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Fauna Surveys, Marshall Precinct Plan Area, Marhsall

Version B

Prepared for:

The City of Greater Geelong

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Cover Photograph

A photograph of a dam in the northern portion of the study area (January 2022)

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Table of Contents

Introduction

Background and Purpose

Ecolink Consulting Pty Ltd was engaged by the City of Greater Geelong (Council) to undertake fauna habitat assessments and fauna surveys for species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) within the Marshall Precinct Structure Plan (PSP) area. The PSP area includes a portion of the Marshall Creek and a series of nearby dams, and forms the study area for the current report.

As per the Request for Quotation, the assessment undertaken by Ecolink Consulting in January and February 2022 included:

- A desktop assessment for potential impacts to Matters of National Environmental Significance (MNES) under the EPBC Act, particularly including, but not limited to:
    - Yarra Pygmy Perch *Nannoperca obscura*;
    - Australian Grayling *Prototroctes maraena*;
    - Australian Mudfish *Neochanna cleaveri;*
    - Orange Bellied Parrot *Neophema chrysogaster;* and,
    - The Lake Connewarre complex Ramsar site;
- Targeted surveys for Growling Grass Frog *Litoria raniformis* within areas of suitable habitat, including the Marshall Creek area and nearby dams; and
- Targeted surveys of Latham's Snipe *Gallinago hardwickii* within areas of suitable habitat, including the Marshall Creek area and nearby dams.

Following the outcomes of the above-mentioned scope of work, and in consultation with the City of Greater Geelong, it was determined that targeted fish surveys should also be completed. In April 2022, Ecolink Consulting Pty Ltd subcontracted Aquatica Environmental Pty Ltd to complete these fish surveys. The surveys particularly targeted Yarra Pygmy Perch, Australian Grayling and Australian Mudfish (as required), which are threatened species that have been identified as having potential habitat within the study area.

The current report (Version B) incorporates the findings of the fish surveys, and addresses comments provided by the City of Greater Geelong on the previous report (Version A). For each of the MNES, we have considered the on-site, and potential off-site impacts, posed by future development of the precinct. In particular, this report recommends measures to be included in the Storm Water Management Strategy and the Integrated Water Management Plan, which are currently being prepared by external consultants.

The Marshall Precinct Structure Plan – Potential Impacts

The study area is located within the Marshall PSP area which is located on the urban fringe of Geelong City and within the Armstrong Creek Growth Area. A Draft Marshall Precinct Structure Plan has been prepared for the study area, which provides a master plan for the proposed development of the Marshall PSP (City of Greater Geelong 2019). The City of Greater Geelong have provided the latest Marshall Future Urban Structure Plan – Option H (Figure 1).

The study area is approximately 123 hectares in area in an irregular shape, generally bounded by Barwon Heads Road to the east, Reserve Road to the South, the Dennington trail line in the west,

and existing residential development in the north west. It also includes a relatively small area to the east of Barwon Heads Road, inclusive of both sides of Tannery Road and Horseshoe Bend Road (Figure 1).

The Draft Marshall PSP generally nominates the land in its south-west for medium density residential development, the south-east as standard residential development and the north-east as commercial land. Areas proposed for drainage, open space and conservation will generally be retained along the Marshall Creek and in low-lying areas elsewhere within the study area (City of Greater Geelong 2019).

Upgrades to Marshall Creek are required to manage drainage and stormwater in the future Marshall PSP. Drainage and stormwater works, as well as the civil development of the precinct, are likely to include earthworks and civil works, which may directly impact habitats currently provided to native wildlife. The loss of wetlands resulting from these works and the alterations to hydrology would lead to a loss of habitat for native wildlife. To mitigate these impacts, it is understood that the works will be undertaken in accordance with a Storm Water Management Strategy and the Marshall PSP Integrated Water Management Plan (in prep.).

Indirect impacts to the Lake Connewarre Wildlife Reserve and associated wetlands which form the nationally significant *Port Phillip Bay (Western Shoreline) and Bellarine Peninsula* Ramsar Site, listed under the EPBC Act, may also occur through increased stormwater flows and the increased likelihood of sediments and pollutants reaching the wetlands.

Further discussion on the potential impacts to Matters of National Environmental Significance and additional recommendations to mitigate these impacts are provided within this report.

Priority Fauna Species

Targeted surveys were undertaken for two priority species: Growling Grass Frog and Latham's Snipe. The desktop assessment also considered potential impacts to other EPBC Act-listed fauna species, as well as Lake Connewarre complex Ramsar site. These impacts are discussed in greater detail below.

Growling Grass Frog *Litoria raniformis*

Conservation Status

The Growling Grass Frog is listed as Vulnerable on the Commonwealth EPBC Act, and the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act).

Species Description

The Growling Grass Frog is a relatively large frog to 10 centimetres from snout to vent. It is variable in colour, ranging from mottled bright green and bronze colour above, through to brown. It generally has dark brown bumps on its back. It has a pale cream underside, with a faint cobbling pattern. A pale stripe runs from the side of the head down the flanks (Barker *et al.* 1995).

Plate 1. Growling Grass Frog *Litoria raniformis*

Distribution and Habitat

The Growling Grass Frog is a relatively mobile frog species that inhabits a diverse range of wetlands such as swamps, marshes, slow flowing rivers/streams, lakes, drainage lines and artificial waterbodies (e.g. farm dams, reservoirs and former quarry pits). The species generally breeds in permanent or near-permanent waterbodies, but has also been recorded breeding regularly in ephemeral waterbodies, where they hold sufficient water during the breeding season (Heard *et al*. 2004; Ecology Australia 2006).

Several key habitat attributes significantly influence the presence and/or breeding success of the Growling Grass Frog, including:

- Connectivity to occupied sites;
- Hydroperiod (i.e. water permanence);
- Cover of aquatic vegetation;
- Water quality, particularly salinity;

- Terrestrial vegetation, including overshading by trees and shrubs; and
- Absence of predatory fish (Ecology Australia Pty Ltd 2006; Heard *et al.* 2004; Heard and Scroggie 2009; Heard *et al.* 2010; Heard *et al.* 2012).

With regard to the hydroperiod of waterbodies, larger and more permanent waterbodies are more likely to be occupied and sustain populations over a longer period. The Growling Grass Frog is a highly aquatic frog. As such, the drying out of waterbodies can increase the chance of local extinctions (Heard and Scroggie 2009); however, periodic drying of wetlands can also be potentially beneficial through reducing impacts from predatory fish and/or amphibian chytrid fungus *Batrachochytrium dendrobatidis*, which has caused the decline of amphibians worldwide.

The cover of aquatic vegetation has a strong positive relationship with habitat occupancy; aquatic vegetation is characterised as submerged, floating or emergent vegetation types. The microhabitat provided by the vegetation is important for the Growling Grass Frog (Heard and Scroggie 2009), with the species showing preferential use of submerged and floating vegetation during nocturnal activity (Heard *et al.* 2008), while emergent vegetation provides sheltered perching sites for basking during the day and for ambushing prey (Pyke 2002). These plants also provide important microhabitat for aquatic larvae and are likely to serve as a refuge from predatory fish (Heard and Scroggie 2009; Webb and Joss 1997).

Several studies have demonstrated that connectivity is a critical factor for the ongoing persistence of Growling Grass Frog populations in a given area (e.g. Heard and Scroggie 2009; Heard *et al.* 2010). The likelihood of a site being colonised by the species is strongly linked to connectivity, specifically the number of suitable wetlands in close proximity to the site (e.g. within approximately 1,000 m). This connectivity is essential as the species has been shown to operate under a 'metapopulation' paradigm, where sites vary in occupancy year to year, driven by local conditions and the processes of localised extinction and colonisation (Heard *et al.* 2013).

The Growling Grass Frog spends the non-breeding season (approximately May to September) sheltering in terrestrial environments (e.g. rocks, fallen timber, soil cracks or dense ground vegetation) some distance from water (Pyke 2002; Wassens *et al.* 2008; Wilson 2003). Terrestrial habitat surrounding waterbodies is important not only for providing shelter and over-wintering refuge, but also to provide a buffer from surrounding land uses (existing and future). Buffer distances aim to account for distances moved by the frog during foraging at night and also movement to over-wintering sites.

The presence of predatory fish, such as Eastern Gambusia *Gambusia holbrooki*, has contributed to the decline of Growling Grass. Although, waterbodies with an extensive cover of aquatic vegetation may provide sufficient refuge and shelter for aquatic larvae to persist even in the presence of predatory fish (Heard and Scroggie 2009).

Latham's Snipe *Gallinago hardwickii*

Conservation Status

Latham's Snipe is not considered a threatened species internationally (Birdlife International 2016), or nationally. The species is listed as a MNES on the EPBC Act as a migratory species and a marine species. As a migratory species it is listed on the Japan-Australia Migratory Bird Agreement (JAMBA) and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), which are bi-lateral agreements between the countries to minimise harm to migratory shorebirds which migrate between them and their habitat. Latham's Snipe are also listed on the Bonn Convention, which provides a framework for signatories with jurisdiction over any part of the range of a nominated migratory species to co-operate to prevent their extinction.

Species Description

Latham's Snipe are medium-sized, ground-foraging, wetland birds, with a long, probing bill and short wings and legs (Plate 1). Sexes are similar in appearance, and there is not a distinctive juvenile plumage (Higgins and Davies 1996). The plumage of Latham's Snipe camouflages with the vegetation in which they forage (Higgins and Davies 1996). They are brown birds, flecked with buff feathers, on their back, fading to cream and white on their belly. Although there are two other species of Snipe that occur in Australia, these species rarely overlap with the range of Latham's Snipe in the south, which makes the species easily distinguished from other migratory shorebirds in Victoria.

Plate 2. Latham's Snipe *Gallinago hardwickii*

Distribution and Habitat

In Australia, Latham's Snipe occur in a variety of permanent and ephemeral wetlands (Higgins and Davies 1996). Latham's Snipe generally occur on the fringes of freshwater wetlands, in, or near dense fringing vegetation or emergent aquatic vegetation, as well as dense woody vegetation such as tea-tree scrubs, coastal heaths and even woodlands and forests (Higgins and Davies 1996). The species is known to use modified and artificial habitats, including pasture, rice-crops, ploughed paddocks, orchards, drainage ditches and irrigation channels (Higgins and Davies 1996). They are often disturbed by people and grazing, but persist in disturbed wetlands in urban environments (Higgins and Davies 1996).

Latham's Snipe feed on soft mud and in shallow water on the margins of wetlands, usually in the evenings and mornings (Higgins and Davies 1996). Their diet consists of seeds and other plant material, earth-worms, spiders and insects (Higgins and Davies 1996). Their prey is captured by probing of soft ground with the flexible tip of the bill. They roost during the day on the ground, in dense vegetation near feeding areas, usually under clumps of vegetation (Higgins and Davies 1996).

Latham's Snipe are found throughout eastern Australia during the Austral summer. They undergo regular annual movements between their breeding grounds in Japan to Australia in the Australian spring, with peak numbers in Australia from September to March, after which they return to Japan to breed. Given their migration route, peak numbers arrive and depart the south of Australia within this time frame, as birds disperse slowly south and then north, prior to their departure for winter (Higgins and Davies 1996).

Other Matters of National Environmental Significance

A desktop assessment and habitat assessment was undertaken for other MNES identified by the City of Greater Geelong as having the potential for to occur within the study area including:

- Yarra Pygmy Perch;
- Australian Grayling;
- Australian Mudfish*;*
- Orange Bellied Parrot*;* and,
- The Lake Connewarre complex Ramsar site.

Targeted fish surveys for Yarra Pygmy Perch and Australian Mudfish have been undertaken. The survey methodology was also suitable for Australian Grayling, although this species was considered unlikely to occur from the outset by Aquatica Environmental on the basis that it is a river specialist with an absence of suitable habitat within the study area (Aquatica Environmental Pty Ltd 2022).

The Marshall PSP area is upstream of the Lake Connewarre State Game Reserve which is a wetland system, linked to the sea by the Barwon River and forms part of the *Port Phillip Bay (Western Shoreline) and Bellarine Peninsula* Ramsar Wetland.

Note that the presence and distribution of EPBC Act-listed flora species and communities have previously been assessed for a report entitled *Flora and Fauna Survey and Biodiversity Survey, Marshall Precinct: Armstrong Creek Urban Growth Area* (Ecology and Heritage Partners Pty Ltd 2014). That report found that no EPBC Act-listed ecological communities were present within the study area for that assessment (which included the Marshall PSP area), and that no EPBC Act-listed flora species are considered likely to occur within the study area, as no suitable habitat was present. On this basis, the current assessment and report excludes these MNES from its scope and does not comment on the likelihood of threatened flora species or ecological communities persisting within the study area.

Survey Methods

Desktop Assessment

A desktop assessment was completed to determine the historic presence of threatened fauna species, classified as MNES, which may need further assessment or consideration as precinct planning progresses.

The desktop assessment reviewed the following databases:

- The Commonwealth Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (Department of Agriculture Water and the Environment 2022) to determine MNES, under the EPBC Act, that are modelled to occur in the vicinity of the study area;
- The Victorian Department of Environment, Land, Water and Planning (DELWP), Victorian Biodiversity Atlas (Department of Environment Land Water and Planning 2022) for historical records of threatened fauna species in the vicinity of the study area; and,
- Previous ecological reports, property vegetation plans or management plans relevant to the study area that are publicly available or made available by the City of Greater Geelong.

In addition, we have summarised pertinent outcomes from the Aquatica Environmental Targeted Fish Survey report (Aquatica Environmental Pty Ltd 2022).

Targeted Surveys

Targeted surveys for Growling Grass Frog and Latham's Snipe were undertaken by Principal Ecologists, Simon Scott and Dr Stuart Cooney.

Growling Grass Frog

Potential habitat for Growling Grass Frog was identified in collaboration with Council and included waterways and waterbodies within the Marshall PSP area (Figure 1). The Survey Sites were determined by Ecolink Consulting Pty Ltd whilst undertaking diurnal surveys. A total of 11 Survey Sites were established at waterbodies which provided the highest quality habitats for Growling Grass Frog, and which provided broad spatial coverage of the study area.

The targeted Growling Grass Frog survey included a diurnal Growling Grass Frog survey on 12 January 2022 and three nocturnal surveys on 12 January 2022, 19 January 2022 and 2 February 2022.

All surveys included active searching, call playback and tadpole surveys:

- Active surveys included the assessors actively searching on and under floating debris and organic matter, down cracks and under rocks surrounding the fringes of the wetland; and
- The call playback survey methodology meant that the assessors undertook ten minutes of quiet listening; and
- Dip netting for approximately five minutes to locate and identify Growling Grass Frog tadpoles (undertaken during the diurnal survey only).

At each Growling Grass Frog Survey Site, the call playback surveys included:

- Quiet listening for frog calls, undertaken for five minutes prior to call-playback;
- Growling Grass Frog call-playback, with the advertisement call of the species played approximately six to ten times at each site; and
- A further five minutes of quiet listening quiet listening.

In addition, active searching was undertaken for approximately 20 person minutes at each site per night, covering the accessible/visible interior, margins and surrounding terrestrial habitat of wetlands. Where nocturnal surveys were undertaken a spotlight was used.

The frog species and the number of observed individuals, as well as the approximate numbers of calling males, were recorded during each survey.

The survey effort is considered adequate as Heard et al (2010) demonstrates that a threshold of 95% detection probability requires at least two surveys when conducted in October–December, whereas three are required in January–March.

Weather conditions were appropriate for frog detection with mild weather on each of the survey days (Table 1).

Table 1. Weather conditions during diurnal and nocturnal frog surveys at the study area.

Survey #	Diurnal	Nocturnal 1	Nocturnal 2	Nocturnal 3
Date	12 Jan 2022	12 Jan 2022	19 Jan 2022	2 Feb 2022
Start time	10:30	21:45	21:30	21:30
Finish time	20:30	01:45	01:30	01:30
Temperature (°C) at commencement	25.0	21.0	20.5	18.5
Humidity (%)	76	76	65	60
Wind speed average (km/h)	25	18	24	19
Wind direction	N	S	S	SE
Rain (mm)	0	0	0	1
Cloud cover (Octaves)	6/8	7/8	6/8	3/8
Preceding 24 hour rain (mm)	0	0	0	0

Survey Hygiene

To reduce the risk of infection and spread of amphibian disease, particularly chytrid fungus, the handling, collection and preservation was to follow standards used by the NSW National Parks and Wildlife Service (Department of Environment and Climate Change (NSW) 2008).

Habitat Assessment

The following habitat variables were measured and recorded during the diurnal survey:

- The location of potentially suitable habitat (Australian Map Grid co-ordinates);
- An analysis of the percentage cover of emergent, submerged, floating and fringing vegetation and terrestrial vegetation at both occupied (including sites where successful breeding is occurring) and unoccupied sites;
- Percentage cover and composition of terrestrial refuge sites (e.g. rocks, logs, debris) surrounding waterways and wetlands;

- Basic water chemistry analysis (dissolved oxygen, electrical conductivity, pH, turbidity, temperature, salinity);
- Information regarding water levels at sites;
- The type of surrounding habitat within 30 metres of each site;
- The location of potential dispersal routes and linked habitat; and,
- The presence and overall abundance of aquatic (Eastern Gambusia and other fish) and terrestrial predators (e.g. foxes, cats, birds).

Water chemistry was measured using a Horiba U-10 multi-parameter water quality analyser system on 12 January 2022, during the diurnal assessments.

General comments on the presence of pollutants, rubbish, refuse, or other threatening processes were made. A photograph of the waterbody was taken.

Latham's Snipe

Potential habitat for Latham's Snipe was identified in collaboration with the Council, and included the Marshall Creek, drains and waterbodies within the Marshall PSP area (Figure 1). Habitat for Latham's Snipe was area was systematically traversed on foot on three occasions: 12 January 2022, 19 January 2022, 20 January 2022 and 2 February 2022. Four surveys is consistent with the survey effort recommended in the *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (Department of the Environment and Energy 2017). The location and number of Latham's Snipe observed was recorded into a hand-held iPad mini tablet loaded with GIS software.

Fish Surveys

Fish surveys were undertaken by Aquatica Environmental over two days and one night on 27 and 28 April 2022. Surveys were generally undertaken at the same locations as the Growling Grass Frog surveys undertaken by Ecolink Consulting, however, a site near the south-wester corner was not assessed, as information on its fish community was obtained from discussion Austral Research and Consulting who recently surveyed this area (Aquatica Environmental Pty Ltd 2022). In addition, an additional survey site was created, and a control site was surveyed at a known population of Yarra Pygmy Perch as a reference site.

The survey methodology followed the survey protocols outlined in the national Recovery Plan for Yarra Pygmy Perch (Nannoperca obscura) (Saddlier 2010), *Survey Guidelines for Australia's Threatened Fish* (Department of Sustainability Environment Water Population and Communities 2011) and the *Biodiversity Precinct Structure Planning Kit* (DSE 2010).

Fauna Habitat Assessments

Fauna habitat assessments were undertaken concurrently with the targeted surveys for Latham's Snipe and Growling Grass Frog. Notes were recorded whilst traversing the site, where access was provided, or by vehicle from adjacent roads where access to properties was not provided. General notes on fauna habitats were recorded, particularly in relation to potential habitats for threatened species.

Limitations

The following limitations and qualifications apply to this report:

- The results of the desktop assessment are reliant on data obtained from various databases and other reports. These databases all have internal vetting procedures, however the accuracy of these historical data and some of the results provided within these reports cannot be verified. The desktop assessment does, however, rely on the most accurate data available.
- As with all ecological assessments, a greater survey effort is likely to yield additional flora and fauna records.
- The City of Greater Geelong have provided anecdotal advice that the numbers of Latham's Snipe were generally lower during the recent survey season than previous years. This includes the nearby Jerringot Wetland and Belmont Common area which can support up to 300 individual Latham Snipe at any one survey event (Peter Schembri, Senior Strategic Planner, *in litt*. 4 April 2022)

Despite these limitations to the assessment, the results gained by both a desktop and a field surveys are adequate to address the purposes of this report

Results

Growling Grass Frog

The Victorian Biodiversity Atlas identifies multiple records of Growling Grass Frogs within three kilometres of the study area:

- Approximately 200 metres north of the study area on private land and 1.3 kilometres north of the study area, east of Tuckers Road, in residential land. These are Museum specimens dating back to 1959 and 1967, and the accuracy of these locations cannot be relied upon. Growling Grass Frogs are unlikely to persist in these locations;
- Approximately 2.5 kilometres north of the study area, at the Belmont Common, which adjoins the Barwon River. The records date back to 1995, although the number of individuals recorded at these locations is not included in the Victorian Biodiversity Atlas; and
- Approximately 2.5 kilometres east of the study area at Reedy Lake, which forms part of the Lake Connewarre wetland complex, with three individuals recorded on separate occasions during 2016 (Department of Environment Land Water and Planning 2022).

Based on the desktop assessment, it is concluded that a population of Growling Grass Frogs may persist within the vicinity of the study area, and that individuals may utilise habitats in the vicinity of the Barwon River, as well as nearby waterbodies and waterways as breeding or dispersal habitats.

Despite this, Ecology and Heritage Partners (2014) did not record Growling Grass Frogs during two targeted surveys conducted during October and November 2010. In that report they identified five waterbodies which may provide suitable habitat, and provided a moderate to high likelihood of occurrence in these locations (Ecology and Heritage Partners Pty Ltd 2014). The waterbodies identified as providing suitable habitat for Growling Grass Frog include Survey Sites 1 and 11 of the current Growling Grass Frog survey. The other three suitable waterbodies that were identified by Ecology and Heritage Partners are located near Barwon River north of the study area of this report.

Growling Grass Frogs were not recorded during the current assessment. Four Survey Sites (1, 3, 6, 10) were identified with moderate to high quality habitats for Growling Grass Frogs:

- Survey Site 1 which is a moderately large waterbody, with a high cover of open water, emergent vegetation including Reeds and submerged vegetation, including Water Milfoil *Myriophyllum* sp.. Cattle did not appear to access this dam during the current assessment. However, exotic predatory fish and native birds (gallinules) were recorded, which may depredate Growling Grass Frogs, their eggs or tadpoles. Due to the proximity to Barwon River, there is a moderate probability that this waterbody will be colonised by Growling Grass frogs in the future.
- Survey Site 3 was relatively small, but also contained a moderate cover of emergent native vegetation and open water. As with Survey Site 1, there is a moderate likelihood that this waterbody will be colonised by Growling Grass Frogs in the future.
- Survey Site 6 is further away from possible source populations of Growling Grass Frog and is near the centre of the study area. Still, it contained a high cover of open water, emergent vegetation including Reeds and submerged vegetation including Water Milfoil *Myriophyllum* sp. Shading from nearby exotic and native trees is not desirable for Growling Grass Frogs, which prefer areas of open water.

- Survey Site 10, which is in the south-western portion of the study area, contained high cover of open water, emergent vegetation including Reeds and submerged vegetation, like Site 6. However, shading from planted shrubs and trees, as well as exotic Gorse *Ulex europeaus* and Boneseed *Chrysanthemoides monilifera* fringing the dam reduced the quality of habitat provided within this dam.

Other Survey Sites (2, 4, 5, 7, 8, 9, 11) provided generally poor quality habitats for Growling Grass Frog on the basis that:

- Salinity was high, particularly at Survey Sites 2 and 11;
- The waterbodies appeared ephemeral, with only shallow water present during the current assessment, which is likely to dry out during Summer periods of average rainfall;
- They were disturbed by livestock, or road runoff, or regular landowner activities such as mowing, "cleaning" of dams or removal of vegetation. They generally contained turbid or stagnant water. Examples included Survey Sites 4, 7, 8 and 9;
- They lacked submerged and floating vegetation, with only a very small amount of emergent vegetation;
- The fringing vegetation at some Survey Sites included pasture grasses and weeds, including Wild Oats *Avena* sp., Barley Grass *Hordeum* sp., Rye-grass *Lolium* sp., Cocksfoot *Dactylis glomerata*, Blanket Weed *Galenia pubescens* and Toowoomba Canary Grass *Phalaris aquatica.* These species are not recognised as providing preferred habitats for Growling Grass Frog*;*
- The predatory fish, Eastern Gambusia, was recorded when dip netting, or observed during nocturnal surveys;
- Only Spotted Marsh Frog *Limnodynastes tasmaniensis* and Common Froglet *Crinia signifera* tadpoles were recorded during the current assessments, suggesting that not all species are successfully reproducing, and that predatory fish may be impacted survivability; and
- Other predatory species, including foxes and cats, would also be present. Australian Wood Ducks *Chenonetta jubata,* Pacific Black Ducks *Anas superciliosa,* Chestnut Teal *Anas castanea* and/or gallinules were observed at seven out of the 11 Survey Sites (Table 2).

Table 2. Habitat variables measured to determine the suitability of dams at the study area.

Dam	Variable measured	Survey Site 1	Survey Site 2	Survey Site 3	Survey Site 4	Survey Site 5	Survey Site 6	Survey Site 7	Survey Site 8	Survey Site 9	Survey Site 10	Survey Site 11
Plate Ref.		3	4	5	6	7	8	9	10	11	12	13
Approx. size (m^2)		1,800	1,400	450	380	600	1,300	100	100	100	5,800	940
Livestock present		Nil	Nil	Sheep	Nil	Nil	Nil	Nil	Nil	Cattle	Nil	Nil
	Type of waterbody	Artificial dam	Artificial dam	Artificial dam	Creek & culvert	Artificial dam	Online dam	Creek	Creek & culvert	Creek	Artificial dam	Dam
	Water level (%)	75	90	90	50	40	80	50	70	20	75	60
Vegetation	Floating (%)	10	0	10	0	0	25	0	0	0	10	0
	Submerged (%)	70	0	25	0	0	70	0	0	0	60	0
	Emergent (%)	50	25	25	20	5	30	20	20	20	30	2
	Fringing (%)	90	90	80	40	80	50	80	90	90	90	40
	Terrestrial (%)	100	70	90	80	80	90	90	90	90	90	70
Terrestrial refuge sites (% cover)		15	10	5	5	5	5	5	5	5	5	5
Water chemistry	Dissolved oxygen (mg/L)	8.6	4.8	8.2	3.8	4.4	7.8	5.6	6.2	3.1	8.9	3.8
	Electrical conductivity (mS/cm)	11.9	111.2	10.8	10.9	20.6	10.6	10.9	10.8	30.6	20.7	111.6
	pH	7.4	6.8	7.3	7.1	7.1	7.2	7.3	7.5	7.4	7.3	6.9
	Turbidity (FTU)	40	80	80	60	240	80	120	80	280	60	80
	Temperature (°C)	19.0	19.5	20.0	21.5	20.5	19.5	19.5	19.5	21.5	20.0	21.5
	Salinity (ppt)	0.11	2.18	0.21	0.44	0.38	0.26	0.48	0.33	0.16	0.21	2.23
Predators	Aquatic	Yes, Eastern Gambusia	No	No	No	No	Yes, Eastern Gambusia	Yes, Eastern Gambusia	Yes, Eastern Gambusia	Yes, Eastern Gambusia	No	No
	Terrestrial	Yes, ducks, teal, gallinules	No	Yes, ducks, gallinules	Yes, ducks	Yes, ducks	Yes, ducks, gallinules	No	No	No	Yes, ducks, gallinules	Yes, ducks

Four frog species were recorded during the surveys: Spotted Marsh Frog, Common Froglet, Southern Brown Tree Frog *Litoria ewingii,* and Whistling Tree Frog *Litoria verreauxii* (Table 3). Spotted Marsh Frog and Common Froglet were widespread throughout the study area, although neither species was recorded at Survey Site 7 or 9. Southern Brown Tree Frog and Whistling Tree Frog were only recorded on one occasion, at one location: Survey Site 6 and Survey Site 3 (respectively). Except for Whistling Tree Frog, each of these species are common within the local region, and throughout much of southern Victoria.

The total numbers of frogs were lower than was expected. Substantially higher numbers of frogs have been recorded elsewhere on the Bellarine Peninsula in similar habitats during targeted surveys (pers obs.).

Table 3. Results of targeted Growling Grass Frog surveys at Survey Site 1.

Survey Site	Common Name	Diurnal Survey	Nocturnal Survey #1	Nocturnal Survey #2	Nocturnal Survey #2
1	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	Tadpoles	6C	3C	3C
	Common Froglet	Tadpoles	-	1C	-
2	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	-	2C	3C	-
3	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	-	5C	5C	3C
	Whistling Tree Frog	-	1C*	-	-
4	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	-	3C	3C	6C
	Common Froglet	Tadpoles	1C	-	-
5	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	-			4C
6	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	-	20+C	10+C	20+C
	Common Froglet	Tadpoles	3C	5C	3C
	Southern Brown Tree Frog	-	-	-	1C
7	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	-			-
8	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	Tadpoles	5C	5C	5C
	Common Froglet	Tadpoles	-	-	-
9	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	-			-
10	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	-	20+C	15C	5C
	Common Froglet	Tadpoles	-	-	-
11	**Growling Grass Frog**	-	-	-	-
	Spotted Marsh Frog	-	-	2C	-

Table Notes: C = Calling (not seen). C* = Calling from the vicinity, not directly at the survey site

Latham's Snipe

A total of five Latham's Snipe were recorded, at two broad locations, during the four surveys. This included three Latham's Snipe in the northern-most portion of the study area, either side of Horseshoe Bend Road, near Growling Grass Frog Survey Sites 3 and 11, as well as two Latham's Snipe near the centre of the study area, west of Horseshoe Bend Road in the vicinity of Growling Grass Frog Survey Site 6 (Figure 1; Table 4). Only individuals were recorded at each site on any given day. It is therefore possible that the same individual may have been recorded on multiple occasions.

Latham's Snipe were most often flushed from long grassy vegetation in close proximity to a waterbody. When flushed, most birds flew approximately 50-100m away from the observer, but were seen to land at wetlands or grassy areas nearby.

Table 4. Observations of Latham's Snipe during the current assessment

Survey Number	Date	Survey 1
1	12 Jan 2022	One Latham's Snipe east of Horseshoe Bend Road, near Growling Grass Frog Survey Site 3; and One Latham's Snipe west of Horseshoe Bend Road near Growling Grass Frog Survey Site 6.
2	19 Jan 2022	One Latham's Snipe west of Horseshoe Bend Road near Growling Grass Frog Survey Site 11.
3	20 Jan 2022	One Latham's Snipe west of Horseshoe Bend Road near Growling Grass Frog Survey Site 6.
4	2 Feb 2022	One Latham's Snipe west of Horseshoe Bend Road near Growling Grass Frog Survey Site 11.

At the locations where Latham's Snipe were recorded, habitats were of high quality for the species. They generally comprised long grasses or sedges exceeding 30 centimetres in height providing cover whilst foraging. The birds were not located near busy roads, as the northern ends of Horseshoe Bend Road were closed to through traffic at the time of the assessment (due to the road upgrade works occurring along Barwon Heads Road).

Significant population of Latham's Snipe are described as locations that have previously been identified as internationally important for the species, or areas that support at least 18 individuals of the species under the definition provided in the *Draft Background Paper to EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebird Species* and the *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (Department of the Environment and Energy 2017; Department of the Environment Water Heritage and the Arts 2009). The numbers of Latham's Snipe observed during the current assessment does not therefore constitute observations of a significant population of the species.

Other Matters of National Environmental Significance

A list of other EPBC Act-listed fauna species, both threatened and migratory, which were identified during the desktop assessment is provided in Table 5.

Most of the threatened species identified in the desktop assessment are unlikely to occur as their habitat requirements are not met, or due to the degraded nature of their habitats within the study area. Many of the species are shorebirds which do not breed in the southern hemisphere, and which are more likely to occur in coastal habitats, including beaches, estuaries and wetlands; habitats which do not occur within the study area. The development of the Marshall PSP is unlikely to significantly impact any of the species listed that have been assessed as being unlikely to occur or which have a low likelihood of occurrence within Table 5.

Four species listed in Table 5 (other than Growling Grass Frog and Latham's Snipe discussed above) have a moderate likelihood of occurrence within the study area, or have previously been recorded within the study area: Grey-headed Flying-fox *Pteropus poliocephalus*, Swift Parrot *Lathamus discolor*, Australian Grayling *Prototroctes maraena* and Yarra Pygmy Perch *Nannoperca obscura*.

Grey-headed Flying Fox is listed as Vulnerable under the EPBC Act. A roost site is known to occur at Eastern Park in Geelong. Individual bats will disperse from their roost site throughout the broader area to forage in flowering trees and fruit trees. The trees within the study area would provide moderate quality habitat for Grey-headed Flying Fox, as we would expect that they would provide foraging opportunities for this species. However, the study area is unlikely to provide breeding habitat, or a roost site for the species, and impacts to trees from future development of the Marshall PSP would be unlikely to significantly impact this species.

Swift Parrot is listed as Endangered under the EPBC Act. It has previously been recorded in the south-western portion of the study area (Department of Environment Land Water and Planning 2022). Swift Parrots breed in Tasmania and are Winter migrants to mainland Australia. Preferred habitats on the mainland Australia would include woodlands and Box-Ironbark forests inland of the Great Dividing Range. We would expect that the study area may provide occasional foraging opportunities for Swift Parrot whilst migrating, but it does not provide breeding or limiting habitat for this species. Future development of the Marshall PSP would be unlikely to significantly impact this species.

Two EPBC Act-listed fish species have previously been recorded within the Barwon River, north of the study area; Australian Grayling and Yarra Pygmy Perch. Both of these species are listed as Vulnerable under the EPBC Act. Yarra Pygmy Perch can occur in streams, creeks and pools of water, and Marshall Creek provides moderate quality habitat for this species. Australian Grayling is a river specialist and had only a very low likelihood of occurrence. Targeted fish surveys for these species did not record any individuals of either species. It is concluded that neither Yarra Pygmy Perch or Australian Grayling are likely to occur within the study area (Aquatica Environmental Pty Ltd 2022).

Australian Mudfish is not listed as nationally significant under the EPBC Act, but is listed as Endangered under the FFG Act. This species was not recorded during the targeted fish surveys (Aquatica Environmental Pty Ltd 2022).

Lake Connewarre is a complex of wetlands which form the *Port Phillip Bay (Western Shoreline) and Bellarine Peninsula* Ramsar Site. Pursuant to the EPBC Act, any actions which may significantly

impact upon this wetland would require approval under the EPBC Act. A Referral to DAWE is recommended where the development of the Marshall PSP area may impact upon the *Port Phillip Bay (Western Shoreline) and Bellarine Peninsula* Ramsar Site. Guidance on determining if an impact is likely to be significant is provided in the *Significant Impact Guidelines 1.1; Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment 2013).

Table 5. Preferred habitats and the likelihood of occurrence for EPBC Act-listed 'threatened' and 'migratory' fauna species identified through the desktop assessment.

Common Name	Species Name	National Status	Habitat Preferences	Most Recent Record (# individuals)	Habitat Present on Site	Likelihood of Presence*
Birds						
Australasian Bittern	*Botaurus poiciloptilus*	Endangered	Reed beds, dense vegetation of freshwater swamps and creeks.	2002 (3)	Yes	Low
Australian Painted-Snipe	*Rostratula australis*	Vulnerable	Uncommon summer migrant to Victoria. Lowlands on shallow freshwater swamps with emergent vegetation, and flooded salt marshes.	1956 (1)	Yes	Low
Bar-tailed Godwit	*Limosa lapponica*	Vulnerable, Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins	NPR	No	Unlikely
Black-tailed Godwit	*Limosa limosa*	Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins	NPR	No	Unlikely
Common Greenshank	*Tringa nebularia*	Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Common Sandpiper	*Actitis hypoleucos*	Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Curlew Sandpiper	*Calidris ferruginea*	Critically Endangered	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	2017 (16)	No	Unlikely
Double-banded Plover	*Charadrius bicinctus*	Migratory	Coastal estuaries, tidal mudflats, mangroves, shallow river margins	NPR	No	Unlikely
Eastern Curlew	*Numenius madagascariensis*	Critically Endangered	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Fairy Tern	*Sternula nereis nereis*	Vulnerable	Coastal waters, bays, inlets, brackish lakes, sewerage ponds near coasts.	1974 (1)	Yes	Low
Fork-tailed Swift	*Apus pacificus*	Migratory	Aerial insectivore that rarely lands to perch, often sleeping on the wing. No breeding habitat in Australia.	NPR	No	Unlikely

Common Name	Species Name	National Status	Habitat Preferences	Most Recent Record (# individuals)	Habitat Present on Site	Likelihood of Presence*
Great Knot	*Calidris tenuirostris*	Critically Endangered, Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Grey Falcon	*Falco hypoleucos*	Vulnerable	Woodland, scrub, shrubland and grassland types in arid and semi-arid zones.	NPR	No	Unlikely
Grey Plover	*Pluvialis squatarola*	Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Grey-tailed Tattler	*Heteroscelus brevipes*	Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Latham's Snipe	*Gallinago hardwickii*	Migratory	Wet grasslands, open and wooded swamps.	NPR	Yes	Present. Moderate quality habitat
Lesser Sand Plover	*Charadrius mongolus*	Endangered, Migratory	Tidal mudflats and sandflats, beaches, saltmarsh, estuaries	NPR	No	Unlikely
Little Curlew	*Numenius minutus*	Migratory	Coastal estuaries, tidal mudflats, mangroves, shallow river margins	NPR	No	Unlikely
Marsh Sandpiper	*Tringa stagnatilis*	Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Orange-bellied Parrot	*Neophema chrysogaster*	Critically Endangered	Coastal saltmarshes and coastal pastures	NPR	No	Unlikely
Osprey	*Pandion haliaetus*	Migratory	Coasts and wetlands, occasionally inland along rivers	NPR	No	Unlikely
Pacific Golden Plover	*Pluvialis fulva*	Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Painted Honeyeater	*Grantiella picta*	Vulnerable	Open box-ironbark forests and woodlands, particularly where trees are infested with mistletoe.	NPR	No	Unlikely
Pectoral Sandpiper	*Calidris melanotus*	Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely

Common Name	Species Name	National Status	Habitat Preferences	Most Recent Record (# individuals)	Habitat Present on Site	Likelihood of Presence*
Pin-tailed Snipe	*Gallinago stenura*	Migratory	Uncommon summer migrant to Victoria. Lowlands on shallow freshwater swamps with emergent vegetation, and flooded salt marshes	NPR	Yes	Low
Plains-wanderer	*Pedionomus torquatus*	Vulnerable	Sparse, treeless, lightly grazed native grasslands/herbfields with bare ground, old cereal crops, low shrubland.	1898 (1)	Yes	Low
Red Knot	*Calidris canutus*	Endangered, Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Red-necked Stint	*Calidris ruficollis*	Migratory	Coastal estuaries, tidal mudflats, mangroves, shallow river margins	NPR	No	Unlikely
Regent Honeyeater	*Anthochaera phrygia*	Endangered	Depends on nectar and insects from Box-Ironbark Eucalypt forests. Only breeding habitat lies in Northeast Victoria and central coast of NSW	NPR	No	Unlikely
Ruddy Turnstone	*Arenaria interpres*	Migratory	Tidal reefs and pools, mudflats	NPR	No	Unlikely
Rufous Fantail	*Rhipidura rufifrons*	Migratory	Eucalypt forests and rainforests	NPR	Yes	Low
Sanderling	*Calidris alba*	Migratory	Estuaries, tidal mudflats, mangroves, shallow river margins, coastal or inland	NPR	No	Unlikely
Satin Flycatcher	*Myiagra cyanoleuca*	Migratory	Tall forests, preferring wetter habitats such as heavily forested gullies	NPR	No	Unlikely
Sharp-tailed Sandpiper	*Calidris acuminata*	Migratory	Coastal estuaries, tidal mudflats, mangroves, shallow river margins	NPR	No	Unlikely
Swift Parrot	*Lathamus discolor*	Endangered	Winter migrant from Tasmania. Generally prefers Box-Ironbark forests and woodlands inland of the Great Dividing Range during winter.	2006 (13)	Yes	Low to Moderate
Swinhoe's Snipe	*Gallinago megala*	Migratory	Uncommon summer migrant to Victoria. Lowlands on shallow freshwater swamps with emergent vegetation, and flooded salt	NPR	No	Unlikely

Common Name	Species Name	National Status	Habitat Preferences	Most Recent Record (# individuals)	Habitat Present on Site	Likelihood of Presence*
			marshes			
Terek Sandpiper	*Xenus cinereus*	Migratory	Tidal mudflats, saltmarshes, coastal swamps, estuaries.	NPR	No	Unlikely
Whimbrel	*Numenius phaeopus*	Migratory	Mudflats, beaches, and coastal marshes	NPR	No	Unlikely
White-throated Needletail	*Hirundapus caudacutus*	Vulnerable	Aerial insectivore that rarely lands to perch, often sleeping on the wing	1973 (4)	Yes	Low
Yellow Wagtail	*Motacilla flava*	Migratory	Rare vagrant migrant to Australia. Grassy meadows near water.	NPR	No	Unlikely
Red-necked Phalarope	*Phalaropus lobatus*	Migratory	Coastal marshes and lakes	NPR	No	Unlikely
Mammals				NPR		
Spotted-tail Quoll	*Dasyurus maculatus maculatus*	Vulnerable	Forests including large intact areas of vegetation for foraging.	NPR	No	Unlikely
Swamp Antechinus	*Antechinus minimus maritimus*	Vulnerable	Heathy forest, wetlands, heathland and coastal scrub.	NPR	No	Unlikely
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable	Roost sites commonly occur in gullies, in vegetation with dense canopy cover and close to water. May disperse or forage into trees elsewhere	2021 (609)	Yes	Present. Moderate quality habitat.
Southern Brown Bandicoot	*Isoodon obesulus obesulus*	Endangered	Heathy forest, heathland and coastal scrub.	1964 (1)	No	Unlikely
Frogs						
Growling Grass Frog	*Litoria raniformis*	Vulnerable	Permanent lakes, swamps, dams and lagoons.	2016 (12)	Yes	Low
Reptiles						
Striped Legless Lizard	*Delma impar*	Vulnerable	Lowland native grasslands, typically dominated by native tussock forming grasses. Typically occurs on deep cracking clay soils.	NPR	No	Unlikely
Fish						

Common Name	Species Name	National Status	Habitat Preferences	Most Recent Record (# individuals)	Habitat Present on Site	Likelihood of Presence*
Australian Grayling	*Prototroctes maraena*	Vulnerable	Clear gravelly streams; deep slow flowing pools.	1986 (14)	Yes	Unlikely
Dwarf Galaxias	*Galaxiella pusilla*	Vulnerable	Slow moving waters, including ephemeral drains.	NPR	Yes	Low
Yarra Pygmy Perch	*Nannoperca obscura*	Vulnerable	Slow flowing creeks or still lakes with abundant aquatic vegetation and log snags	2014 (84)	Yes	Unlikely
Invertebrates						
Golden Sun Moth	*Synemon plana*	Critically Endangered	Tussock grasslands preferably dominated by Wallaby Grasses and Spear Grasses.	NPR	No	Unlikely

Table Notes:

This table includes species listed exclusively as 'migratory' or 'marine' under the EPBC Protected Matters Search results (Department of Agriculture Water and the Environment 2022).

NPR – Not previously recorded

*** Likelihood of Presence Definitions:**

Unlikely – Site does not contain habitat and/or it is outside the species' known, current distribution. Birds and bats may fly over.

Low –Site contains some marginal habitat, but the species was not observed and has not been recorded in previous recent surveys in the area. Birds and bats may fly over.

Moderate – Site contains preferred habitat that may support a population of the species. Birds and bats may opportunistically or seasonally forage at the site.

High – Site contains preferred habitat which is likely to support the species. Birds and bats are likely to regularly (at least seasonally) forage or roost at the site.

Present – Preferred habitat is present on the site, and the species was observed on the site, or recently recorded on the site.

NPR– No previous record, modelled presence only under the EPBC Protected Matters Search results (Department of Agriculture Water and the Environment 2022).

Threatened status based on the *Flora and Fauna Guarantee Act 1988* - Threatened List: June 2021 (Department of Environment Land Water and Planning 2021)

Significant Impact Guidelines

The current assessment has determined that future development of the Marshall PSP:

- Is unlikely to significantly impact Growling Grass Frogs which were not recorded during the current surveys, nor within the study area during the desktop assessment, or during a previous survey for the species within the study area (and beyond) completed in 2010 (Ecology and Heritage Partners Pty Ltd 2014);
- Is unlikely to significantly impact Latham's Snipe, despite observations of individual birds during the current assessment. A significant population of Latham's Snipe is described as locations that have previously been identified as internationally important for the species, or areas that support at least 18 individuals of the species (Department of the Environment and Energy 2017; Department of the Environment Water Heritage and the Arts 2009). Therefore, a significant impact to this species is unlikely to occur, and a referral to the DAWE, under the EPBC Act is not recommended;
- Is unlikely to impact Yarra Pygmy Perch and Australian Grayling which were not recorded during targeted fish surveys (Aquatica Environmental Pty Ltd 2022);
- Is unlikely to significantly impact upon the local population of Grey-headed Flying-fox which is likely to forage within the study area on occasion;
- Is unlikely to significantly impact upon the Swift Parrot, which may opportunistically forage at trees within the study area during migrations from Tasmania;
- May significantly impact upon the Lake Connewarre wetland and the *Port Phillip Bay (Western Shoreline) and Bellarine Peninsula* Ramsar Wetland (see below).

The Significant Impact Criteria for the Lake Connewarre, *Port Phillip Bay (Western Shoreline) and Bellarine Peninsula* Ramsar Wetland include impacts which result in any of the following criteria:

- Areas of the wetland being destroyed or substantially modified;
- A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland;
- The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected;
- A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health; or
- An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland (Department of the Environment 2013).

The Guidelines also provide examples of impacts to wetlands that may be considered significant (Department of the Environment 2013). It states:

'Establishing a new subdivision in an existing suburb, with established infrastructure designed to manage environmental impacts, upstream of a large Ramsar wetland (such as the Moreton Bay Ramsar wetland) would not be expected to have a significant impact on the wetland.

By contrast, establishing a new subdivision in the vicinity of a smaller Ramsar wetland is likely to have a significant impact on the wetland if it involves extensive vegetation clearing, clearing riparian vegetation, modifying the flow of water to or within the wetland, or if it will result in significant discharges of pollutants into the wetland.' (Department of the Environment 2013; p. 33).

This report makes a series of recommendations to mitigate impacts to the Lake Connewarre, *Port Phillip Bay (Western Shoreline) and Bellarine Peninsula* Ramsar Wetland to try to minimise impacts to fauna values.

Recommendations

To avoid and mitigate impacts to the Lake Connewarre, *Port Phillip Bay (Western Shoreline) and Bellarine Peninsula* Ramsar Wetland, we make the following recommendations (wherever practicable):

- That the development design:
  - Retain existing native vegetation and fauna habitats;
  - Incorporate water sensitive urban design principles into storm water management;
  - Includes retarding basins that include biobasins and gross pollutant traps to intercept and treat all stormwater prior to discharge into Lake Connewarre;
- Hydrology is managed to:
  - Improve water quality from that which currently occurs at the site and at Lake Connewarre;
  - Manage flow rates to avoid substantial alterations water levels and flow rates into to Lake Connewarre;
  - Create appropriate hydrology for retaining wetlands within the landscape, and improving habitats for native wildlife such as Growling Grass Frogs and Latham's Snipe.
- Construction work is managed to avoid direct and indirect impacts to waterways through:
  - Implementation of a Construction Environment Management Plan;
  - Sediment and erosion control measures;
  - Dust control;
  - Weed management, including managing weeds, weed pathogens, and undertaking vehicle hygiene protocols;
  - The creation of wetlands and biobasins which are constructed early in the development process to ensure flows are managed and treated appropriately prior to discharge throughout the entire life of the development of the Marshall PSP;
  - Chemical, fuel and pollutant controls; and
  - The creation of exclusion (No Go) areas where sensitive ecological values are present.
- Improve habitats for Growling Grass Frog, Latham's Snipe, fish and other wildlife by:
  - Undertaking works in areas containing threatened species habitats undertaken outside the breeding season, or outside of the migratory period;
  - Incorporating animal welfare protocols into the abovementioned Construction Environment Management Plan;
  - Developing hydrological regimes that maintain fauna habitats (e.g. supporting aquatic vegetation, semi-aquatic vegetation, as well as terrestrial vegetation), allow native fish passage, and provide a suitable hydrological regime to manage pest animals. This can include periods of drying to kill predatory exotic fish such as Eastern Gambusia.
  - Designing wetlands (and possibly water treatment facilities such as the retarding basins/biobasins) to be connected through a series of ponds, and to incorporate desirable and varied water depths and habitat variability (including swales which may be preferred by Latham's Snipe). Wetland design guidelines have been prepared for Melbourne's growth areas and can assist in this regard;
  - Using open space areas to protect biodiversity assets from development; and
  - Ensuring the revegetation of wetlands is undertaken with locally indigenous species which would favour desirable native fauna species.

In addition, it is recommended that the fauna salvage is undertaken to mitigate and minimise fauna injury or mortalities, and avoid breaches of the Wildlife Act

Based on the assessments described above, it is concluded that the proposed Marshall development is unlikely to significantly impact any EPBC Act-listed fauna species. Adherence to the recommendations provided within this report will minimise impacts to the Lake Connewarre, *Port Phillip Bay (Western Shoreline) and Bellarine Peninsula* Ramsar Wetland and, should they be implemented, a referral would not be required.

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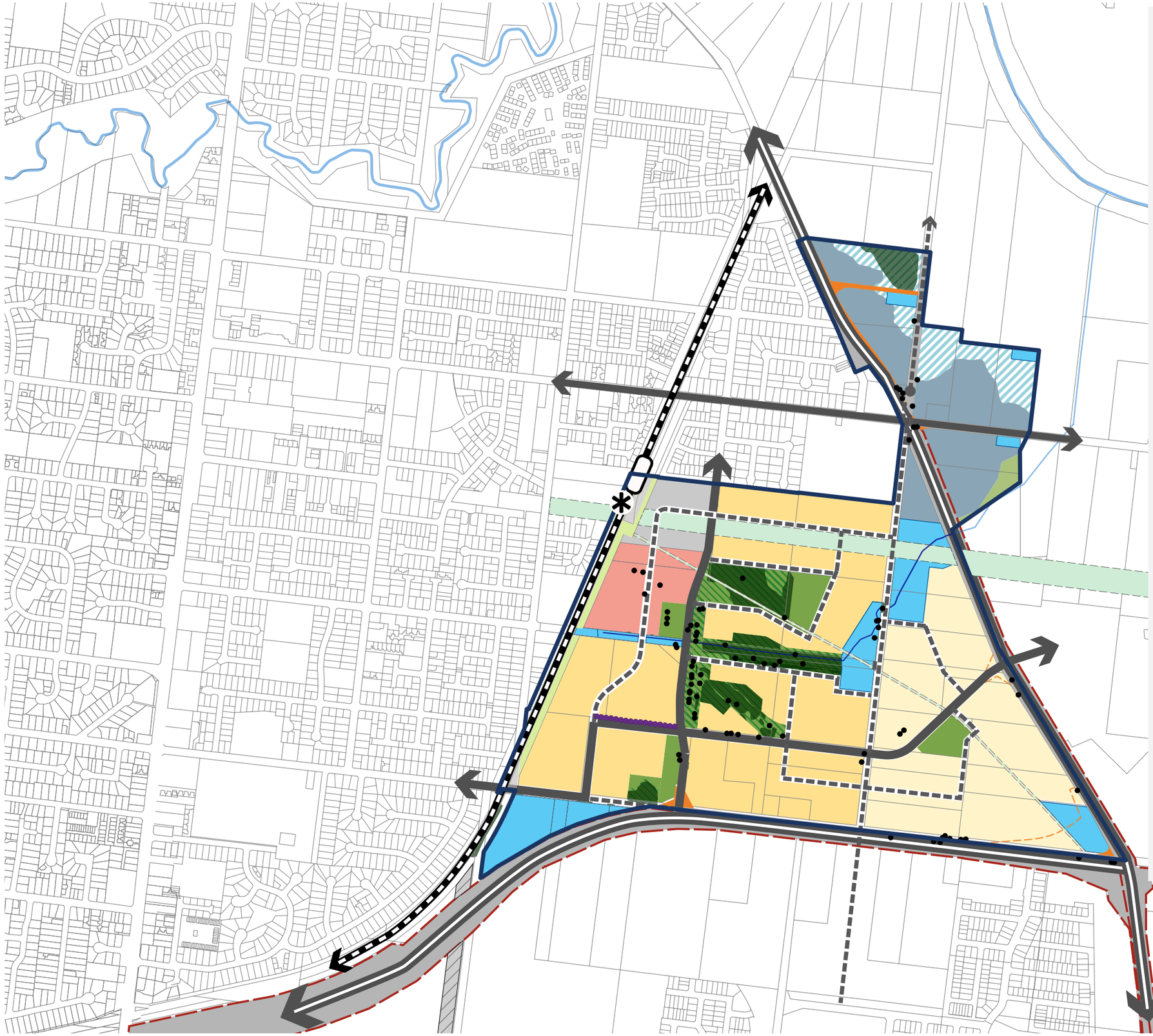
Figure 1. Marshall Future Urban Structure Plan – Option H



LEGEND

- investigate tree point
- tree point
- vegetation area
- precinct boundary
- standard residential
- medium density residential
- transport hub
- station precinct
- commercial/bulky goods
- drainage reserve
- credited (unencumbered) open space
- conservation
- waterway / drainage line
- central waterway
- railway and station
- potential future station location
- PAO (public acquisition overlay)
- arterial road projects area
- arterial road intersection extent (including proposed access road)
- potential arterial road duplication extent
- road truncation (Barwon Heads Road duplication project)
- Armstrong Creek transit corridor
- sewer easement
- Barwon Water easement
- electricity easement and transmission tower
- proposed FO (flood overlay)
- arterial road
- connector street
- key local street

CITY OF GREATER GEELONG

MARSHALL FUTURE URBAN STRUCTURE OPTION H

PROJECT NO.: PRJ-16-1158 REVISION: 01 DATE: 13.04.2022 DRAWN BY: PL

0 100m 200m 400m

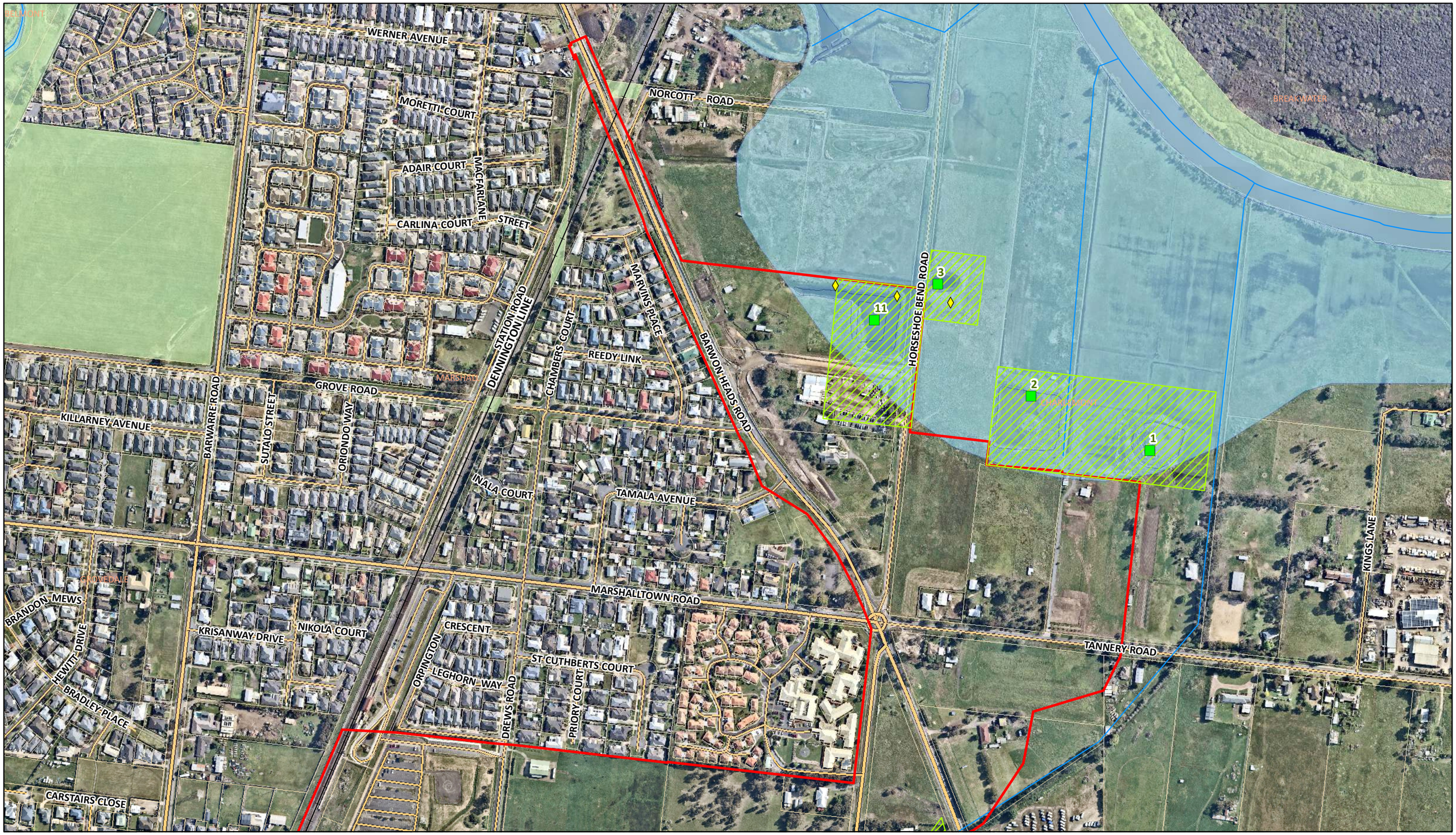


Figure 2: Results of the Current Assessment

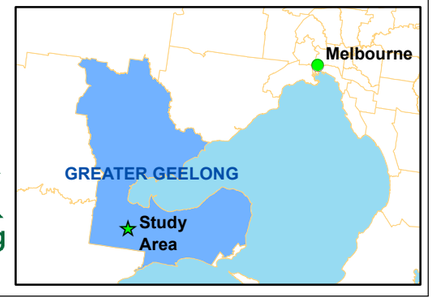
Marshall Precinct (North)

Legend

- Study Area
- Lathams Snipe Survey Sites
- Growling Grass Frog Survey Sites
- Latham's Snipe Records
- Creeks and Waterways

0 50 100 150 200 Meters

ecolink consulting



P/N 2120 Figure 1. January 2022. Aerial photography: Nearmap. 6 October 2021.

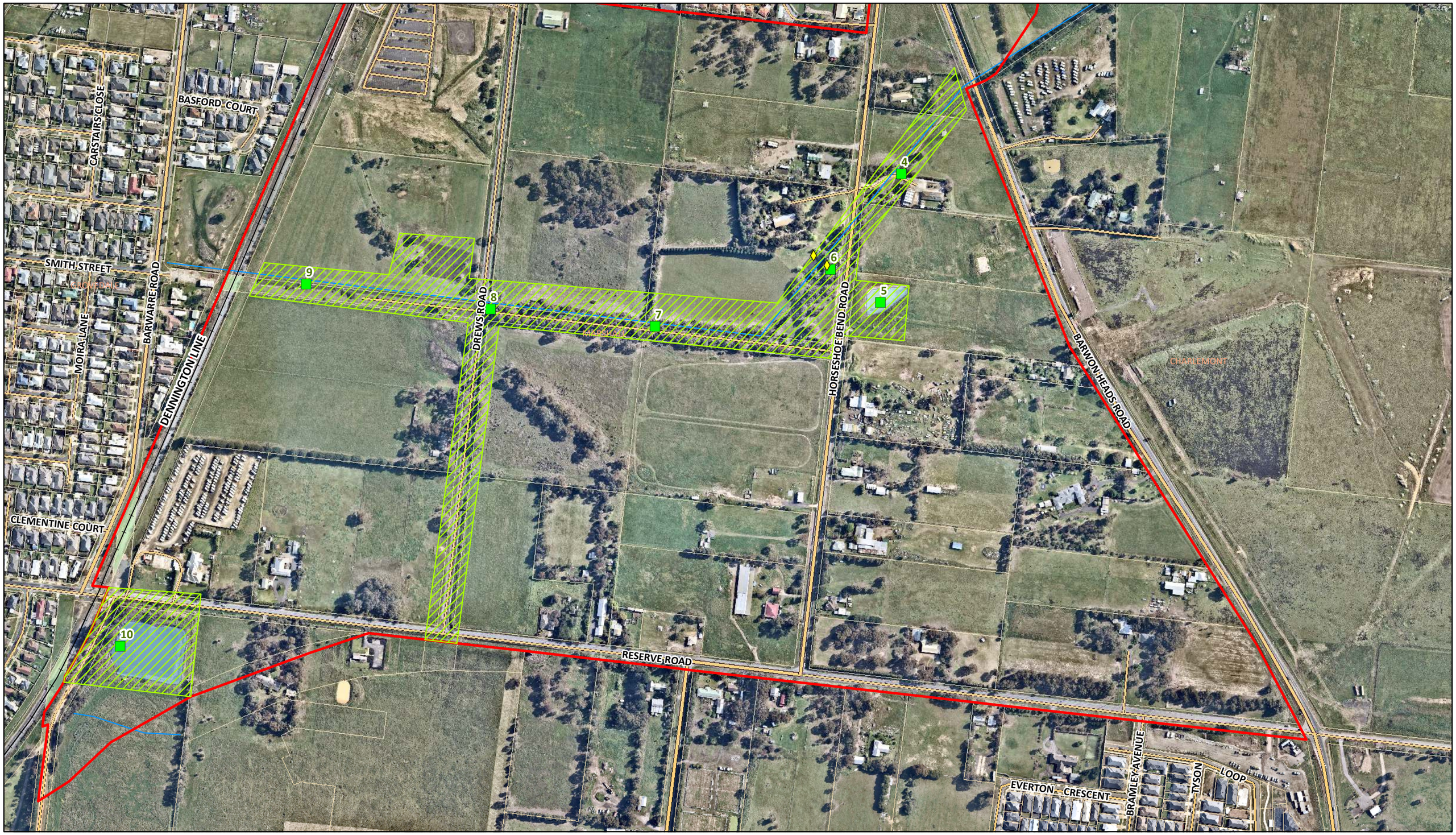


Figure 2: Results of the Current Assessment

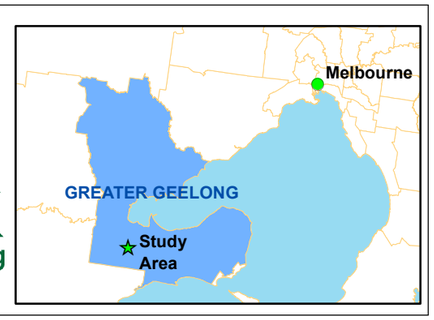
Marshall Precinct (South)

Legend

- Study Area
- Lathams Snipe Survey Sites
- Growling Grass Frog Survey Sites
- Latham's Snipe Records
- Creeks and Waterways

0 50 100 150 200 Meters

ecolink consulting



P/N 2120 Figure 1. January 2022. Aerial photography: Nearmap. 6 October 2021.

Note: some threatened species points have been shifted for display purposes

Figure 3: EPBC Act-listed Fauna Species Previously Recorded within 3km of the Study Area.

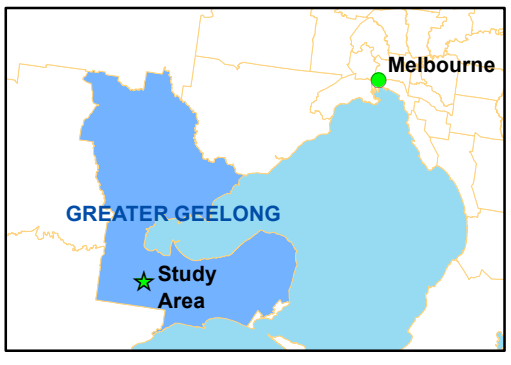
Marshall Precinct

Legend

- Study Area
- 3km Study Area Buffer

Common Name

- Australasian Bittern
- Australian Painted-snipe
- Curlew Sandpiper
- Fairy Tern
- Plains-wanderer
- Swift Parrot
- Wandering Albatross
- White-throated Needletail
- Eastern Barred Bandicoot
- Grey-headed Flying-fox
- Southern Brown Bandicoot
- Growling Grass Frog
- Australian Grayling
- Yarra Pygmy Perch
- Public Land



Plates

Plate 3. Growling Grass Frog Survey Site 1.

Plate 4. Growling Grass Frog Survey Site 2

Plate 5. Growling Grass Frog Survey Site 3

Plate 6. Growling Grass Frog Survey Site 4

Plate 7. Growling Grass Frog Survey Site 5

Plate 8. Growling Grass Frog Survey Site 6

Plate 9. Growling Grass Frog Survey Site 7

Plate 10. Growling Grass Frog Survey Site 8

Plate 11. Growling Grass Frog Survey Site 9

Plate 12. Growling Grass Frog Survey Site 10

Plate 13. Growling Grass Frog Survey Site 11