Growling Grass Frog population.

4.9 Chemical spills, erosion and sedimentation

Chemical management, erosion and sedimentation controls will be managed and monitored during construction in accordance with a site-specific Project Management Plan (PMP) developed by the Principal Contractor, vetted and accepted by Barwon Water. Corrective actions of any spill will involve a Spill Kit being deployed immediately before the spill being cleaned up by the Principal Contractor. Drainage points will be inspected to prevent chemical influx.

4.10 Management post-construction

The following general actions must be undertaken post-construction:

- Implement any post-construction actions as identified within the site-specific CEMP (SMEC 2025).
- Weed management must be undertaken throughout the construction phase of the Project and on at least an annual basis for the following ten (10) years (Section 4.7). This includes routine slashing (monthly) undertaken during daylight hours to keep the Overflow Detention Storage Basin maintained to the required standard (i.e. short mown grass).
- Disturbed areas are to be reinstated to their pre-construction condition, except for water bodies that will be permanently removed. Highly degraded and weedy sites do not need to be reinstated.
- Remove temporary frog fencing and install permanent exclusion fencing as specified.
- Implement habitat and species monitoring and associated reporting over five (5) years as per Section 1 below.
- Monitor for incidental evidence of predators, pest animals plant and weeds and apply adaptive management as outlined in Section 5.6 below.
- Undertake any recommended contingency management actions identified during habitat and species monitoring in accordance with Section 5.6 below.

4.11 Management Actions

A summary of the management actions to be implemented as part of this Growling Grass Frog Offset and Management Plan is provided in Appendix 5. These actions represent the minimum management, monitoring and adaptive management requirements to be undertaken for the Offset Site over a minimum period of ten (10) years and are considered necessary to establish, maintain and protect suitable habitat values for Growling Grass Frog.

5. Monitoring and reporting

Monitoring and management of the constructed wetland must be undertaken to ensure that habitat remains suitable for Growling Grass Frog. Once the wetland has been constructed and vegetation has been established after five-years, it is expected that the wetland will be largely self-sufficient.

Reports must be completed and submitted to the City of Greater Geelong Council, Barwon Water and DCCEEW within six (6) weeks of the associated monitoring event.

5.1 Vegetation, habitat and water quality

5.1.1 Monitoring

Vegetation, habitat and water quality monitoring will be a key component to the successful implementation of this management plan. Accordingly, the following vegetation, habitat and water quality monitoring schedule will be undertaken:

- **Practical Completion:** Vegetation, habitat and water quality will be assessed by a suitably qualified ecological restoration sub-contractor immediately after conclusion of Practical Completion construction works.
- **Final Completion:** Vegetation, habitat and water quality will be assessed by a suitably qualified ecological restoration sub-contractor immediately after conclusion of Final Completion of construction works. The Offset Site must also be assessed against the *Offset Site completion criteria* (Section 3.2.4.3) to confirm whether the site has reached Final Completion. Frogs cannot be introduced to the Offset Site until it has met the *Offset Site completion criteria*. The suitability of the Offset Site must be verified by a qualified ecologist, and a letter report demonstrating that the Offset Site has met these targets must be submitted to DCCEEW for approval before frog relocation can proceed.
- **Baseline (Year 0):** Findings from the Final Completion assessment (above) will establish the baseline (Year 0) measurements.
- **Years 1-2:** Year 1 of vegetation, habitat and water quality monitoring begins when the Offset Site reaches Practical Completion (and therefore overlaps with the establishment period required to achieve Final Completion). Monitoring is required every **three months** during the first two years to ensure successful establishment of the wetland habitat and vegetation. Habitat monitoring will include regular reports to Barwon Water for any vegetation loss and plant cover recorded. Plants lost during this period which impact on the cover of vegetation must be replaced. Monitoring in Years 1-2 will be undertaken by a suitably qualified ecological restoration sub-contractor and Barwon Water to ensure the objective of the landscape plan have been accomplished.
- **Year 3:** Monitoring every **six months** will be undertaken to track progress of the wetland and ensure that vegetation is maintaining necessary densities. Monitoring will be undertaken by the Barwon Asset Solutions' (subsidiary of Barwon Water) horticultural team, who have experience in vegetation establishment and are familiar with the habitat requirements of Growling Grass Frog, along with further consultation with a Growling Grass Frog expert to ensure Growling Grass Frog best practice is achieved.
- **Years 4-5:** Monitoring **annually** will be undertaken to ensure the habitat continues to meet the needs of the Growling Grass Frog population and maintains long-term viability. Monitoring will be undertaken by the Barwon Asset Solutions' horticultural team.

  Each vegetation, habitat and water quality monitoring event will include the following assessments:

- **Vegetation cover:** Measure and record the percent cover (%) of both aquatic and terrestrial vegetation, referencing target goals outlined in the landscape plan (Henry Landscape Design 2025; Appendix 2.1).
- **Revegetation success:** Document the success of plantings, noting any failed vegetation that requires replanting or additional intervention.

- **Weed presence:** Identify both exotic and native weedy species that could threaten the habitat, particularly species such as Common Reed (*Phragmites australis*) and bulrushes (*Typha* spp.), which could dominate the wetland.
- **Pest animals:** Identify the presence of pest animal species that could threaten habitat quality and/or species long-term occupancy within the Offset Site.
- **Water quality:** Measure and record the parameters associated with the EPA Victoria Freshwater Environmental Quality Objectives (temperature, pH, turbidity, salinity, nutrients, dissolved oxygen).
- **Fencing:** Inspect for defects or holes and ensure fencing functions as intended.
- **Site photographs:** Capture images from fixed locations to document habitat changes over time.

5.1.2 Reporting

The outcomes of vegetation, habitat and water quality monitoring must be supplied as follows:

- **Practical Completion:** A letter report summarising the wetland establishment process and the outcome of the vegetation, habitat and water quality monitoring. This will include photographs of the process and the completed wetland and habitat.
- **Final Completion:** A letter report summarising the outcome of vegetation, habitat and water quality monitoring, and demonstrating that the Offset Site has met Final Completion targets (Section 3.2.4.3), must be submitted to DCCEEW for approval before frog relocation can proceed.
- **Baseline (Year 0):** The letter report from the Final Completion assessment (above) will provide the findings for the baseline (Year 0) assessment.
- **Years 1-3:** A letter report must be supplied after each habitat monitoring event in Years 1-3. Findings must also be summarised in the Annual Report (Section 5.3).
- **Years 4-5:** An annual summary of habitat and water quality monitoring must be supplied in the Annual Report (Section 5.3).

The reports must summarise findings of vegetation, habitat and water quality monitoring and provide management action recommendations such as:

- Any water quality recommendations.
- Additional revegetation or replanting where needed.
- Weed control to manage invasive species.
- Biomass reduction if vegetation density becomes too high.
- Other habitat rectifications to ensure optimal conditions for the Growling Grass Frog.

5.2 Growling Grass Frog

5.2.1 Monitoring

Growling Grass Frog population monitoring in conjunction with habitat monitoring post-construction will ensure species' habitat remains suitable to which population levels are stable or improving. Any detected declines or habitat degradation will trigger review of contingency management actions as outlined in Section 5 below.

Growling Grass Frog monitoring must be undertaken by a qualified ecologist as follows:

- **Baseline (Year 0):** Growling Grass Frog monitoring must be undertaken in the weeks following Growling Grass Frog relocation to monitor the early establishment of the population. A nocturnal survey must be undertaken weekly for the first month following relocation, then every 2 weeks in the second month (total of 6 surveys). Diurnal and recruitment surveys are not required. Timing can be slightly varied to ensure appropriate weather conditions and seasonality for all surveys.

- **Years 1-5:** Growling Grass Frog monitoring must occur **annually** for the first five (5) years post-construction of the Offset Site. Annual monitoring includes one diurnal survey, two nocturnal surveys and one recruitment survey following the methods described below.

Survey method must be in accordance with *Survey Guidelines for Australia's threatened frogs - Guidelines for detecting frogs listed as threatened under the EPBC Act 1999* (Commonwealth of Australia, 2010) and the *Significant Impact guidelines for the vulnerable Growling Grass Frog*.

Conservation dogs may be used for the detection of Growling Grass Frog where feasible. Where a frog is detected by a conservation dog, it will be captured by hand by a suitably qualified ecologist. Any proposed use of conservation dogs will be undertaken in consultation with DEECA and DCCEEW prior to implementation.

Each monitoring event must include diurnal, nocturnal and recruitment surveys as follows:

- **Diurnal surveys** will include the following:
  - Undertake a detailed habitat assessment in accordance with Appendix 3.1 to measure overall habitat quality and attributes important to the species ecology (aquatic vegetation cover, water quality, disturbance signs, etc.).
  - Active searching for species activity and usage of the offset site in areas of terrestrial and aquatic habitat within the waterbody and areas located within the temporary frog fencing or permanent exclusion fencing (depending on the timing of surveys).
  - Dip netting for tadpoles and predatory fish (see below).
- **Nocturnal surveys** must include the following:
  - Record data in accordance with Appendix 3.2.
  - Four nights per monitoring event.
  - October/November: 2 x 60 minute surveys using call playback and active searching around waterbody.
  - January/February: 2 x 60 minute surveys using dip netting for tadpoles/metamorphs and active searching for sub-adults.
- **Recruitment monitoring** must be undertaken in January annually for the first five (5) years, using collapsible bait traps (set for two nights per event), or dip netting where males are calling. This can be undertaken with January nocturnal surveys.

5.2.2 Reporting

The outcomes of Growling Grass Frog monitoring must be supplied as follows:

- **Baseline (Year 0):** A letter report summarising the findings of the baseline assessments must be provided at completion of the baseline monitoring. These findings will establish the baseline (Year 0) measurements.
- **Year 1-5:** The outcome of Growling Grass Frog monitoring must be provided as part of the Annual Report.

5.3 Annual report

An annual report must be submitted to the City of Greater Geelong Council, Barwon Water and DCCEEW within three (3) months of completing each annual monitoring event.

The annual report will be prepared outlining the combined results of all vegetation, habitat, water quality and Growling Grass Frog monitoring results. The timing of the first annual report will be such that it encompasses all Year 1 monitoring outcomes (i.e. it is to be submitted after completion of the Year 1 Growling Grass Frog monitoring which is the last sequential monitoring event).

The annual report will include, but is not limited to the following recommended content:

Introduction & Objectives

- Outline purpose of monitoring (compliance, species protection, habitat suitability).
- Reference the Growling Grass Frog Management Plan requirements and EPBC Act conditions of approval.

Methods

- Habitat assessments (vegetation cover, weed control, hydrology, water quality, fencing).
- Growling Grass Frog monitoring requirements for diurnal, nocturnal, species recruitment monitoring.
- Risk assessment observations (aligned with Section 4.1.4 threat categories and Section 5 below).

Results

- Habitat suitability: vegetation structure, water depth, water quality.
- Vegetation establishment: % native cover, % weeds, success of replanting.
- Species monitoring: number of Growling Grass Frog observed (adults, sub-adults, tadpoles), calling activity, recruitment evidence.
- Threats recorded: disease, predation, invasive species, weed dominance, water quality risks.
- Site security and other matters: fencing, illegal ingress, contaminants, rubbish.

Comparison Against Monitoring Targets

- Evaluate results against the defined performance targets (see below in Section 3.3.5).

Risk Assessment Outcomes

- Summarise threats detected and their assigned risk rating (likelihood × consequence).
- Identify whether risks increased/decreased from previous year.

Contingency Management Actions

- Note any corrective actions triggered (e.g. weed control, replanting, predator management).
- Timeline for implementing actions.

Conclusions and Recommendations

- Overall habitat suitability and population trajectory (stable/improving/declining).
- Recommendations for adaptive management.

Supporting information

- Appendices, datasheets, photographs, maps, raw monitoring data.

5.4 Audit

An independent audit of compliance with this plan will be carried out at the end of Year 1, Year 3 and Year 5.

The auditor will be independent from both Barwon Water and the ecologist(s) responsible for carrying out the monitoring.

5.5 Summary of monitoring and reporting

A summary of all monitoring and reporting requirements is provided in Table 6.

Table 6: Summary of monitoring and reporting requirements

Actions	Milestone	Monitoring	Reporting *
Vegetation, habitat and water quality	*Practical Completion:*	Assessment immediately after conclusion of Practical Completion construction works (Section 3.2.4.1).	Letter report.
	Final Completion:	Assessment immediately after conclusion of Final Completion construction works (Section 3.2.4.2).	Letter report. Must be submitted to the City of Greater Geelong Council, Barwon Water and DCCEEW for approval before frog relocation can proceed.
	Baseline (Year 0):	As per Final Completion.	Concurrent with letter report for Final Completion.
	Year 1 & 2:	Every 3 months.	Letter report after each monitoring event.
	Year 3:	Every 6 months.	Letter report after each monitoring event.
	Year 4 & 5:	Annual.	Annual
Growling Grass Frog population	*Baseline (Year 0):*	Weekly for the first month following relocation, then every 2 weeks in the second month. Timing can be slightly varied to ensure appropriate weather conditions and seasonality for all surveys.	Letter report at completion of baseline monitoring.
	Year 1 to 5:	Nocturnal surveys for adult frogs in Oct/Nov and Jan/Feb. Recruitment survey for tadpoles in Jan.	Annual
Annual report	*Year 1 to 5:*	N/A	Annual
Audit	*Year 1 to 5:*	N/A	Annual

Notes: Reports must be completed and submitted to City of Greater Geelong, Barwon Water and DCCEEW within six (6) weeks of the associated monitoring event.

5.6 Contingency and adaptive management

Based on the results provided within each monitoring report, the land manager must implement any recommended contingency management actions to maintain optimal habitat conditions for Growling Grass Frog and associated habitat. This structured monitoring ensures that the constructed wetland will continue to support the species, meeting both short-term establishment goals and long-term habitat sustainability. This section outlines adaptive management strategies to maintain and protect Growling Grass Frog habitat during and after construction activities are completed.

The following summary Table 7 details the monitoring targets to inform contingency management.

Table 7: Monitoring targets to inform contingency management.

Monitoring Component	Monitoring Method	Frequency	Target / Performance Criteria	Management Response if Target not met
Vegetation	Habitat assessment (diurnal)	**Years 1–2:** Every 3 months. **Year 3:** Every 6 months. **Years 4–5:** Annual.	Maintain 50% density target for aquatic vegetation zones only (DELWP 2017). Maintain 80% survival rate for all planted vegetation within each zone (aquatic + terrestrial zones) by 12 months and 24 months post-planting. Maintain ≤5% perennial weed cover.	If planting survival rate is <80% and/or weeds >5%, replanting and/or weed control required. Weed control, including selective herbicide application suitable for wetland habitats and physical removal by a suitably qualified contractor, and will be conducted to prevent degradation of frog habitats. Monitoring and native vegetation re-establishment will follow any weed control efforts in response to the two-year establishment period and designated habitat monitoring events in Years 3-5. Vegetation degradation or dieback may require increased monitoring depending on assessment by a suitably qualified ecological restoration sub-contractor, and dead vegetation replaced to maintain high quality Growling Grass Frog terrestrial and aquatic habitats.
Habitat Features	Habitat assessment (diurnal)	Annually	Diverse aquatic and terrestrial habitat structure: submerged, emergent, and floating vegetation present; rock/log refuges installed and maintained	Replace failed plantings, add refuge structures if absent. Maintenance of wetlands will continue regularly to ensure habitat remains suitable for the species. This includes removing predatory fish, controlling weeds, maintaining water levels and maintaining high water quality. Degradation can occur due to lack of maintenance, erosion, pollution, or weed encroachment. Maintenance procedures will include erosion control, removal of rubbish, and increasing monitoring to prevent habitat degradation.
Habitat Hydrology	Habitat assessment (diurnal)	Annually (spring/ summer)	Maintain a permanent submergent zone at all times during the Growling Grass Frog breeding period (October-February)	Water levels are to be maintained at the summer draw down period (Figure 5). Additional water to be added if required during monitoring events if necessary to maintain suitable breeding and recruitment habitat for the species. If wetland dewatering is deemed necessary, follow dewatering procedures in Section 4.6.
Water Quality	Habitat assessment (diurnal) using hand-held	Annually	Meets EPA Victoria Freshwater Environmental Quality Objectives (temperature, pH, turbidity, salinity, nutrients, dissolved oxygen)	If water quality parameters are outside the Target thresholds, or if water is contaminated by accident, the source of the contaminant must be identified and removed as a priority. Appropriate actions must then be taken to rectify the contamination with advice from an expert in wetlands and water quality.

Monitoring Component	Monitoring Method	Frequency	Target / Performance Criteria	Management Response if Target not met
	water quality meter			This will include adjusting inflow rates to the wetland or adding additional controls to improve quality of overland flows reaching the wetland. If wetland dewatering is deemed necessary, follow dewatering procedures in Section 4.6.
Growling Grass Frog Monitoring – Adults	Diurnal active searches and nocturnal call playback surveys	Annually	Stable or increasing Growling Grass Frog population detected	Frog populations may naturally fluctuate and/or may be affected directly by predation, construction activities and unauthorised access by site vehicles or personnel. If a population decline is detected that is unlikely to be a natural fluctuation, the cause of the decline must be immediately investigated and remedial actions implemented. Barwon Water will engage an expert in Growling Grass Frog if a notable population change is detected to provided further advice and help to identify possible cause of population change. Depending on the cause of the decline, remedial actions could include more active habitat improvements, improving work method practices, capture and relocation measures, additional habitat features, increase control of predators or augmenting vegetation. This will include and liaison with DEECA and/or DCCEEW as necessary. Remedial actions will be based on the outcomes of species and habitat monitoring and following the advice of an ecologist.
Growling Grass Frog Monitoring – Recruitment	Dip-netting, bait traps, nocturnal surveys	Annually (January to February)	Evidence of successful breeding (tadpoles, metamorphs) each year	As above. If no recruitment is detected for >2 years, escalate management response. This will include liaison with DEECA and/or DCCEEW as necessary and may include an independent Growling Grass Frog expert and statistician (if required).
Growling Grass Frog Monitoring - Genetics	Genetic sampling in accordance with appropriate animal ethics	As required	To maintain and/or improve genetic diversity within the Offset Site	If deemed appropriate and in consultation with DCCEEW and Growling Grass Frog experts, undertake genetic sampling before and after construction to assess genetic diversity, detect potential changes in gene flow, and inform future management interventions (if required).

Monitoring Component	Monitoring Method	Frequency	Target / Performance Criteria	Management Response if Target not met
	and permit approvals			
Predators & Invasive Species	Dip-netting, spotlighting, incidental records	Annually	No Eastern Gambusia, Red Fox, feral cat, or other key predator impacts	If detected, initiate control program (hydrological management, fish removal, pest animal control). In cases of possible pest fish introduction (e.g., Eastern Gambusia) that is deemed to be impacting Growling grass Frog breeding and recruitment, wetland dewatering will be recommended by an ecologist. If wetland dewatering is deemed necessary, follow dewatering procedures in Section 4.6.
Fencing / Site Security	Habitat assessment (diurnal)	Annually (or opportunistically during other surveys)	Frog exclusion fencing intact; no breaches or defects	Repair or replace fencing if defective within 2 weeks of detecting the defect.
Other (e.g. chemical spills, erosion, sediment control)	As per site-specific CEMP (SMEC 2025)	As per site-specific CEMP (SMEC 2025)	As per site-specific CEMP (SMEC 2025)	Other construction management matters will be monitored managed in accordance with a site-specific CEMP (SMEC 2025).
Risk Assessment	Review risks during habitat assessment (diurnal / nocturnal)	Annually	Refer to Section 5.6 and Section 6	If risks escalate, implement corrective actions within agreed timelines

6. Risk Assessment

The following section outlines the key threat principals identified for Growling Grass Frog (DELWP 2017), the potential impact to the species and an overall risk assessment score allocated to each threat. Details of the risk assessment are primarily focussed on threats that are applicable to the Project, with contingency measures and monitoring outlined within this management plan aimed to mitigate such threats, to enable adaptation to evolving risks and ensure effective management in the long-term.

6.1 Risk Matrix Definitions

The following risk matrix definitions have been used to define ratings for known and/or potential threats to Growling Grass Frog as part of the Project.

6.1.1 Likelihood

This represents the probability or chance that a specific event (threat) will occur (Table 8), as follows:

- **Almost Certain (5):** The event is expected to occur in most circumstances.
- **Likely (4):** The event will probably occur in most circumstances.
- **Possible (3):** The event might occur at some point.
- **Unlikely (2):** The event could occur but is improbable.
- **Rare (1):** The event is highly unlikely to occur but is still possible.

6.1.2 Consequence

This represents the severity of the event (threat) on the species or its habitat (Table 8), as follows:

- **Negligible (1):** Minimal or no impact on the species or ecosystem.
- **Minor (2):** Low-level impact, may cause some disruption but species can recover without significant long-term effects.
- **Moderate (3):** Noticeable impact, may affect population numbers or habitat quality, but recovery is possible with some intervention.
- **High (4):** Serious impact, with likely long-term effects on the population or habitat that require significant recovery actions.
- **Major (5)**: Catastrophic impact, with a risk of population collapse or severe, irreparable habitat damage.

Table 8: Risk matrix table

RISK MATRIX			CONSEQUENCE				
			Negligible	Minor	Moderate	High	Major
			1	2	3	4	5
LIKELIHOOD	5	Almost Certain	Moderate	High	High	Major	Major
	4	Likely	Minor	Moderate	High	Major	Major
	3	Possible	Minor	Moderate	High	High	High
	2	Unlikely	Negligible	Minor	Moderate	Moderate	High
	1	Rare	Negligible	Negligible	Minor	Minor	Moderate

6.1.3 Overall Risk Rating

The matrix intersects likelihood and consequence to provide the following risk levels (Table 8):

- **Negligible (Green):** Very low risk, no action needed.
- **Minor/Moderate (Green/Yellow):** Low to moderate risk, requires monitoring and possibly some mitigation actions.
- **High (Orange):** Significant risk, requires active management and mitigation strategies.
- **Major (Red):** Critical risk, immediate and intensive intervention required to prevent population or habitat loss.

6.1.4 Risk Assessment

The risk assessment aims to assess and prioritise the various threats associated with Growling Grass Frog as part of the Project (Table 9). Based on likelihood and consequence, certain threats such as habitat loss and disease present High Risks, requiring immediate and intensive conservation measures. Alternatively, risks such as human disturbance are Minor and can be managed through localised management. This structured approach ensures that resources are directed toward the most pressing threats for effective species management. A summary of these is provided below in Table 9.

Table 9: Summary or risk assessment results

Threats	Impact to species	Contingency planning	L	C	Risk Rating
Relocation	• The Growling Grass Frog does not establish a breeding population within the offset site	• Capture and relocation measures implemented by suitably qualified ecologists (see Section 4.5.3) • The Growling Grass Frog population and habitat will be closely monitored, particularly during the first two years following relocation. If monitoring indicates that population establishment or habitat condition is not meeting performance expectations, stringent habitat replacement and improvement measures will be implemented in accordance with Section 5.6.	3	5	**High**
Habitat Loss	• Direct habitat loss through construction, draining wetlands and filling of natural habitat.	• Direct habitat loss will be replaced by a newly constructed high-quality Growling Grass Frog wetland (Offset Site) in accordance with industry standards (see Section 3.2).	5	3	**High**
Disease	• Infection by the chytrid fungus causes illness and death and may be spread by machinery, light vehicles or site personnel.	• The management of chytrid fungus during construction will follow the guidelines identified in Section 4.4.	3	4	**High**

Threats	Impact to species	Contingency planning	L	C	Risk Rating
Population decline	• Risk of decline to the abundance of Growling Grass Frog and an important population. • Risk of genetic population decline as a result of poor breeding success and/or a lack of breeding with meta-populations within adjoining populations.	• Growling Grass Frog wetland in accordance with industry standards (see Section 3.2). • Habitat establishment and species monitoring will be undertaken for the first five years following construction of the wetland. • Capture and relocation measures implemented by suitably qualified ecologists (see Section 4.5.3). • Option to monitor reproductive success of the population in the new wetland using a BAIS. • If required, consider introduction of new individuals in consultation with DEECA, DCCEEW and an independent Growling Grass Frog expert with relevant approvals.	3	3	**High**
Mortality during construction	• Direct mortality of Growling Grass Frog during construction can impact the abundance of an important population on site.	• Construction will be undertaken in three controlled stages with appropriate mitigation measures to minimise the risk of mortality during construction. This will be integrated with designated frog fencing and capture and relocation measures implemented by suitably qualified ecologists (see Section 4.5.6).	3	3	**High**
Predation	• Introduced fish and mammal species (Eastern Gambusia, Red Fox and feral Cat) may prey on the species. • Direct mortality of Growling Grass Frog during construction can impact the abundance of an important population on site.	• The management of predation will be informed by monitoring guidelines and contingency management measures provided in Section 5.6.	3	3	**High**
Hydrology / water quality	• Wetland dry over summer can reduce breeding activity. • Alterations to water levels and flow patterns impacting	• Hydrology will be maintained to a high standard (i.e. potable water) and will maintain the high-water level at all times by direct pumping from adjoining treatment	2	3	**Moderate**

Threats	Impact to species	Contingency planning	L	C	Risk Rating
	aquatic vegetation and breeding activity. • Contaminants, turbidity, pesticides and heavy metals can degrade water quality and may impact adults, tadpoles and aquatic vegetation.	basins. The wetland also has the ability to be drained empty for maintenance or removal of exotic fish species such as Eastern Gambusia (see Section 3.2.5). The wetland will maintain a permanent submergent zone at all times during the Growling Grass Frog breeding period (October-February).			
Dense vegetation cover / shadowing	• Dense or tall terrestrial plants near wetlands can impact the suitability of frog habitat by shading or limiting refuge habitat. • Clearing or excessive vegetation growth due to nutrient changes may affect species habitat. • Vegetation growth can overshadow wetlands and reduce sunlight reaching pools and aquatic vegetation zones.	• Growling Grass Frog habitat will be made to industry standards to ensure that suitable flora species are planted in the wetland zone outlined in Section 3.2 (Table 2). • Regular surveillance and periodic maintenance by qualified contractor will ensure the aquatic plants are inspected and managed as required.	2	3	**Moderate**
Chemical spills	• Construction activities pose the risk of chemical spills in proximity to Growling Grass Frog habitats.	• Mitigation measures, including storage locations, refuelling requirements and emergency response requirement (i.e. spill kits) will be outlined within a site-specific CEMP (SMEC 2025).	2	3	**Moderate**
Weeds	• Increased weed species has the potential to alter preferred flora species compositions within and adjoining the wetland. • Modification and degradation of habitat may result from increased weed cover.	• The management of pest plants and animals will be outlined within a site-specific CEMP. • Predation will be managed in accordance with monitoring guidelines and contingency management measures provided in Section 5.6.	2	3	**Moderate**
Access / House keeping	• Rubbish encroachment has the ability to decrease habitat quality and allow animals to exit fenced areas if not managed appropriately. • Access by site personnel has the potential to cause accidental mortality of Growling Grass Frog or	• Access to the newly constructed wetland will be managed by exclusion fencing and educational signage (see Section 4.3). • Routine maintenance and monitoring will ensure rubbish is managed by construction sub-contractor	3	2	**Moderate**

Threats	Impact to species	Contingency planning	L	C	Risk Rating
	modification of suitable habitat.	and within the constructed wetland area.			
Erosion / sedimentation	• Reduced water quality and degradation of aquatic vegetation that may lead to a decrease in breeding and recruitment.	• There is no anticipated erosion or sedimentation risk associated with the newly construction wetland once established. Frog exclusion fencing will be established to minimise sedimentation during Stage 2 works (100ML basin construction) as per Section 4.3). • Additional erosion and sedimentation controls will be outlined within a site-specific CEMP (SMEC 2025).	2	2	**Minor**
Connectivity	• Barriers such as roads and infrastructure that disrupt the species movement between habitats.	• Barriers to dispersal are already limiting the species ability to disperse within the landscape (see Section 3.1.3).	2	1	**Negligible**
Grazing	• Livestock grazing damages wetland edges, removes vegetation and decreases water quality.	• There is no grazing pressure currently on site and this threat will not be a risk to newly constructed habitat.	2	1	**Negligible**

Note: L = Likelihood (Section 6.1.1), C = Consequence (Section 6.1.2) and Risk Rating as defined in Section 6.1.3.

7. Emergency contacts and procedures

In the event of an environmental emergency on-site that may compromise the objectives of this OMP, the relevant contacts identified in Table 10 must be notified immediately and no later than 12 hours following the occurrence. At a minimum, notifications shall include DCCEEW, City of Greater Geelong Council, and Barwon Water. Where assistance from emergency services is required (e.g., wildfire suppression), the Country Fire Authority (CFA) and Victoria Police must also be contacted. Emergency services personnel shall be advised of all on-site environmental protection measures to prevent inadvertent damage to ecological values.

Table 10: Emergency contacts

Contact	Role	Telephone
Country Fire Authority (CFA)	Bushfire emergency	000
Victoria Police	Various (e.g. unauthorised access)	000
DCCEEW	Offset Monitoring Responsibility	1800 920 528
City of Greater Geelong Council	Offset Monitoring Responsibility	03 5272 5272
Barwon Water	Landowner	1300 656 007
EPA (Victoria)	Any risk to the environment	131 555
DEECA (Victorian Government)	Native vegetation impacts	136 186

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Appendix 1: Growling Grass Frog

Conservation Status

EPBC Act: Vulnerable
FFG Act: Vulnerable



Image 1: Growling Grass Frog (Source: Dan Weller, SMEC, 2021).

Description

Growling Grass Frog is also commonly known as the Southern Bell Frog, Green and Golden Frog and Warty Swamp Frog. The species is a large diurnal frog that can be distinguished by its bright to olive-green colour, warty back (with brown blotches in the adult), dorso-lateral fold, and distinct tympanum (ear) (DCCEEW 2025).

Growling Grass Frogs generally breed between November to March, following local flooding and a rise in water levels. This rise in water levels triggers breeding males to begin calling for females (DCCEEW 2025). Eggs are laid within days of breeding and tadpoles hatch between 2-4 days later (DCCEEW 2025). The metamorphosis stage of the tadpoles generally takes approximately three months, however, may take up to 12 months in exceptional circumstances (DCCEEW 2024; 2025; DSE 2009). In Victoria, most tadpoles have emerged as frogs by the end of May (SWIFFT 2025).

Growling Grass Frog can be a highly mobile species, capable of moving up to 1 km over a 24-hour period (DCCEEW 2024; 2025; DSE 2009). When restricted to small, permanent waterbodies, dispersal is low where they tend to move shorter distances indicating high site fidelity. Conversely, when occupying ephemeral waterbodies, Growling Grass Frog are likely to disperse more and travel further distances to reach other suitable wetland habitats (SWIFFT 2025).

Growling Grass Frog are carnivorous where their diet ranges from invertebrates, small fish, small reptiles and other amphibians, even Growling Grass Frog young in rare circumstances (DCCEEW 2024; 2025; DSE 2009).

Distribution and habitat

Growling Grass Frog is distributed across south-eastern Australia, being found in New South Wales (Riverina area), Victoria, Tasmania, and south-eastern South Australia. In Victoria, the species has isolated populations in the greater Melbourne area and across areas in south-western Victoria (SWIFFT 2025). Growling Grass Frog has experienced a significant range reduction in recent decades where this species is now considered locally extinct in most areas of Victoria (DCCEEW 2024; 2025; DSE 2009).

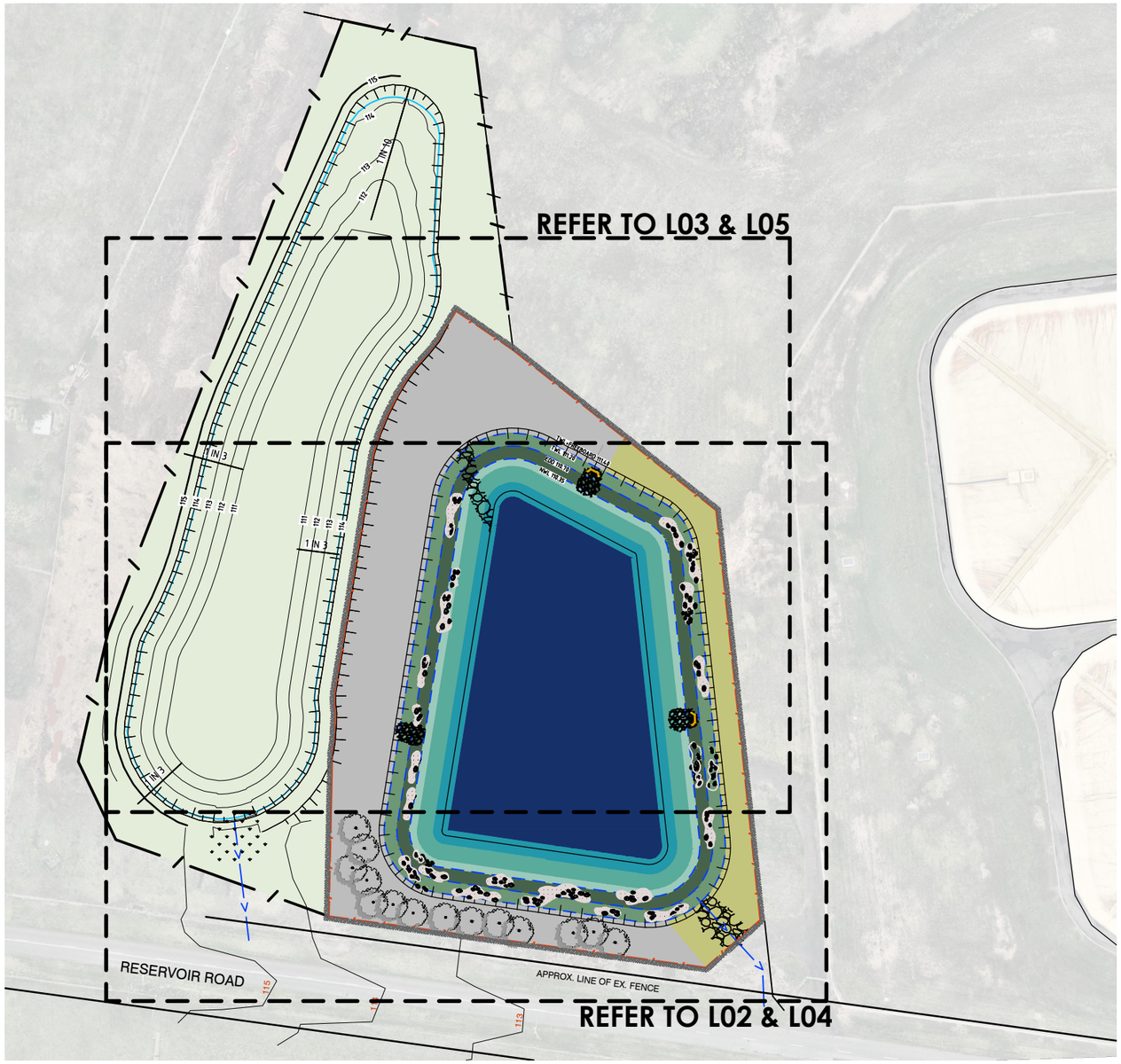
Growling Grass Frog occur in still or slow-moving waterbodies with emergent and fringing vegetation and mats of floating or submerged plants (SWIFFT 2025). They can inhabit artificial waterbodies, such as farm dams, irrigation channels and disused quarries. High quality habitat includes abundant aquatic vegetation and minimal tree canopy cover, with open areas for basking (DCCEEW 2024; 2025; DSE 2009; SWIFFT 2025). Grass and shrub cover on the banks are also important for the emerging froglets to gain protection from predators and to acquire insect prey as a food source (SWIFFT 2025).

Species occurrence in the locality

There are four previous records for Growling Grass Frog from within 10km of the study site, most recently from 2019. Surveys were undertaken between November 2023 and January 2024 in the Impact Site within the site (SMEC 2024b), with a breeding population of Growling Grass Frog detected.

Appendix 2: Landscape plan (Henry Landscape Design)

SITE PLAN



DRAWING SCHEDULE

L01 GENERAL NOTES

L02 LANDSCAPE PLAN - GROUND PREPARATION - SOUTH

L03 LANDSCAPE PLAN - GROUND PREPARATION - NORTH

L04 LANDSCAPE PLAN - PLANTING PLAN - SOUTH

L05 LANDSCAPE PLAN - PLANTING PLAN - NORTH

L06 WETLAND SECTION

L07 PLANTING SCHEDULE & PLANTING DETAIL

GENERAL NOTES

SITE PREPARATION

Make good planted areas to specified standards and by cultivation. Rotary hoe or cultivate ground to depth 25-30cm breaking up large clods of soil, soil lumps no bigger than 50mm diameter, remove all rock greater than 50mm and all debris.
As soon as planting area is prepared spread jute mat & mulch (to specified depths) to suppress weed growth and stabilise topsoil from wind and water erosion. Maintain mulch to the even specified thickness and keep in a clean and tidy state.

WEED REMOVAL

Weed control to be carried out by an experienced and professional weed control contractor with knowledge and skill in the correct identification, detection and management of the weeds on site and generally in the area. The weed control contractor to safely remove all weed material from the site and dispose of according to environmentally accepted practices. Weed control works shall cause minimal soil disturbance, to reduce the spread of weeds and prevent soil erosion. Any chemical controls are to be used in accordance with manufacturer's instructions and Australian standard occupational health and safety procedures. Use of Aquatic safe herbicide only.

PLANT SUPPLY AND PLANTING

Plant specification is based on freshwater conditions. Site salinity readings should be taken before proceeding with plant propagation and selection. If salinity reading indicates brackish to saline conditions plant species selection will need to be reviewed to suit

Refer to plant schedule for detail on species selection, plant pot sizes and plant numbers.

All plants to be healthy, vigorous, well established yet young, hardened off, of good form consistent with the species, free of diseases, not soft or forced (i.e. with sturdy stems and good leaf growth) and with roots suitably established (roots penetrating to the edge of the pot), unrestricted and not damaged. Plants to be propagated from a reputable nursery, plants ordered well in advance and preferably contract grown to ensure availability at time of planting.

Plants to be delivered to site at time of planting and made secure on site from theft and damage. Planting to be maximised by choosing optimum growing conditions to plant, preferably Autumn to middle of Spring after good rain. Otherwise ensure plants do not dry out and are well watered during the landscape contract. Thoroughly water plants prior to planting. Ensure that the plant roots are surrounded by soil and not exposed to air prior or during planting.
Spot cultivate planting holes for shrubs and groundcovers to about two to three times the diameter of the container and a little deeper, with all the soil broken up especially at the base of the hole. If soil is dry fill hole with water and leave it to drain away before planting. Remove plant carefully from container, with minimal root disturbance. Gently tease out any roots which have formed a solid mass or are coiled near the base, place plant in hole with plant soil just minimally below the garden soil level. Place filling in hole, firm soil around plant taking care not to damage roots. Water the plant well (at least 1- 2 litres per plant) to help settle the soil around the root system. Gently tip out water at ground level so as not to damage plant. Make sure the mulch is not in contact with the stem of the plant.

WATERING

After planting, water the plants well to help settle the soil around the root system and to encourage the roots to grow deep into the soil. Monitor new plants during their first summer. For the first two years, during summer, if there has not been much rain or if there is a drought water the plants once or twice a week, to ensure soil does not dry out. This initial deep watering is better to help the plant establish deeper roots down into the soil. Frequent shallow watering encourages surface root growth making plants more vulnerable to dry periods. Once plants are established, watering will only be needed through very dry periods, if at all.

EROSION & WEED CONTROL

All stabilisation matting to be installed as per manufacturers specification

Heavy duty Jute Matting to be installed to planting zone above normal water level (NWL)- 6 hole pre slotted thick Jute

Organic Mulch to be spread to a minimum settled/consolidated depth of 75 mm. Mulch to be kept clear of plant stems to avoid collar rot.

Timber mulch to be a recycled mulch MR20 to landscape mound planting area and 1m perimeter of rabbit exclusion fence

ESTABLISHMENT PERIOD

A 13 week establishment period will be employed to ensure the plants survive.

The contractor shall ensure the plants are adequately hydrated during the first phase of plant establishment. The minimum requirement shall be consistent with the natural rainfall of the site location. New planting to receive regular and frequent deep soakings to ensure that the plants do not not dry out till well established.

After the 13 weeks a site inspection will be conducted to issue practical completion.

MAINTENANCE PERIOD

A twenty four (24) months maintenance program is recommended to be employed after the establishment period.

Maintenance visits shall be conducted at a minimum of once every three months to detect and control out-breaks of environmental weeds before they become a problem and during periods of rapid growth such as during spring or after summer rain shall be constantly monitored (i.e. monthly).

All staff performing weed control must be highly trained in the identification of weeds and indigenous vegetation, and skilled in retaining desirable vegetation that may naturally regenerate on site.

L01 Drawing No **C1** Issue Revision

Barwon Water
Proprietor

PETTAVEL BASIN NO. 3
GROWLING GRASS FROG WETLAND
Project

PETTAVEL BASIN, WAURN PONDS
Site Address

N

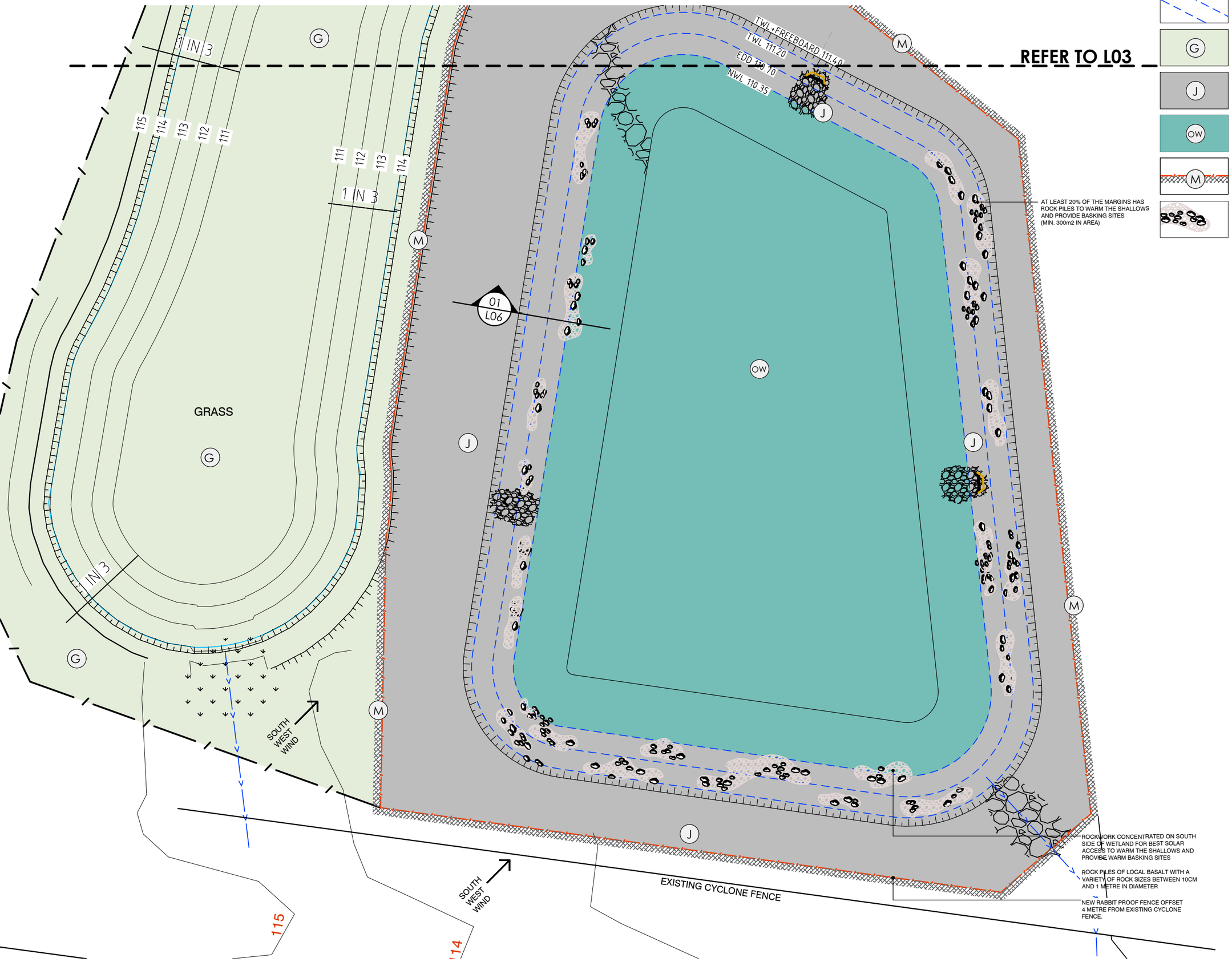
SITE PLAN & GENERAL NOTES
Title

March 2026
Date

NOT TO SCALE
Scale

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LEGEND

- WATER LEVELS
  REFER TO CIVIL DESIGN
- G — TERRESTRIAL ZONE
  (SEEDED GRASS)
- J — EROSION & WEED CONTROL FOR PLANTING AREA
  Supply and Install heavy duty Jute Matting to planting zone above normal water level (NWL)- 6 hole pre slotted
- OW — OPEN WATER
- M — 1m WIDE STRIP OF MULCH TO OUTER EDGE OF RABBIT EXCLUSION FENCE. FENCE MODIFIED TO ALLOW GGF MOVEMENT.
  (WEED FREE MAINTENANCE EDGE)
  Supply and install 75mm thick timber mulch (recycled mulch MR20)
- ROCK SAUNAS FOR GROWLING GRASS FROGS
  ROCK PILES OF LOCAL BASALT WITH A VARIETY OF ROCK SIZES BETWEEN 10CM AND 1 METRE IN DIAMETER

L02 Drawing No — **C1** Issue / Revision

Barwon Water
Proprietor

PETTAVEL BASIN NO. 3
GROWLING GRASS FROG WETLAND
Project

PETTAVEL BASIN, WAURN PONDS
Site Address

N

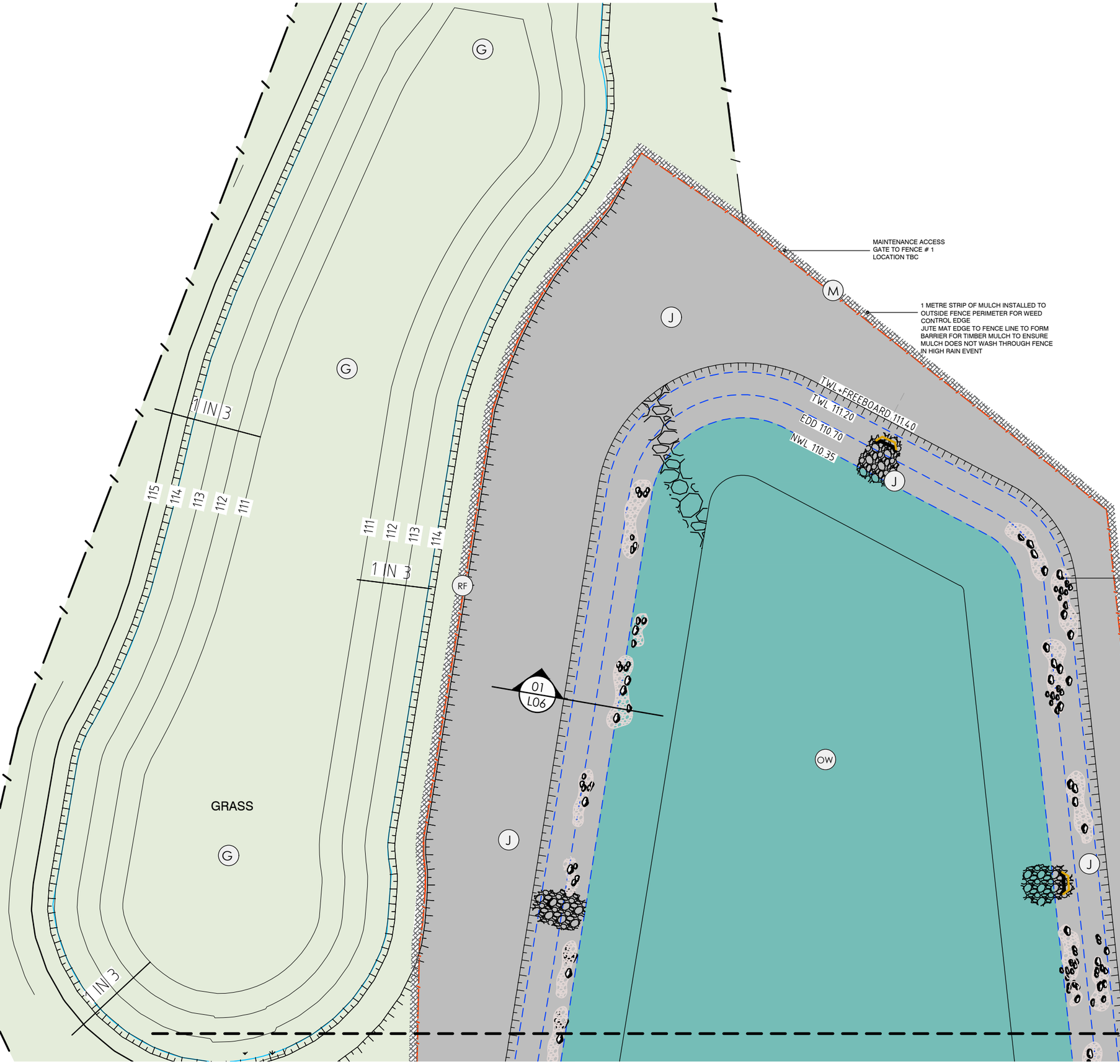
LANDSCAPE PLAN
GROUND PREPARATION-SOUTH
Title

March 2026
Date

1: 500 @ A1
Scale

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ISSUE FOR CONSTRUCTION



LEGEND

- WATER LEVELS
  REFER TO CIVIL DESIGN
- (G) TERRESTRIAL ZONE
  (SEEDED GRASS)
- (J) EROSION & WEED CONTROL FOR PLANTING AREA
  Supply and Install heavy duty Jute Matting to planting zone above normal water level (NWL)- 6 hole pre slotted
- (OW) OPEN WATER
- (M) 1m WIDE STRIP OF MULCH TO OUTER EDGE OF RABBIT EXCLUSION FENCE. FENCE MODIFIED TO ALLOW GGF MOVEMENT.
  (WEED FREE MAINTENANCE EDGE)
  Supply and install 75mm thick timber mulch (recycled mulch MR20)
- ROCK SAUNAS FOR GROWLING GRASS FROGS
  ROCK PILES OF LOCAL BASALT WITH A VARIETY OF ROCK SIZES BETWEEN 10CM AND 1 METRE IN DIAMETER

L03 Drawing No | **C1** Issue | Revision

Barwon Water
Proprietor

PETTAVEL BASIN NO. 3
GROWLING GRASS FROG WETLAND
Project

PETTAVEL BASIN, WAURN PONDS
Site Address

N

LANDSCAPE PLAN
GROUND PREPARATION-NORTH
Title

March 2026 Date
1: 500 @ A1 Scale

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REFER TO L05

1 IN 3

115 114 113 112 111

111 112 113 114

1 IN 3

GRASS

TWL+FREEBOARD 111.40
TWL 111.20
EDD 110.70
NWL 110.35

TP
LEU
LEL
PS
SF
SUB

01
L06

1:8

AT LEAST 20% OF THE MARGINS HAS ROCK PILES TO WARM THE SHALLOWS AND PROVIDE BASKING SITES (MIN. 300m2 IN AREA)

WIDE DEEP WATER SUBMERGENT VEGETATION ZONE

DIVERSE VEGETATION PLANTING IN SHALLOWS OF WETLAND

1 IN 3

SOUTH WEST WIND

APPROX. LINE OF EX. FENCE
RESERVOIR ROAD

EXISTING CYCLONE FENCE

SOUTH WEST WIND

ROCKWORK CONCENTRATED ON SOUTH SIDE OF WETLAND FOR BEST SOLAR ACCESS TO WARM THE SHALLOWS AND PROVISE WARM BASKING SITES

ROCK PILES OF LOCAL BASALT WITH A VARIETY OF ROCK SIZES BETWEEN 10CM AND 1 METRE IN DIAMETER

NEW RABBIT PROOF FENCE OFFSET 4 METRE FROM EXISTING CYCLONE FENCE.

LEGEND

- TERRESTRIAL ZONE (SEEDED GRASS)
- TP — TERRESTRIAL PLANTING ZONE
- LEU — LITTORAL EDGE UPPER PLANTING ZONE 300- 800mm ABOVE NWL PLANTING IN JUTE MAT
- LEL — LITTORAL EDGE LOWER PLANTING ZONE 0-300mm ABOVE NTWL PLANTING IN JUTE MAT
- PS — PERMANENT SHALLOW PLANTING ZONE 0-250mm BELOW NWL
- SF — SUBMERGENT & FLOATING VEGETATION PLANTING ZONE 250-400mm BELOW NWL
- SUB — SUBMERGENT PLANTING ZONE 400-700mm BELOW NWL
- OPEN WATER
- ROCK PILE
- TREE & SHRUB PLANTING SCREEN FOR WIND BREAK
- RABBIT EXCLUSION FENCE (MODIFIED TO ALLOW GGF MOVEMENT) 1m WIDE STRIP OF MULCH TO OUTER EDGE OF FENCE (WEED FREE MAINTENANCE EDGE)

L04 Drawing No | **C1** Issue | Revision

Barwon Water
Proprietor

PETTAVEL BASIN NO. 3
GROWLING GRASS FROG WETLAND
Project

PETTAVEL BASIN, WAURN PONDS
Site Address

N

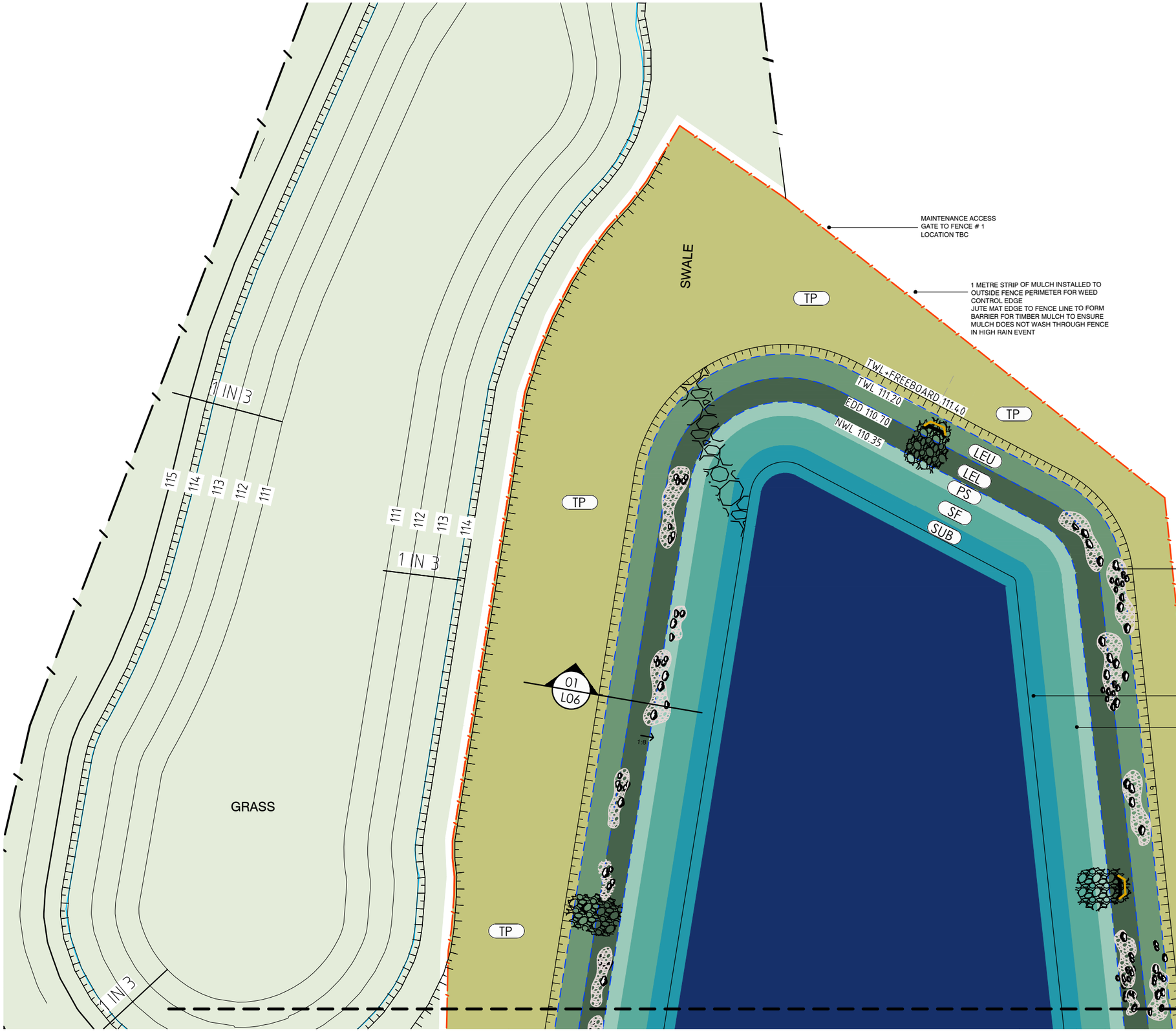
LANDSCAPE PLAN
PLANTING PLAN-SOUTH

Title

March 2026 — Date
1: 500 @ A1 — Scale

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LEGEND

- TERRESTRIAL ZONE (SEEDED GRASS)
- TP — TERRESTRIAL PLANTING ZONE
- LEU — LITTORAL EDGE UPPER PLANTING ZONE 300- 800mm ABOVE NWL PLANTING IN JUTE MAT
- LEL — LITTORAL EDGE LOWER PLANTING ZONE 0-300mm ABOVE NTWL PLANTING IN JUTE MAT
- PS — PERMANENT SHALLOW PLANTING ZONE 0-250mm BELOW NWL
- SF — SUBMERGENT & FLOATING VEGETATION PLANTING ZONE 250-400mm BELOW NWL
- SUB — SUBMERGENT PLANTING ZONE 400-700mm BELOW NWL
- OPEN WATER
- ROCK PILE
- RABBIT EXCLUSION FENCE (MODIFIED TO ALLOW GGF MOVEMENT) 1m WIDE STRIP OF MULCH TO OUTER EDGE OF FENCE (WEED FREE MAINTENANCE EDGE)

L05 Drawing No — **C1** Issue / Revision

Barwon Water
Proprietor

PETTAVEL BASIN NO. 3
GROWLING GRASS FROG WETLAND
Project

PETTAVEL BASIN, WAURN PONDS
Site Address

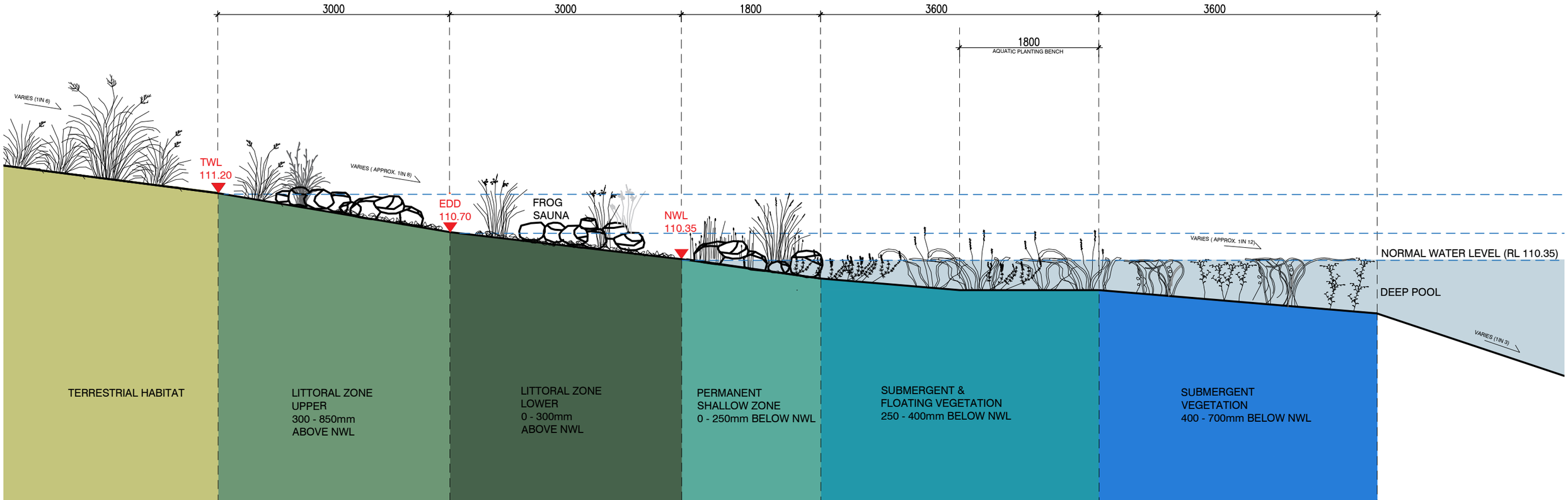
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LANDSCAPE PLAN
PLANTING PLAN-NORTH
Title

March 2026 — Date
1: 500 @ A1 — Scale

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TERRESTRIAL HABITAT

Calocephalus lacteus
Carex appressa
Chloris truncate
Dichanthium sericeum
Dichondra repens
Einadia nutans
Microlaena stipoides
Poa labillardierei var labillardierei
Poa morrisii
Rytidosperma duttonianum
Rytidosperma geniculatum

LITTORAL ZONE UPPER
300 - 850mm ABOVE NWL

Calocephalus lacteus
Carex inversa
Chloris truncate
Dichondra repens
Juncus subsecundus
Poa labillardierei var labillardierei
Rytidosperma duttonianum

LITTORAL ZONE LOWER
0 - 300mm ABOVE NWL

Dichondra repens
Selliera radicans
Samolus repens
Rytidosperma duttonianum
Juncus amabilis
Juncus flavidus
Carex tereticaulis
Carex appressa

PERMANENT SHALLOW ZONE
0 - 250mm BELOW NWL

Alisma plantago-aquatica
Ranunculus inundates
Eleocharis acuta
Machaerina arthrophylla
Marsilea drummondii
Myriophyllum crispatum
Myriophyllum simulans
Persicaria decipiens
Crassula helmsii
Eleocharis sphacelata

SUBMERGENT & FLOATING VEGETATION
250 - 400mm BELOW NWL

Ornduffia reniformis
Cycnogeton procerum
Myriophyllum crispatum
Myriophyllum simulans
Ottelia ovalifolia subsp. Ovalifolia

SUBMERGENT VEGETATION
400 - 700mm BELOW NWL

Potamogeton cheesemanii
Potamogeton crispus
Vallisneria australis

L04 Drawing No **C1** Issue Revision

Barwon Water
Proprietor

PETTAVEL BASIN NO. 3
GROWLING GRASS FROG
WETLAND
Project

PETTAVEL BASIN, WAURN PONDS
Site Address

N

LANDSCAPE PLAN
Title

March 2026
Date

1: 50 @ A3
Scale

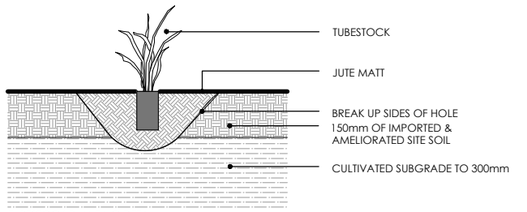
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PLANT SCHEDULE

	PLANT COMMUNITY	SPECIES	POT	PLANTING DENSITY (plants/m2)	PLANT MIX (%)	AREA OF PLANTS (m2)	NUMBER OF PLANTS	
TP	**TERRESTRIAL PLANTING**							
	Code					**TP**		
	Terrestrial Planting Area (m2)					**4,500**		
	Trees & Shrubs	*Allocasuarina verticillata*	Tubestock	approx. 1 tree /16m2 in area shown on plan			**30**	
		Banksia marginata	Tubestock	approx. 1 tree /16m2 in area shown on plan			**15**	
		Bursaria spinosa	Tubestock	approx. 1 tree /16m2 in area shown on plan			**15**	
		Acacia paradoxa	Tubestock	approx. 1 tree /16m2 in area shown on plan			**10**	
	Grasses, herbs	*Calocephalus lacteus*	HIKO or similar format	6	10%	450	**2,700**	
	and low growing plants	*Carex tereticaulis*	HIKO or similar format	6	2%	90	**540**	
		Chloris truncata	HIKO or similar format	6	15%	675	**4,050**	
		Dichanthium sericeum	HIKO or similar format	6	9%	405	**2,430**	
		Dichondra repens	HIKO or similar format	6	5%	225	**1,350**	
		Einadia nutans	HIKO or similar format	6	2%	90	**540**	
		Microlaena stipoides	HIKO or similar format	6	14%	630	**3,780**	
		Poa labillardierei var labillardierei	HIKO or similar format	6	18%	810	**4,860**	
		Poa morrisii	HIKO or similar format	6	5%	225	**1,350**	
		Rytidosperma duttonianum	HIKO or similar format	6	10%	450	**2,700**	
		Rytidosperma geniculatum	HIKO or similar format	6	10%	450	**2,700**	
					100%			**27,070**
LEU	**LITTORAL EDGE UPPER** 300 to 800mm above NWL (EDD TO TWL)							
	Code					**LEU**		
	Planting Area (m2)					**1,000**		
		Calocephalus lacteus	HIKO or similar format	6	10%	100	**600**	
		Carex inversa	HIKO or similar format	6	15%	150	**900**	
		Chloris truncata	HIKO or similar format	6	30%	300	**1,800**	
		Dichondra repens	HIKO or similar format	6	5%	50	**300**	
		Poa labillardierei var labillardierei	HIKO or similar format	6	20%	200	**1,200**	
		Rytidosperma duttonianum	HIKO or similar format	6	20%	200	**1,200**	
					100%			**6,000**
LEL	**LITTORAL EDGE LOWER** 00 to 300mm above NWL (NWL TO EDD)							
	Code					**LEL**		
	Planting Area (m2)					**950**		
		Dichondra repens	HIKO or similar format	6	25%	238	**1,430**	
		Selliera radicans	HIKO or similar format	6	5%	48	**290**	
		Samolus repens	HIKO or similar format	6	5%	48	**290**	
		Rytidosperma duttonianum	HIKO or similar format	6	10%	95	**570**	
		Juncus amabilis	HIKO or similar format	6	15%	143	**860**	
		Juncus flavidus	HIKO or similar format	6	10%	95	**570**	
		Carex tereticaulis	HIKO or similar format	6	20%	190	**1,140**	
		Carex appressa	HIKO or similar format	6	10%	95	**570**	
		Total			**100%**			**5,720**
PS	**PERMANENT SHALLOW ZONE**							
	Code					**PS**		
	Planting Area (m2)					**550**		
		Alisma plantago-aquatica	HIKO or similar format	6	5%	28	**170**	
		Crassula helmsii	HIKO or similar format	6	10%	55	**330**	
		Eleocharis acuta	HIKO or similar format	6	40%	220	**1,320**	
		Eleocharis sphacelata	HIKO or similar format	6	10%	55	**330**	
		Machaerina arthrophylla	HIKO or similar format	6	5%	28	**170**	
		Marsilea drummondii	HIKO or similar format	6	5%	28	**170**	
		Myriophyllum crispatum	HIKO or similar format	6	5%	28	**170**	
		Myriophyllum simulans	HIKO or similar format	6	5%	28	**170**	
		Omduffia reniformis (Syn Villarsia reniformis)	HIKO or similar format	6	5%	28	**170**	
		Persicaria decipiens	HIKO or similar format	6	5%	28	**170**	
		Ranunculus inundatus	HIKO or similar format	6	5%	28	**170**	
		Total			**100%**			**3,340**
SF	**SUBMERGENT & FLOATING -** 250 to 400mm below NWL							
	Code					**SF**		
	Planting Area (m2)					**1,000**		
		Cycnogeton procerum (Syn. Triglochin procera)	HIKO or similar format	4	50%	500	**2,000**	
		Myriophyllum crispatum	HIKO or similar format	4	20%	200	**800**	
		Myriophyllum simulans	HIKO or similar format	4	10%	100	**400**	
		Omduffia reniformis (Syn Villarsia reniformis)	HIKO or similar format	4	15%	150	**600**	
		Ottelia ovalifolia subsp. Ovalifolia	HIKO or similar format	4	5%	50	**200**	
		Total			**100%**			**4,000**
SUB	**SUBMERGENT** 350 to 700 mm below NTWL							
	Code					**SUB**		
	Planting Area (m2)					**900**		
		Myriophyllum salsugibeum	HIKO or similar format	2	10%	90	**180**	
		Potamogeton cheesemanii	HIKO or similar format	2	50%	450	**900**	
		Potamogeton crispus	HIKO or similar format	2	30%	270	**540**	
		Vallisneria australis (Syn. Vallisneria americana)	HIKO or similar format	2	10%	90	**180**	
		Total			**100%**			**1,800**
								47,930

PLANTING DETAIL



TUBESTOCK PLANTING DETAIL
IN JUTE MATTING (TYPICAL)

L07 Drawing No — **C1** Issue — Revision

Barwon Water
Proprietor

PETTAVEL BASIN NO. 3
GROWLING GRASS FROG
WETLAND
Project

PETTAVEL BASIN, WAURN PONDS
Site Address

PLANT SCHEDULE & PLANTING DETAIL

Title

March 2026
Date

NTS
Scale

henry landscape design
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Appendix 3: Habitat Assessment

A3.1: Habitat Assessment Form

Habitat Assessment Form			
Date:		Observers:	
Monitoring period and month:			
Practical Completion:		*Year 3 (6 months / 12 months):*	
Final Completion:		*Year 4 (annual):*	
Year 1 (Q1 / Q2 / Q3 / Q4):		*Year 5 (annual):*	
Year 2 (Q1 / Q2 / Q3 / Q4):		*Other:*	
Aquatic vegetation cover / density (50% target):		**Weed cover (<5% target):**	
Submergent and floating zone:		*Submergent and floating zone:*	
Emergent zone:		*Emergent zone:*	
Terrestrial zone:		*Terrestrial zone:*	
Comments:			
Water quality:			
Temp (C):		*DO (%/mg):*	
Salinity:		*pH:*	
Cond (uS/cm):		*NTU:*	
Inundated zones (circle):	Submergent / Floating zone	*Emergent zone*	*Littoral zone*
Bio-indicator comments:			
Predators or disturbance comments:			
Management recommendations:			

A3.2: Growling Grass Frog Monitoring Form

Growling Grass Frog Monitoring Form	
Date:	Observers:
Monitoring period and month:	
Year 1:	*Year 4:*
Year 2:	*Year 5:*
Year 3:	*Other:*
Have you completed the Habitat Assessment Form?	Y / N
Monitoring outcomes:	
Diurnal survey comments:	
Nocturnal survey comments:	
Bio-indicator comments:	
Predators or disturbance comments:	
Management recommendations:	

A3.3: Impact Site Photographs

Table A3.1: Growling Grass Frog habitat within and adjoining borrow pit (Impact Site)



Plate 1. Secondary borrow pit immediately north of the impact site (May 2024).



Plate 2. Vegetation adjoining the western corner of the borrow pit (May 2024).



Plate 3. Emergent vegetation in the western section of the borrow pit (May 2024).



Plate 4. Emergent and fringing vegetation looking east across the borrow pit (May 2024).





Plate 5. Example of emergent vegetation cover in the western section of the borrow pit (May 2024).



Plate 6. Emergent vegetation and an example of water quality in the centre of the borrow pit (May 2024).



Plate 7. Emergent vegetation in the centre of the borrow pit (May 2024).



Plate 8. *Emergent vegetation covering receding water levels (May 2024).*



Plate 9. *Emergent vegetation covering receding water levels (May 2024).*



Plate 10. Example of limited refuge habitat adjoining the borrow pit (May 2024).



Plate 11. *Emergent vegetation in the centre of the borrow pit (May 2024).*

Plate 12. *Emergent vegetation covering receding water levels (May 2024).*



Plate 13. Emergent vegetation covering water receding levels (May 2024).



Plate 14. Emergent and fringing aquatic vegetation looking west (May 2024).



Plate 15. *Emergent vegetation adjoining regenerating woodland (May 2024).*



Plate 16. Example of limited refuge habitat adjoining borrow pit (May 2024).



Plate 17. Example of limited refuge habitat adjoining borrow pit (May 2024).



Plate 18. Example of limited refuge habitat adjoining borrow pit (May 2024).

Appendix 4: EPBC Act Offset Assessment

A4.1: Habitat quality assessment – Impact Site and Offset Site

Table A4.1: Quality assessment for Growling Grass Frog habitats being impacted and offset by the Project.

Characteristic	IMPACT SITE		OFFSET SITE	
	Aquatic Habitat	Terrestrial Habitat	Aquatic Habitat	Terrestrial Habitat
Site Condition (out of 3)	**2/3** – The aquatic zone is considered to be of **moderate quality**. The Impact Site supports medium-to-high quality aquatic vegetation providing suitable breeding and refuge habitat. However, poor water turbidity (>50 NTU) and the presence of Eastern Gambusia pose threats to recruitment, reducing the site condition score.	**1/3 –** The terrestrial zone is considered to be of **low quality**. The Impact Site has limited terrestrial habitat immediately adjacent to the aquatic zone. While some peripheral tussock and scattered vegetation exist, refuge structures (logs, rocks, crack and crevices) are largely absent, and most surrounding ground is open bare ground under the planted acacia woodland with a limited availability of scattered pasture grasses noted as potential overwintering habitat.	**3/3** – The Offset Site will be constructed to replicate optimal, **high quality**, Growling Grass Frog breeding habitat (DELWP 2017). Water quality will be maintained at <1–5 NTU, aquatic vegetation zones (0.42 ha) will reach >80% plant survival, and permanent hydrological control enables required water levels during key breeding and juvenile development periods. Eastern Gambusia will be absent which will aid successful recruitment.	**3/3 –** the Offset Site terrestrial zone is considered to be of **high quality** once established. The Offset Site will comprise dedicated terrestrial refuge and foraging habitat (rocks, logs, established tussock grasses) designed to species standards (DELWP 2017). Planting and habitat construction will provide abundant refuges, multilayer structures for overwintering and no direct disturbance (fenced, managed).
Site Context (out of 4)	**1/4** – Overall, current connectivity at the Impact Site is constrained by the following factors: • Isolation of wetlands beyond effective dispersal thresholds; • Grazed terrestrial habitat lacking suitable refuges for overland dispersal;	**1/4** – As per aquatic habitat.	**2/4** – Overall connectivity of the Offset Site will be improved. The Growling Grass Frog wetland (aquatic habitat) will connect to a vegetated swale (terrestrial habitat) extending along the western and northern boundary of the property. The vegetated swale will consist entirely of terrestrial habitat, incorporating several ephemeral inline ponds,	**2/4** – As per aquatic habitat.

Characteristic	IMPACT SITE		OFFSET SITE	
	Aquatic Habitat	Terrestrial Habitat	Aquatic Habitat	Terrestrial Habitat
	• Surrounding roads, farmland, rail, and quarry operations acting as barriers; and • Limited moist linear habitats in the form of waterways, drainage or swale drains.		appropriate native vegetation, and habitat features designed specifically for Growling Grass Frog. The vegetated swale and terrestrial habitat zone will enhance habitat connectivity across the site, facilitating movement from the Offset Site toward dams within 300 m of the property (Figure 4).	
Species utilisation (out of 3)	**3/3** – The species has been confirmed to occupy the site with approximately sixteen (16) frogs heard calling over two separate survey events. The species was confirmed to be actively breeding through detection of tadpoles (SMEC 2024a). The species relative abundance is unknown at present.	**1/3** – The Impact Site has limited terrestrial use documented. Targeted surveys confirmed active breeding in the wetland but there is little evidence of regular terrestrial foraging or refuge use on the immediately surrounding land (few refuges, high disturbance). No evidence of post-metamorph survival in terrestrial refuges was recorded.	**2/3** – Given the Offset Site has not yet been constructed, it is assumed that this habitat will support moderate species utilisation with expected increases during monitoring events. It is expected an important population will be maintained once the Offset Site is established, Growling Grass Frog are relocated, and breeding opportunities are provided to the species through the construction of preferred habitat attributes, habitat and species monitoring and adaptive management.	**2/3** – The Offset Site is expected to support terrestrial foraging and refuge once established and frogs are relocated, but use is not yet demonstrated. Until relocation and monitoring confirm terrestrial occupancy and juvenile survival, this component is scored conservatively as documented use is not yet known.
TOTAL (out of 10)	**6/10**	**3/10**	**7/10**	**7/10**

A4.2: Assessment of Offset Site against EPBC Act Environment Offsets Policy

Table A4.2: Assessment of Offset Site against the EPBC Act Environment Offsets Policy.

Item No.	Offset Principles	Response
1	Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action.	The creation of high-quality Growling Grass Frog habitat provides an offset for the protection and management of a threatened species for the Project. The protection and ongoing improvements proposed will secure an area of high-quality habitat which will support the ecological requirements of the species. The site is secure and located on private property owned by Barwon Water which will allow active management of threatening processes in accordance with best practice guidelines identified in this management plan. Ongoing management is important for the long-term viability of this threatened species.
2	Be built around direct offsets but may include other compensatory measures.	The construction of a dedicated Growling Grass Frog habitat and associated on-ground management, monitoring and contingency measures is considered to be a suitable direct offset.
3	Be in proportion to the level of statutory protection that applies to the protected matter.	The proposed offset site is in proportion to the level of statutory protection that applies to the threatened species associated with the Project, in accordance with the EPBC Act.
4	Be of a size and scale proportionate to the residual impacts on the protected matter.	The proposed offset site protects **3.23 ha** of high-quality habitat for an impact of **2.81 ha** of low to moderate quality Growling Grass Frog habitat. Overall, this site is considered to provide adequate offset for the species using best-practice habitat design standards (DELWP 2017).
5	Effectively account for and manage the risks of the offset not succeeding.	The proposed offset will be subject to specific management and monitoring requirements outlined within the Project risk assessment (Section 6) and contingency management (Section 5.6), which details relevant risk and mitigation measures for the site. The offset will be managed by Barwon Water and specialised sub-consultants to secure the desired outcome outlined in this management plan. This will include independent audits and reporting by a suitably qualified ecologist.
6	Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs.	No specific offsets for Growling Grass Frog are prescribed under any State or Local Government offset prescriptions relevant to the Project site.
7	Be efficient, effective, timely, transparent, scientifically robust and reasonable.	The Offset Management Plan (OMP) has been prepared to ensure that management actions are efficient, effective, timely, transparent, scientifically robust and reasonable. The plan includes a detailed management framework supported by a clearly defined monitoring

Item No.	Offset Principles	Response
		program and measurable performance objectives. Management actions have been designed to be practical and achievable within the site context. Evidence supporting the feasibility and achievability of the proposed actions is provided in Section 3.2.3.2 of the OMP. The plan also outlines transparent reporting and adaptive management processes to ensure that outcomes are tracked and management responses can be adjusted where necessary.
8	Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	Governance includes supervision through independent auditing using a suitably qualified ecologist with formal reporting required to be submitted to City of Greater Geelong, Barwon Water and DCCEEW.

Appendix 5: Summary of Management Actions

Table A5.1: Schedule of Management Actions

Year / Stage	Objective	Timing of Activity	Standard to be Achieved	Related Section(s)
Pre-construction	Secure plant in preparation for wetland and terrestrial plantings	April 2026	Planting schedule to meet approved landscape and habitat design specifications	Section 3.2, Appendix 2
Stage 1	Install temporary frog exclusion fencing (1) around Impact Site to prevent frogs from accessing construction site	July 2026	The following describes the requirements for frog fencing: • Frog fencing must be at least 0.5 m high (up to 1 m where possible) and have an overhanging lip (between horizontal to 45° downwards) of at least 100 mm on the side facing the wetland, to prevent frogs from climbing over the fence. Star pickets with caps are installed at 3 m centres in two rows to create an overhang with three wire strands running through the star pickets. • The bottom of the fence must be buried at least 100 mm into the soil. • The frog fence must consist of a single piece of material from the top of the lip to the bottom of the buried section to ensure there are no holes through which frogs could pass. • Temporary frog fencing must use standard sediment fencing (i.e. geotextile/silt fence).	Section 4.3.2
	Civil construction of the Growling Grass Frog wetland, the Overflow Detention Storage Basin and the southern extent of the Vegetated Swale.	July to December 2026	The construction, vegetation planting and habitat establishment of the Growling Grass Frog Wetland and the terrestrial habitat zone immediately surrounding the wetland will be implemented by a suitably qualified ecological restoration sub-contractor in accordance with the *Growling Grass Frog Habitat Design Standards: Melbourne Strategic Assessment* (DELWP 2017), but will also comply with the *Aquatic Plant Supply Standard* prepared by Melbourne Water (Melbourne Water 2025). The habitat design specifications and planting densities are provided within the detailed landscape plan (Henry Landscape Design 2025).	Section 3.2.2, Appendix 2
	Remove temporary frog exclusion fencing (1) from Impact Site to allow unrestricted movement between the Impact Site and the Offset Site	December 2026	Remove temporary frog exclusion fencing as required by contract specifications	Section 4.3.2
	Practical Completion	December 2026	Monitor wetland has reached ecological functionality within 12 months of construction.	Section 3.2.3.1

Year / Stage	Objective	Timing of Activity	Standard to be Achieved	Related Section(s)
Stage 2	Early Establishment Period (12 months) - Hold Point	December 2026-2027	The following Offset Site completion criteria are the vegetation and habitat establishment targets used to determine whether the wetland is ready for frog introduction: • **Aquatic vegetation:** Planting zone density will result in establishment of cover target of 50% for submergent / floating vegetation and patches of emergent vegetation (as per DELWP 2017 requirements for Aquatic Habitat) (Table 2). • **Terrestrial vegetation:** Planting zone density will result in establishment of planting densities of terrestrial vegetation in accordance with Appendix 2.1(Henry Landscape Design 2025), and as per DELWP 2017 requirements for Terrestrial Habitat (Table 2). • **Survival:** 80% survival for aquatic and terrestrial planted vegetation. Plants lost during the establishment period which impact on the cover of vegetation must be replaced by a suitably qualified ecological restoration sub-contractor under the guidance of Barwon Water. • **Weeds:** <5% perennial weeds in the submergent and floating vegetation zone, emergent vegetation zone and terrestrial zones. • **Hydrological Capacity:** Water depth, surface area and hydroperiod must match the breeding requirements of Growling Grass Frogs. It is expected given the ability to manipulate water levels (see Section3.2.5), that the wetland will sustain the wetland habitat submergent zone at all times to provide permanent inundation for breeding and tadpole development. • **Water quality:** Water quality meets temperature, dissolved oxygen, conductivity, pH, turbidity and salinity and nutrient levels within the EPA Victoria Freshwater Environmental Quality Objectives (State Environment Protection Policy – Waters) to support healthy frog populations and their food base (EPA 2025). Water testing to be conducted by independent contractor and NATA accredited laboratory results submitted for review to ensure water quality is within the acceptable water quality thresholds. • **Biological indicators:** Evidence of supporting biological indicators will also be considered prior to relocation of Growling Grass Frog, this may include but is not limited to the presence of locally common frog species and the presence of food sources (invertebrates and macroinvertebrates). • **Predators and competitors:** Confirm absence of invasive fish species (i.e. Eastern Gambusia) and other aquatic or terrestrial predators that could significantly reduce egg or tadpole survival. • **Human disturbance:** Demonstrate site security and a vegetated buffer managed to remove any human disturbance to protect water quality and habitat structure once planted and established.	Section 3.4.2.3
	Before-After Impact Study BAIS	Prior to commencement of Stage 2 construction	The BAIS study will be developed to include genetic sampling or marking of individuals to assess population size, genetic diversity and population connectivity before and after construction. This will also assist with monitoring the effectiveness of the Offset Site, site usage and breeding success by Growling Grass Frog over time. This will be undertaken under appropriate research and animal ethics permits and must be implemented by an independent Growling Grass Frog expert and biostatistician to ensure the program is scientifically robust and capable of detecting population responses over time.	Section 4.5.1
	Minimise spread of Chytrid fungus	Prior to commencement of Stage 2 construction	Hygiene protocols implemented for personnel, vehicles and equipment	Section 4.4
	Manage weeds	Prior to commencement of Stage 2 construction	Weed management in Offset Site undertaken by BAS to minimise habitat degradation	Sections 4.7
	Manage pest animals	Prior to commencement of Stage 2 construction	Pest animal management in Offset Site undertaken by BAS to minimise habitat degradation and predation risk	Sections 4.8
	Prevent erosion, sedimentation and contamination	Prior to commencement of Stage 2 construction	Chemical management, erosion and sedimentation controls will be managed and monitored during construction in accordance with a site-specific Project Management Plan (PMP) developed by the Principal Contractor, vetted and accepted by Barwon Water. Corrective actions of any spill will involve a Spill Kit being deployed immediately before the spill being cleaned up by the Principal Contractor. Drainage points will be inspected to prevent chemical influx.	Sections 4.9

Year / Stage	Objective	Timing of Activity	Standard to be Achieved	Related Section(s)
	Establish water quality and habitat conditions at Final Completion	December 2027	Vegetation, habitat and water quality will be assessed by a suitably qualified ecological restoration sub-contractor immediately after conclusion of Final Completion of construction works. The Offset Site must also be assessed against the Offset Site completion criteria to confirm whether the site has reached Final Completion. Frogs cannot be introduced to the Offset Site until it has met the Offset Site completion criteria. The suitability of the Offset Site must be verified by a qualified ecologist, and a letter report demonstrating that the Offset Site has met these targets must be submitted to DCCEEW for approval before frog relocation can proceed.	Section 3.2.4.3
	Install temporary frog exclusion fencing (2) around Impact Site to prevent frogs from accessing construction site	December 2027	As per temporary frog exclusion fencing (1) above.	Section 4.3.2
	Confirm establishment of offset habitat	December 2027	Final Completion targets achieved prior to frog relocation as outlined above.	Section 3.4.2.3
Year 0 (Baseline)	Final Completion - Baseline Habitat Data	December 2027	Findings from the Final Completion assessment (above) will establish the baseline (Year 0) measurements.	Section 3.2.4.3
Year 0 (Baseline)	Capture and release Growling Grass Frog individuals	December 2027-February 2028	The following actions must be undertaken prior to any capture and relocation activities: • The suitability of the Offset Site to support Growling Grass Frog must first be verified by a suitably qualified ecologist before any capture and relocation of Growling Grass Frog can proceed. details the completion criteria and targets for Growling Grass Frog habitat and water quality in the new wetland that must be met before frogs can be relocated there. • Obtain necessary permits and approvals: – Approval to capture, collect and relocate Growling Grass Frog will be required from the Department of Energy, Environment and Climate Action (DEECA) under the Victorian *Wildlife Act 1975*. – DEECA must be informed at least three business days prior to the translocation of Growling Grass Frog.	Sections 4.5.2, 4.5.3, 4.5.4, 4.5.5 and 4.5.6 Section 3.2.4.3
Year 0 (Baseline)	Monitor relocated Growling Grass Frog population	December 2027-January 2028	Growling Grass Frog monitoring must be undertaken in the weeks following Growling Grass Frog relocation to monitor the early establishment of the population. A nocturnal survey must be undertaken weekly for the first month following relocation, then every 2 weeks in the second month (total of 6 surveys). Diurnal and recruitment surveys are not required. Timing can be slightly varied to ensure appropriate weather conditions and seasonality for all surveys. Survey method must be in accordance with *Survey Guidelines for Australia's threatened frogs - Guidelines for detecting frogs listed as threatened under the EPBC Act 1999* and the *Significant Impact guidelines for the vulnerable Growling Grass Frog*.	Section 5.2.1
Year 0 (Baseline)	Baseline summary report	February 2028	A letter report summarising the findings of the baseline assessments must be provided at completion of the baseline monitoring. These findings will establish the baseline (Year 0) measurements.	Section 5.2.2
Stage 3	Civil construction of the northern extent of the Vegetated Swale	February 2029	Construction and establishment of the northern component of the Offset Site comprising the northern extent of the vegetated swale and an inline pond.	Section 2.6.3
Years 1–2	Establish aquatic and terrestrial vegetation and monitoring habitat quality	Every 3 months	Confirm ≥80% survival of planted vegetation and ≤5% perennial weed cover. Monitoring is required every three months during the first two years to ensure successful establishment of the wetland habitat and vegetation. Habitat monitoring will include regular reports to Barwon Water for any vegetation loss and plant cover recorded. Plants lost during this period which impact on the cover of vegetation must be replaced. Monitoring in Years 1-2 will be undertaken by a suitably qualified ecological restoration sub-contractor and Barwon Water to ensure the objective of the landscape plan have been accomplished.	Section 3.4.2.3
Year 1	Independent audit	End of Year 1	Independent audit completed assessing compliance with OMP requirements	Section 5.4
Year 3	Establish aquatic and terrestrial vegetation and monitoring of habitat quality	Every 6 months	As per Years 1-2	Section 3.4.2.3

Year / Stage	Objective	Timing of Activity	Standard to be Achieved	Related Section(s)
Year 3	Independent audit	End of Year 3	Independent audit completed assessing compliance with OMP requirements	Section 5.4
Years 4-5	Establish aquatic and terrestrial vegetation and monitoring of habitat quality	Annually	As per Year 3	Section 3.4.2.3
Years 1–5	Monitor Growling Grass Frog population	Annually during active season	Each monitoring event must include diurnal, nocturnal and recruitment surveys as follows: • Diurnal surveys will include the following: – Undertake a detailed habitat assessment in accordance with Appendix 3.1 to measure overall habitat quality and attributes important to the species ecology (aquatic vegetation cover, water quality, disturbance signs, etc.). – Active searching for species activity and usage of the offset site in areas of terrestrial and aquatic habitat within the waterbody and areas located within the temporary frog fencing or permanent exclusion fencing (depending on the timing of surveys). – Dip netting for tadpoles and predatory fish (see below). • Nocturnal surveys must include the following: – Record data in accordance with Appendix 3.2. – Four nights per monitoring event. – October/November: 2 x 60 minute surveys using call playback and active searching around waterbody. – January/February: 2 x 60 minute surveys using dip netting for tadpoles/metamorphs and active searching for sub-adults.	Section 5.2, Appendix 3.1,Appendix 3.2
Years 1-5	Monitor recruitment success	Annually (Jan–Feb)	Recruitment monitoring must be undertaken in January annually for the first five (5) years, using collapsible bait traps (set for two nights per event), or dip netting where males are calling. This can be undertaken with January nocturnal surveys.	Section 5.2
Years 1–5	Maintain wetland hydrology	Ongoing, particularly spring–summer	Permanent submergent zone maintained during breeding season	Section 4.6.1
Years 1–5	Maintain habitat condition and refuge features	Ongoing	Aquatic vegetation, refuge rocks/logs, frog saunas and dispersal habitat maintained in suitable condition	Section 3.4.2.3
Years 1–5	Undertake weed management	Bi-annually	Weed infestations controlled prior to dominance or seeding; revegetation undertaken where required	Sections 4.7
Years 1–5	Undertake pest animal management	Bi-annually	Evidence of foxes, rabbits, or other pest species managed to minimise habitat impacts	Sections 4.8
Years 1–5	Undertake water quality monitoring	During all habitat monitoring events	Water quality parameters remain within EPA Victoria Freshwater Environmental Quality Objectives	Section 3.4.2.3
Years 1–5	Implement adaptive management where triggers exceeded	As required following monitoring	Contingency measures implemented where habitat degradation or population decline detected	Section 5.6
Years 1–5	Reporting to regulators and stakeholders	Within 6 weeks of monitoring events	Monitoring reports submitted to Barwon Water, City of Greater Geelong and DCCEEW	Section 5
Year 5	Independent audit	End of Year 5	Independent audit completed assessing compliance with OMP requirements	Section 5.4
Years 5-ongoing	Undertake weed management	Ongoing annually post-monitoring	Weed management in Offset Site undertaken by BAS to minimise habitat degradation as required	Sections 4.7
Years 5-ongoing	Undertake pest animal management	Ongoing annually post-monitoring	Pest animal management in Offset Site undertaken by BAS to minimise habitat degradation and predation risk as required	Sections 4.8

Appendix 6: Case study

Australian Ecosystems provided the following information to demonstrate how constructed wetlands can be established very rapidly if they are planted out with the appropriately sized plant stock and planted at the right time of year.

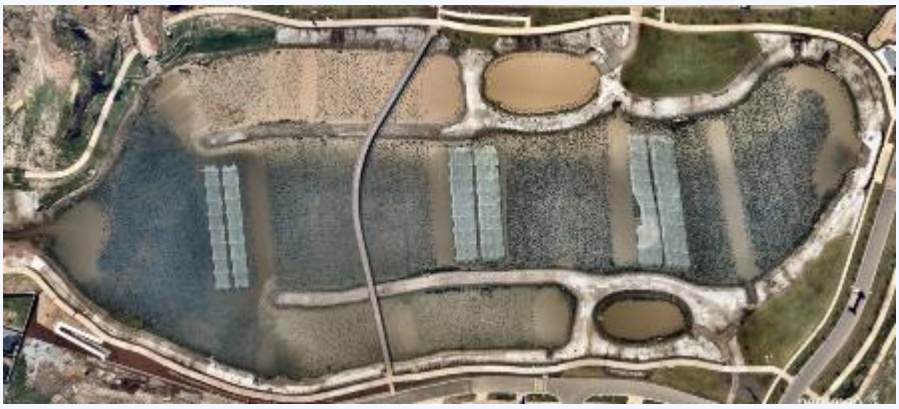
Factors contributing to rapid growth of aquatic plants are day length and water temperature. If plants can be installed in early Spring as the day is lengthening and water is starting to warm up, the plants grow very rapidly throughout the Spring and Summer period and can be fully established by the end of the following Autumn.

The example provided is a wetland in Clyde, which was established as follows and shown in the images below:

- Plant stock was propagated over Spring 2018 / Summer 2019 in 600cc sized plant containers.
- The wetland was planted with the propagated plants in September 2019.
- The wetland plants were in an advanced state of establishment by April 2020.

September 2019

Nearmap image supplied by Australian Ecosystems.



November 2019

Nearmap image supplied by Australian Ecosystems.



April 2020

Nearmap image supplied by Australian Ecosystems.



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