

Croskell PSP Proposed Drainage Strategy

Growling Grass Frog Survey Report

Prepared for Melbourne Water

Prepared by Water4Good

MEG250-07-TD-OT-REP-0001 Rev. 0

05 April 2023



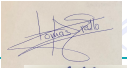
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Revision History

Revision N°	Prepared By	Description	Date
Rev. A	Tomas Vaillo Roman	Issue for Review	07/02/23
Rev. 0	Tomas Vaillo Roman	Issue for Use	05/04/23

Document Acceptance

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List of Abbreviations

DAWE	Department of Agriculture, Water and the Environment
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEECA	Department of Energy, Environment and Climate Action
DELWP	Department of Environment, Land, Water and Planning
DSS	Drainage Services Scheme
eDNA	Environmental DNA
EE Act	<i>Environment Effects Act 1978</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVC	Ecological Vegetation Class
FFG Act	<i>Flora and Fauna Guarantee Act 1988</i>
GGF	Growling Grass Frog
MNES	Matters of National Environmental Significance
MSA	Melbourne Strategic Assessment
NVPP	Native Vegetation Precinct Plan
PMST	Protected Matters Search Tool
P&E Act	<i>Planning & Environment Act 1987</i>
PSP	Precinct Structure Plan
VPA	Victorian Planning Authority
WSUD	Water Sensitive Urban Design

1 Introduction

Melbourne Water has commissioned Water4Good to complete a targeted species survey for the nationally endangered Growling Grass Frog (GGF) (*Litoria raniformis*) for the Croskell Precinct Structure Plan (PSP) Proposed Drainage Strategy Project (hereafter 'the project').

GGF is listed as 'Vulnerable' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and 'Threatened' under the *Flora and Fauna Guarantee Act 1988* (FFG Act).

1.1 Project description

The project involves completing a drainage concept options assessment and functional design of major drainage assets (e.g., retarding basins, wetlands and new waterway alignments) for the Croskell PSP. The functional design of the major assets will provide greater certainty to the land required for the assets, which will inform the PSP and schemes and confirm the quantities and cost estimation to inform the scheme contribution rate.

As part of these works, targeted species surveys for GGF and Dwarf Galaxias (*Galaxiella pusilla*) will be undertaken to help guide the drainage design outcomes and endeavour to support ecological and landscape connectivity and provisioning for significant species that may use or move through this system. A separate report will be prepared for the Dwarf Galaxias targeted survey (refer to Appendix D).

1.2 Study area

The Croskell Precinct is located within the suburbs of Cranbourne East and Clyde North, approximately 45 km south-east of Melbourne's CBD, within the southern-eastern growth corridor (Figure 1). The Precinct covers an area of approximately 272 ha.

The GGF survey study area is located within both the northern and southern sections of the Croskell Precinct and includes four wetlands and a drainage line which provide potential GGF habitat. The entire study area is located within Melbourne Water owned land (refer to Appendix A).

There are additional waterbodies and drainage lines which exist on private land within the precinct which may provide potential GGF habitat. However, these areas were not able to be accessed, and therefore were not surveyed.

The proposed drainage concept design within the Croskell PSP (refer to Appendix B) includes:

- Channel swales;
- Constructed waterways;
- Wetland areas, bypass ad inlets; and
- Wetland storage reserves.

1.3 Purpose and objectives

The objectives of this assessment are to:

- Identify the presence of GGFs within the study area by undertaking targeted surveys and environmental DNA sampling;
- Provide recommendations on areas that should be protected because of high value GGF habitat;
- Review connectivity of habitats within the surrounding precinct and potential GGF movement to consider opportunities to support habitat connectivity within the Drainage Services Scheme (DSS) assets; and
- Provide recommendations for creating GGF habitat within the new DSS assets.

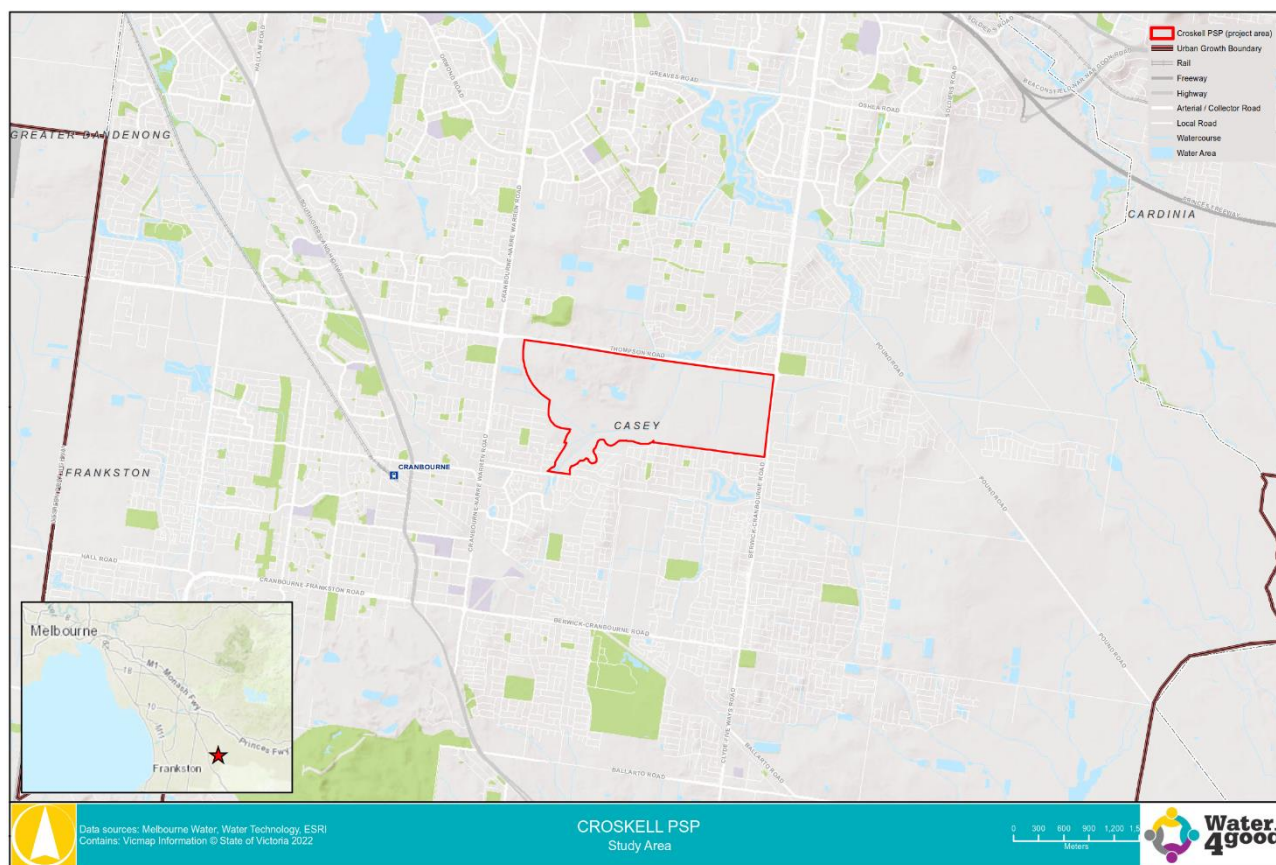


Figure 1 Croskell Precinct.

2 Methodology

2.1 Desktop Assessment

A desktop review of online databases, previous reports and relevant legislation and policy was undertaken to identify the potential presence of species and communities of conservation significance occurring within the project area. This review consisted of the following sources:

Databases reviewed include:

- Department of Climate Change, Energy, the Environment and Water (DCCEEW) *Environment Protection and Biodiversity Conservation Act 1994* (EPBC Act) Protected Matters Search Tool (PMST) database (DCCEEW 2022), within 5 km;
- DEECA NatureKit (DELWP 2022a) bioregion location, modelled Ecological Vegetation Class (EVC) distribution and bioregional conservation status within the site;
- DEECA Victorian Biodiversity Atlas (VBA) (DELWP 2022b), within 5 km; and
- Habitat Compensation Dataset for the Melbourne Strategic Assessment (DELWP 2013).

2.1.1 Literature review

A review of previous GGF investigations was undertaken to provide an indication of potential presence of the species in the area. Resources reviewed included:

- Croskell Precinct Structure Plan Biodiversity Assessment (WSP 2022).

2.2 Field Surveys

GGF targeted surveys and eDNA samples were undertaken at the following locations (refer to Appendix A):

- Wetland north of Thompson's Rd;
- Wetland and drainage line north of Linsell Boulevard; and
- Wetlands south of Linsell Boulevard.

2.2.1 Habitat assessment

A diurnal site walkover and habitat assessment was conducted on 13 December 2022. The primary purpose of the habitat assessment was to determine the presence of bankside, emergent, submergent, floating and aquatic vegetation present at each waterbody. Presence of aquatic vegetation is one of the key probabilities of occupancy for growling grass frog in urbanised landscapes (Heard *et al.* 2010). Other key determinants include wetland hydroperiod and connectivity.

2.2.2 Nocturnal surveys

Targeted GGF surveys were completed on 19 and 20 December 2022 by two ecologists.

The survey method, timing and duration employed was as per the survey technique in Heard *et al.* (2010) and designed to achieve a cumulative probability of detection for the growling grass frog of 95% probability.

Targeted surveys were completed on warm nights (air temp above 12° C) during times of little or no wind (Heard *et al.* 2010). This is in accordance with *Survey guidelines for Australia's threatened frogs – Guidelines for detecting frogs listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (DEWHA, 2010) and the survey guidelines in the *Significant impact guidelines for the vulnerable growling grass frog (Litoria raniformis)* (DEWHA, 2009).

Night surveys commenced at each site with quiet observation from the waterline for a period of 10 minutes, listening for calling males. Call playback was applied at the end of this period to stimulate calling by males.

Following listening and playback, a search of aquatic habitat areas was conducted for active frogs with the aid of spotlights and binoculars were used to confirm the identity of frogs observed. Surrounding terrestrial habitat areas were also searched where possible, however much of the surrounding terrestrial habitat was thick swards of tall exotic grasses over 1 m in height, which is vegetation that makes it hard for frogs to disperse.

2.2.3 Environmental DNA (eDNA) surveys

Environmental DNA (eDNA) samples were collected on 22 December 2022 by two ecologists. eDNA samples were collected at four different wetland locations (refer to Appendix A).

The sampling method was as per the survey technique in the EnviroDNA water sampling protocol guide (eDNA, 2022). Each eDNA kit contained a sterile pair of latex gloves, one large 60mL syringe, three filters and three small syringes containing preservative.

Water samples from each wetland was collected in the large syringe and pushed through the filters until the water could no longer be pushed through. This was repeated three times through three different filters using the same syringe. Any remaining water was expelled by drawing air into the syringe and pushing this through each filter. Finally, the preservative was added to all three filters, and the collection details were filled out on the front of each zip lock bag (site code, date, volumes etc.). Samples were then delivered to the eDNA laboratory for analysis.

2.2.4 Assumptions and Limitations

The findings of this report are subjected to the following assumptions and limitations:

- Access was granted to Victorian Planning Authority (VPA) lot number seven during the diurnal habitat assessment, and it was discovered that ideal GGF habitat exists within the wetlands on this property. Additionally, the wetland on the south-eastern border of VPA lot number four also contains ideal GGF habitat. However, access was not granted to these private properties for the nocturnal and eDNA surveys. Therefore, GGF may be present at these locations
- Information about potential GGF sub-populations throughout the entire precinct was not obtained during this survey
- Due to access restrictions, surveys were not conducted at waterbodies and drainage lines, located at lot number 4,5,13,15,17 and 19, which exist on private land within the precinct. It is noted that these may provide potential GGF habitat
- The outcome of the surveys is considered to reflect GGF usage of the waterbodies surveyed during the 2022-2023 breeding season only.

3 Results

3.1 Desktop assessment results

3.1.1 Data Review

The EPBC Act protect matters search tool identified that GGF is 'likely to occur' within 5 km of the study area.

The VBA database identified one GGF record within 1 km of the study area, however, this record is from 1980, and there haven't been any further records since this time (refer to Appendix C).

Additionally, the Melbourne Strategic Assessment (MSA) Growing Grass Frog Strategically Important Area (Clyde Creek) is only approximately 5 km south-east of the study area.

3.1.2 Literature review

WSP conducted targeted GGF surveys for the VPA within the Croskell Precinct in December 2021. The surveys were undertaken in a large dam, 10m to the west of the study area (see Figure 2 below) in accordance with the *Significant impact guidelines for the vulnerable growling grass frog (Litoria raniformis)* (DEWHA 2009) and the *Survey guidelines for Australia's threatened frogs* (DEWHA 2010b). Nocturnal surveys including call playback, spot lighting and hand searching were completed on nights where the air temperature was above 12°C, and during times of little to no wind. No GGF were found to be present within this location. As a result, this dam was excluded as a survey location for the current assessment.

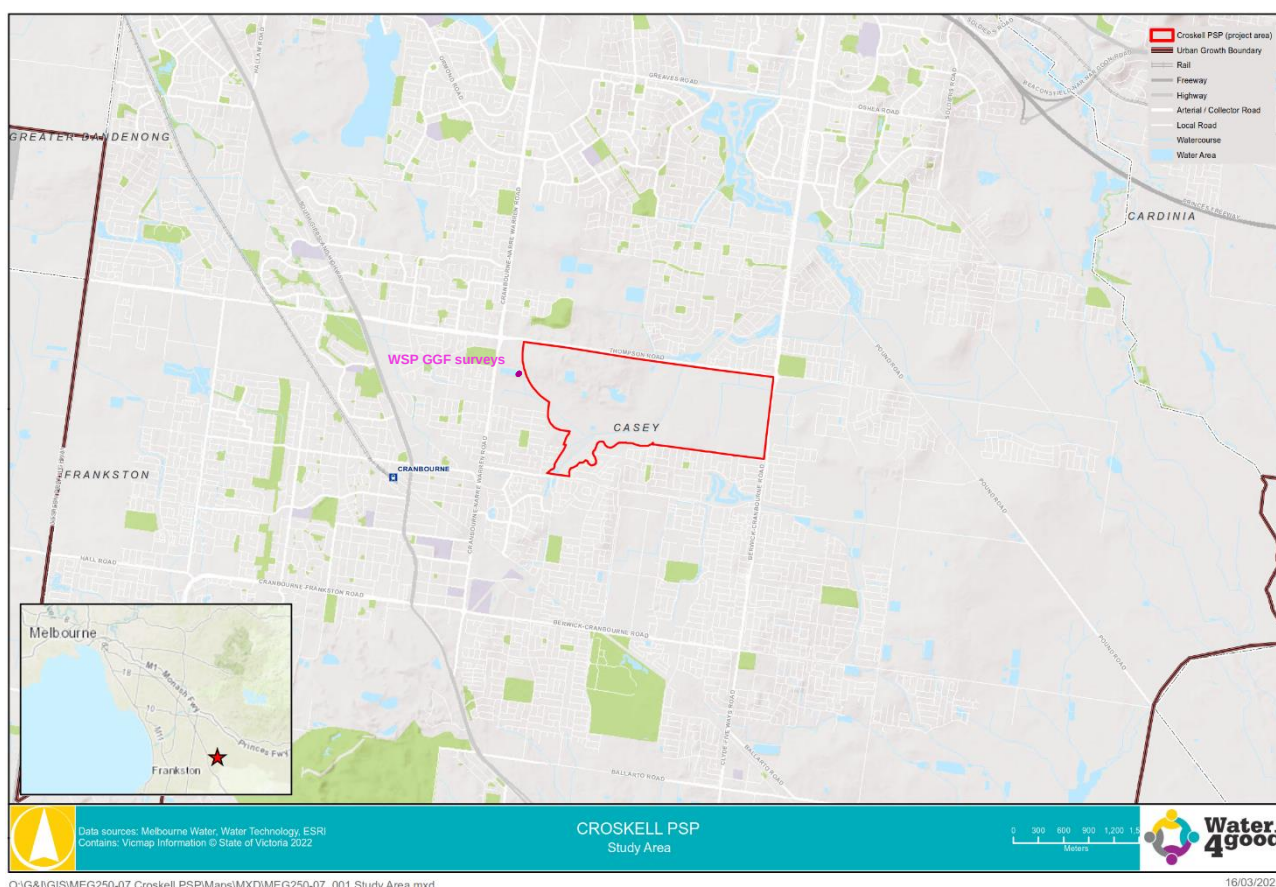


Figure 2 GGF survey location completed by WSP in June 2022.

3.2 Field Survey

3.2.1 Habitat assessment

The location of the three wetlands and one waterway surveyed are mapped in Appendix A. These wetlands are a part of the Ti Tree Creek drainage system, which aims to relieve the impacts of urban development on stormwater flows.

Wetland 1

Wetland 1 is a stormwater wetland approximately 2.6 ha in size, located approximately 40 m north of Thompsons Rd (see Photo 1 below). The vegetation around the wetland was characterized by indigenous species including Swamp Gum (*Eucalyptus ovata*), Blackwood (*Acacia melanoxylon*), Swamp Paperbark (*Melaleuca ericifolia*), Common Reed (*Phragmites australis*), Tall Sedge (*Carex appressa*), Thatch Saw-sedge (*Gahnia radula*), Black-anther Flax-lily (*Dianella revoluta*), Knobby Club-rush (*Ficinia nodosa*), Slender Knotweed (*Persicaria decipiens*) and, *Bolboschoenus* sp. The main exotic species observed were Wild Oat (*Avena* sp.), Rye grass (*Lolium* sp.) and Common Sow-thistle (*Sonchus oleraceus*).

Litter is present in the surrounding vegetation and the wetland contains high numbers of mosquito fish (*Gambusia holbrooki*). Furthermore, several Australian Magpies (*Cracticus tibicen*) were observed and a Golden-headed cisticola was heard (*Cisticola exilis*)

The wetland is shallow with a muddy base, with:

- no floating aquatic vegetation;
- minimal submergent vegetation, limited to the exotic Canadian pondweed (*Elodea Canadensis*);
- no debris, rocks or logs suitable for cover around the perimeter of the wetland.



Photo 1 Wetland 1 and surrounding terrestrial habitat, facing northwest.

Wetland 2

Wetland 2 has an area of approximately 0.53 ha. It is located approximately 25 m north of Linsell Boulevard, and 2.1 km southwest of wetland 1, connected via a large drainage line.

The wetland is shallow with:

- no floating aquatic vegetation;
- emergent vegetation is dominated by Tall Spike-rush (*Eleocharis sphacelata*), rushes and slender knotweed;
- fringing vegetation includes rushes, Kangaroo Grass (*Themeda triandra*), Tall Sedge and Common Tussock-grass (*Poa labillardierei*);
- emergent terrestrial vegetation surrounding the wetland includes exotic mowed Canary Grass (*Phalaris canariensis*), Drain Flat Sedge (*Cyperus eragrostis*) and Common Sow-thistle
- no debris, rocks or logs suitable for cover around the perimeter of the wetland.



Photo 2 Wetland 2 and surrounding terrestrial habitat, facing northwest.

Wetland 3

This wetland is located approximately 18m south of Linsell Boulevard and 51m south of wetland 2. It covers an area of approximately 0.3 ha.

The wetland is shallow with:

- no floating aquatic vegetation;
- emergent vegetation is dominated by Tall Spike-rushes, rushes and Slender Knotweed;
- fringing vegetation includes Tall Sedge, rushes and Kangaroo Grass;
- emergent terrestrial vegetation surrounding the wetland includes mowed Canary Grass, Drain Flat Sedge and English Broom (*Cytisus scoparius*)
- no debris, rocks or logs suitable for cover around the perimeter of the wetland.

Waterway 1

This waterway is primarily a drainage line, which traverses the study area from south to north, draining into wetland 1, north of Thompson Rd.

This waterway has:

- no floating aquatic vegetation;
- submergent vegetation which includes Common Reed and Tall Sedge;
- fringing and emergent vegetation is dominated by tall exotic grasses dominated by Canary Grass;
- no debris, rocks or logs suitable for cover around the perimeter of the wetland.



Photo 3 Waterway 1 and surrounding terrestrial habitat

3.2.2 Nocturnal surveys

Nocturnal survey results are provided in Table 1 below.

No GGF individuals were heard or observed across the two evening surveys within the waterbodies surveyed. Only Striped marsh frog (*Limnodynastes peronii*) was heard during surveys (see Table 1).

3.2.3 eDNA surveys

The results from the eDNA surveys, analyzed by EnviroDNA, indicate no presence of GGF at all four of the locations sampled. The three samples for each location returned negative results for GGF presence.

Table 1 Targeted growling grass frog survey results.

Site	Date	Start time	Finish time	Temperature (°C)	Wind (speed & direction)	Humidity (%)	Conditions	Frog species observed/heard (O/H)	Comments
Wetland 1	19/12/2022	20:40	21:16	18.8	15 km/h ESE	42	Clear	Striped Marsh Frog (H)	
	20/12/2022	20:35	21:03	18.2	11 km/h ESE	56	Partly cloudy	Striped Marsh Frog (H)	
Wetland 2 and Waterway 1	19/12/2022	21:34	22:15	17	17 km/h ESE	45	Clear	Striped Marsh Frog (H)	
	20/12/2022	21:13	21:52	17.3	13 km/h ESE	59	Partly cloudy		
Wetland 3	19/12/2022	22:15	22:40	15.4	15 km/h ESE	57	Clear		
	20/12/2022	21:35	22:05	15.9	13 km/h ESE	65	Partly cloudy		

4 Conclusions and Recommendations

Although GGF was not recorded within the study area, there have been records in nearby areas and a site to the south-east is designated MSA GGF habitat.

The proposed design of the retarding basin, wetlands and new waterway alignment (refer to Appendix B) should consider the creation of GGF habitat. The GGF Habitat Design Standards (DELWP, 2017) provide guidance on protecting and creating the various types of habitats required to support metapopulations (multiple populations linked by migration) of GGFs over the long term. The standards do not provide design specifications for stormwater wetlands or other types of waterbodies such as lakes built for amenity purposes but may provide useful advice in cases where a project wishes to provide GGF habitat as a secondary objective.

For example, GGF wetlands require areas of shallow water, steep drop-offs and areas of deeper water to escape predators; aquatic vegetation for shelter; and staging site for calling and egg deposition (DELWP 2017). Rock piles near and in the wetland margin are likely to assist with chytrid fungus control by providing basking sites and warming the shallows (DELWP, 2017).

The GGF Habitat Design Standards also provides two sketches depicting GGF habitat design and ideal wetland attributes (see Figures 3 and 4 below). Aspects of the below GGF ponds could be used in the creation of the retarding basin and wetland.

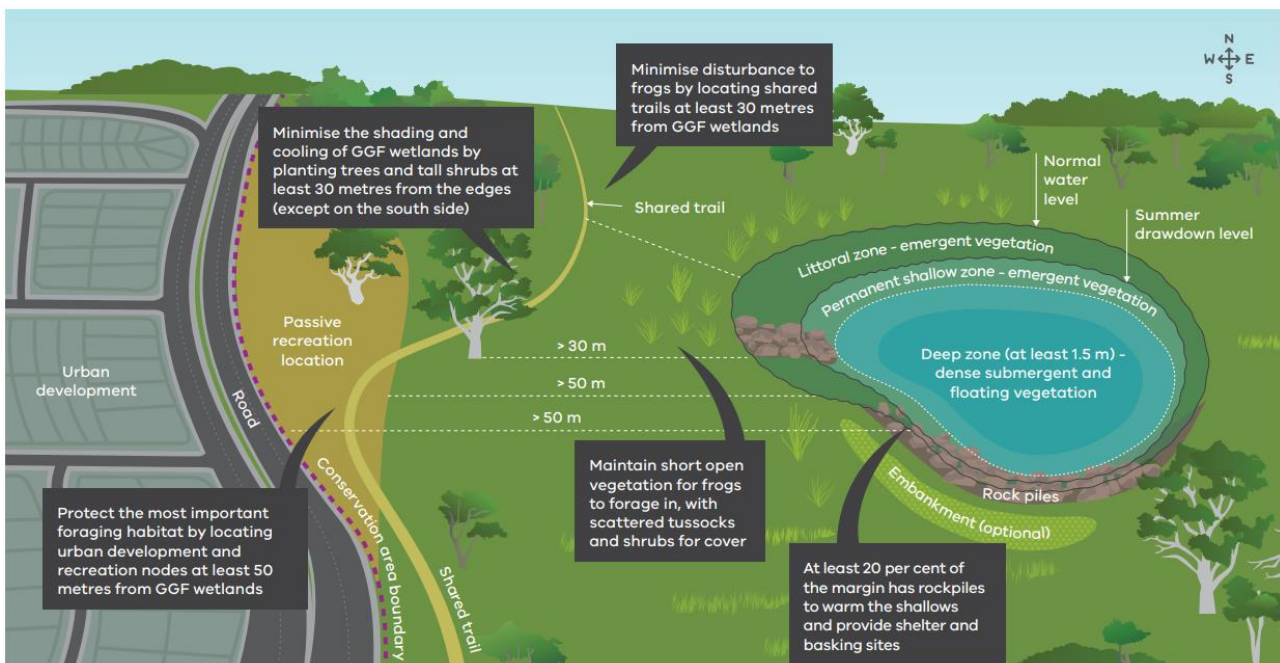


Figure 3 GGF habitat design (DELWP 2017).

Additionally, as the presence of Eastern Gambusia can negatively impact upon GGF populations, the proposed wetland will need to be monitored to ensure this species doesn't become overabundant. Drying out/drawing down of wetlands can be beneficial for controlling Eastern Gambusia populations. Control of Eastern Gambusia will also benefit Dwarf Galaxias, mentioned in section 4.3 below.

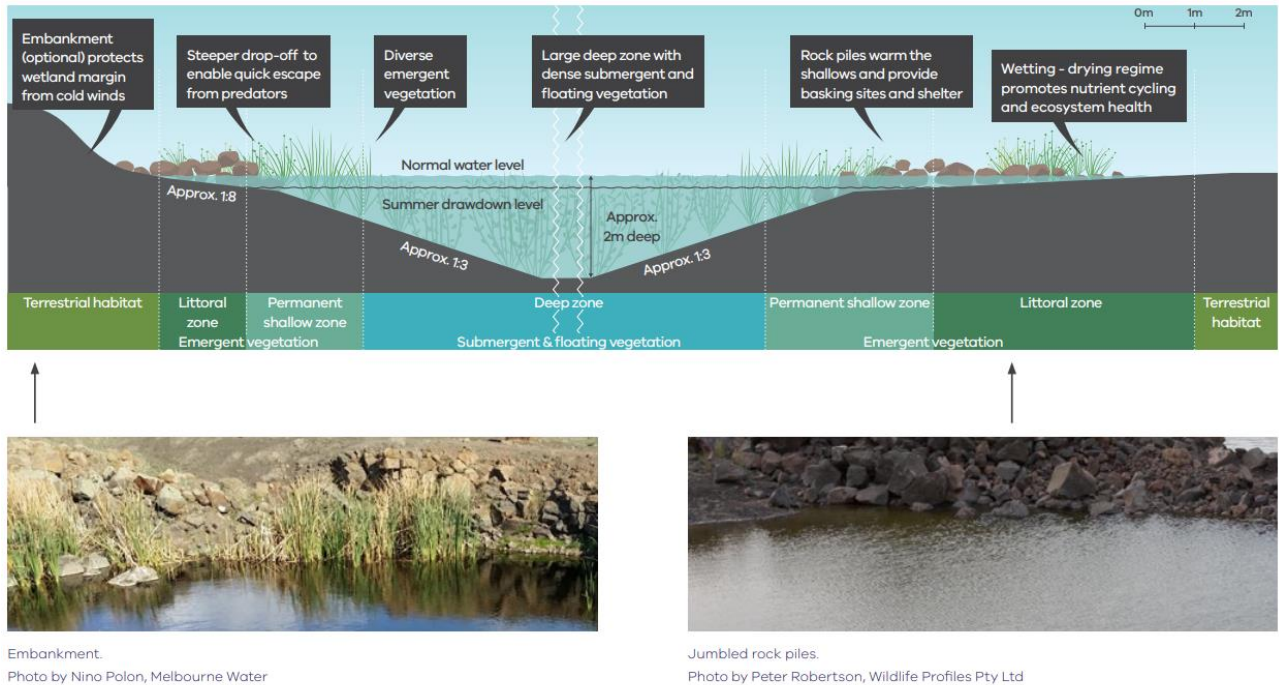


Figure 4 GGF wetland attributes (DELWP 2017).

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Appendix A – Map of GGF + eDNA Survey Locations



 Crookell PSP (project area)
 GGF Survey Locations



Data sources: Melbourne Water, Water Technology, MetroMap
Contains: Vicmap Information © State of Victoria 2022

CROKELL PSP
GGF survey locations

0 50 100 150 200 250
Meters



Appendix B – Drainage Concept Design



Data sources: Melbourne Water, Water Technology, MetroMap
Contains: Vicmap Information © State of Victoria 2022

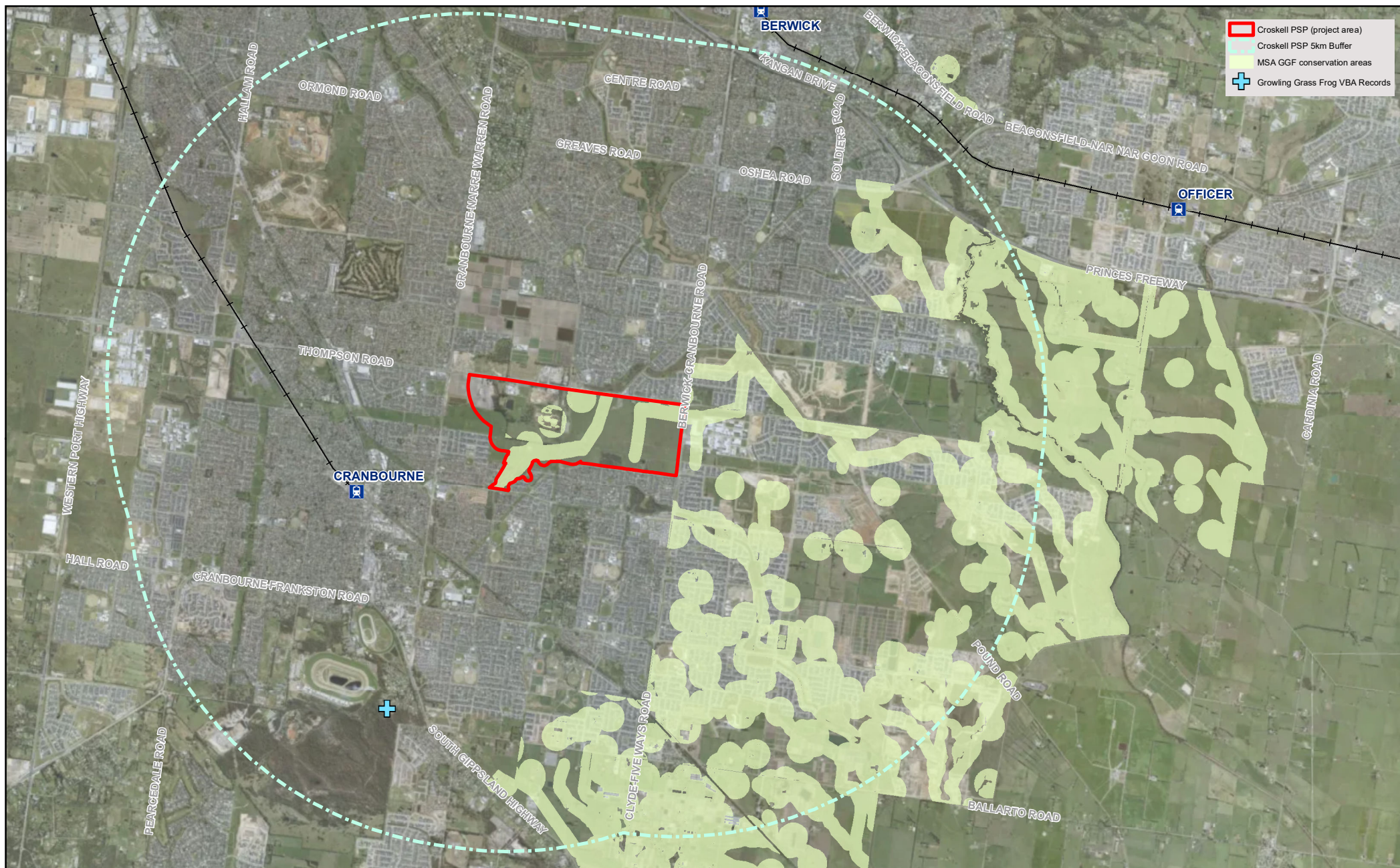
CROSKELL PSP

Drainage Concept Design

0 50 100 150 200
Meters



Appendix C – VBA Results



Data sources: Melbourne Water, Water Technology, MetroMap
Contains: Vicmap Information © State of Victoria 2022

CROOKELL PSP

GGF VBA Records and MSA GGF conservation areas

6027600
Meters



Appendix D – Investigative survey for Dwarf Galaxias Croskell Precinct, Cranbourne East

Investigative survey for dwarf galaxias Crookell Precinct, Cranbourne East



Main channel flowing towards Thompsons Road

**John McGuckin
Streamline Research Pty. Ltd.**

**Report prepared for
KBR**

February 2023

EXECUTIVE SUMMARY

KBR commissioned Streamline Research to conduct a targeted survey for the nationally threatened fish species, the dwarf galaxias (*Galaxiella pusilla*) in the Croskell Precinct in Cranbourne East. This report provides information related to this species which can be used to assist with the concept and functional design of the drainage strategy.

As the dwarf galaxias has been found in both Berwick to the north and to the south west in Cranbourne South, it was considered important to determine whether the species occurred in the Croskell PSP Study Area, particularly since the area has not previously been surveyed for the species.

As a result of this investigation a better understanding of the current distribution of the dwarf galaxias can be assessed, which is important given the extensive localised flooding that has occurred in the City of Casey during 2022, which potentially could have allowed for dwarf galaxias to move into wetted areas not previously listed as known habitat.

This study has found that within the Croskell Precinct low lying, permanent wetlands are expected to have historically occurred, but these are long gone, having been first drained to allow for farming, and later, to improve drainage from residential developments near Cranbourne township.

If dwarf galaxias habitat is to be incorporated into the Croskell PSP development it should have features that are specific to the needs of the species. Constructed habitat would need to provide permanent water, appropriate plantings and exclusion from connected waterways that supports exotic fish.

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1.0 INTRODUCTION

KBR commissioned Streamline Research to conduct a targeted survey for the nationally threatened fish species, the dwarf galaxias (*Galaxiella pusilla*) in the Croskell Precinct (PSP) in Cranbourne East. This report provides information related to this species which can be used to assist with the concept and functional design of the drainage strategy.

The dwarf galaxias is a small native fish of national significance which is listed as vulnerable under the *Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act, 1999*. In Victoria, the dwarf galaxias is considered an endangered threatened species under the *Flora and Fauna Guarantee Act, 1988* (Department of Environment Land, Water and Planning, 2021).

By surveying the Croskell PSP Study Area it was hoped that a better understanding of the current distribution of the dwarf galaxias could be assessed, given that extensive localised flooding has occurred in the City of Casey during 2022.

1.1 Study area

The Croskell PSP Study Area is located in the City of Casey at Cranbourne East (Figure 1).

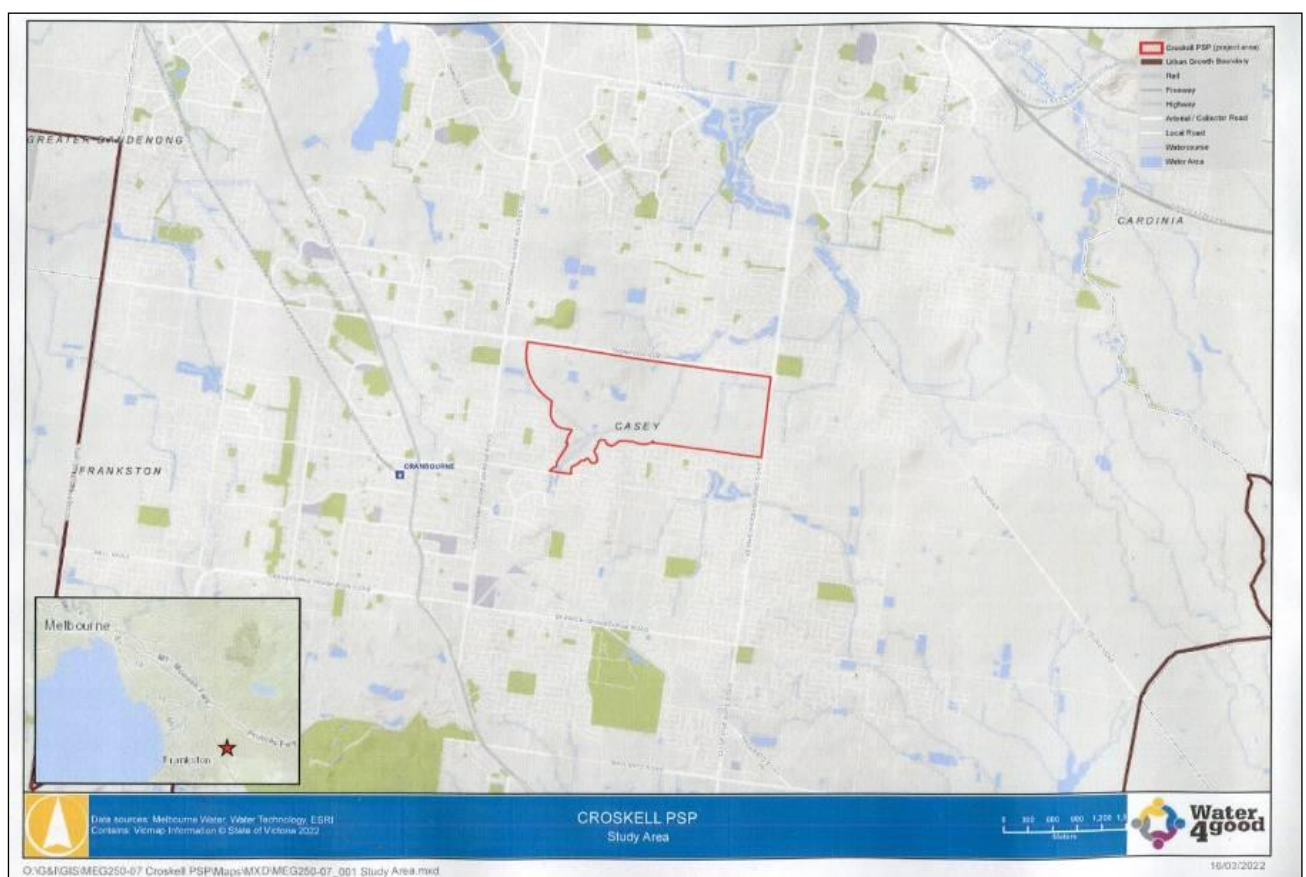


Figure 1. Location of the Croskell PSP Study Area in Cranbourne East (source map provided by KBR).

Figure 2 shows the expanse of the Croskell PSP Study Area. Thompsons Road is on the northern boundary. Narre Warren Road is to the west and Berwick Cranbourne is to the east. Linsell Boulevard is located on the southern boundary.

The existing drainage within the Croskell PSP has been extensively modified in the past. The main drainage channel passes from the south to the north, connecting water from the residential development on the southern side of Linsell Boulevard to the residential development to the north of Thompsons Road. On the western side of the main channel there is several small straight tributaries which have been dug to drain the surrounds. The Croskell PSP Study Area also has several low lying areas which can hold surface water and a few constructed dams.



Figure 2. Croskell Precinct Study Area (source map provided by KBR).

1.2 Dwarf galaxias

Dwarf galaxias have not previously been captured in the Croskell PSP Study Area, but this is possibly only because the area has not previously been surveyed. Historically, the dwarf galaxias would have had a widespread distribution throughout the City of Casey and would have been a common species in low lying wetland habitats.

Back in 2007, a population of dwarf galaxias was found on the northern side of Grieves Road, approximately 5 km to the north of the Croskell PSP Study Area. Unfortunately, the species has not since been found in the area, even during an extensive investigation of the Hallam Valley a couple of years ago (McGuckin, 2021).

As dwarf galaxias were known to have existed near Settlers Run Golf Course in Cranbourne South in the 1990's it conceivable that a population of the species may have remained undetected in the Croskell PSP Study Area.

2.0 FIELD INVESTIGATION

On 16 December 2022 a field survey for the dwarf galaxias was made in the Croskell PSP Study Area.

A total of 18 locations were sampled for dwarf galaxias.

Ten of the sample sites were in the main channel that passes through the Study Area (sites 1-10). A further four locations were on tributaries of the channel (sites 11-14). Of the two wetlands surveyed, one was connected to a tributary channel (site 15), while the other was in a low-lying area disconnected from the main water channel (site 16). Two man-made dams were also surveyed (sites 17 and 18).

Figure 3 shows the locations of the waterways sampled in this investigation. Appendix 1 shows photographs of the sites.

A fine dip net was used to sample for dwarf galaxias. The technique is ideal for capture of the species, particularly when areas of typical habitat are targeted for fish survey.

The overnight setting of bait traps was not considered necessary, even though the technique is considered desirable under Commonwealth dwarf galaxias sampling protocols (Department of Sustainability, Environment, Water, Population and Communities, 2011).

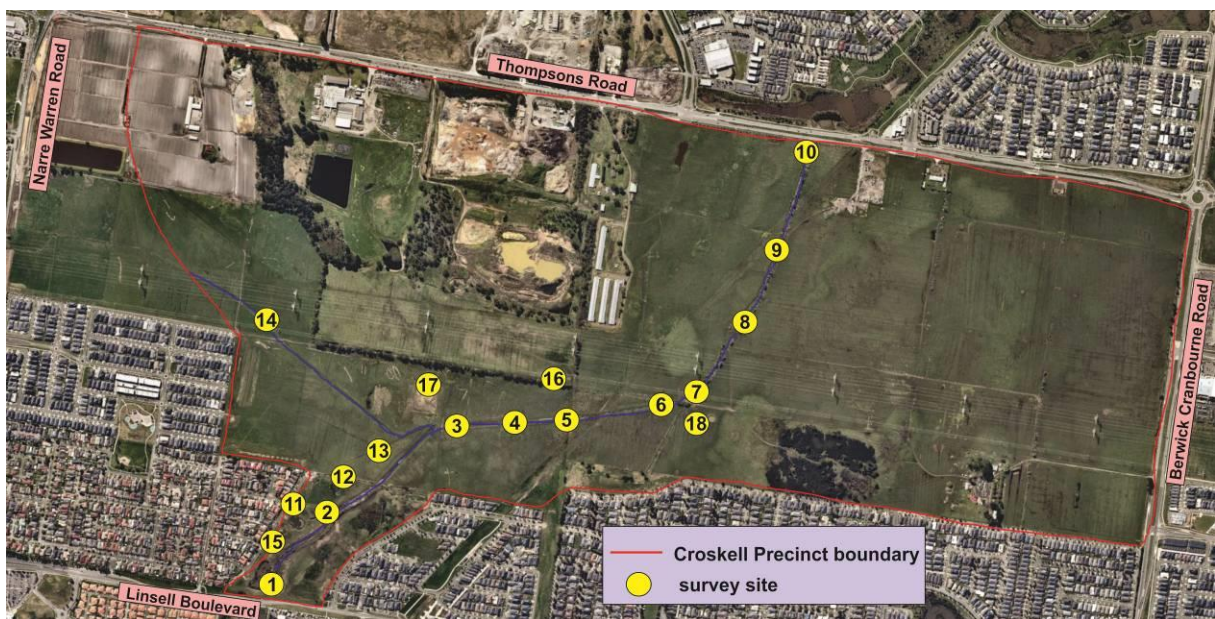


Figure 3. Dwarf galaxias survey locations in the Croskell PSP Study Area (source map provided by KBR).

3.0 FINDINGS

Table 1 shows the topographical map reference of each survey location and the capture of fish made at each. Overall, fish were captured at 16 of the 18 sites.

The targeted dwarf galaxias was not found within the Croskell PSP Study Area. Of all the locations surveyed, the shallow wetland in the central area (site 16) looked to have the most suitable habitat to support a dwarf galaxias population. The location did have a lot of tadpoles and some natural aquatic plants, but no dwarf galaxias, possibly reflecting that it dries out. Still, it is the type of wetland that dwarf galaxias might favour during wet periods when fish from primary habitats (which have permanent water) have opportunity to move into secondary habitats (which typically dry out).

Three fish species were captured in this study, all of which are exotic species. The species were the eastern gambusia (*Gambusia holbrooki*), goldfish (*Carassius auratus*) and the oriental weatherloach (*Misgurnus anguillicaudatus*).

The eastern gambusia was captured at all locations where fish were recorded. Goldfish and oriental weatherloach were only captured at one location (site 7).

Fish were absent in the catch at just two locations, the shallow tributary drain to the west of the Study Area (site 14) and the shallow off-stream wetland (site 16).

Table 1. Survey sites and fish capture.

Site Number	Location	Western Port 1:100000 7921 zone 55		Dip netting
		East	North	
1	Main drainage channel	3351175	5781793	eastern gambusia
2	Main drainage channel	351371	5782028	eastern gambusia
3	Main drainage channel	351648	5782274	eastern gambusia
4	Main drainage channel	351778	5782280	eastern gambusia
5	Main drainage channel	352027	5782301	eastern gambusia
6	Main drainage channel	352325	5782349	eastern gambusia
7	Main drainage channel	352365	5782367	eastern gambusia, goldfish oriental weatherloach
8	Main drainage channel	352545	5782640	eastern gambusia
9	Main drainage channel	352620	5782830	eastern gambusia
10	Main drainage channel	352698	5783086	eastern gambusia
11	Tributary to main drainage channel	351279	5782030	eastern gambusia
12	Tributary to main drainage channel	351424	5782108	eastern gambusia
13	Tributary to main drainage channel	351536	5782152	eastern gambusia
14	Tributary to main drainage channel	351188	5782522	no fish
15	Wetland	351243	5782004	eastern gambusia
16	Wetland	352010	5782394	no fish
17	Farm dam	351631	5782370	eastern gambusia
18	Farm dam	352425	5782308	eastern gambusia

4.0 DISCUSSION

4.1 Drainage Concept

Drainage Concept Design for the Croskell PSP Study Area is shown in Figure 4.

It is proposed that there will be four wetland storage reserves, each with a constructed wetland. Each reserve is designed to provide floodplain storage to help regulate passage of streamflow in the main channel from the south to north of the Croskell PSP. It is presumed that it will be possible for water to be both drained and filled within the wetlands to help prevent high/bankfull streamflow in the main channel of the Croskell PSP. The storage reserves offer a buffer to lessen elevated streamflows in the main channel during wet periods. In this way, the storage reserves can be beneficial in manipulating water movement within the Croskell PSP.

Of all the locations surveyed in this investigation, the shallow wetland in the central area of the Croskell PSP (site 16) is the best representation of the type of habitat that might support dwarf galaxias. If this habitat was to be preserved, it may provide for future support of the dwarf galaxias, if habitat for this species is an intention of the Croskell PSP development.



Figure 4. Proposed Drainage Concept Design (source map provided by KBR).

4.2 Dwarf galaxias and other fish species

Historically, the dwarf galaxias is expected to have occurred in the Croskell PSP Study Area.

The construction of the drainage channels in the Croskell PSP are expected to date back to the drainage of the township of Cranbourne and surrounds, which was channelised to reach Hallam Main Drain at some time prior to 1980. Prior to this, it is expected that low lying areas were drained to allow for rural farming.

It is known that a remnant population of dwarf galaxias existed in the channel alongside Grieves Road, Berwick which is in the same drainage basin as the Croskell PSP. Unfortunately, residential development and changes to the drainage system between the Croskell PSP and Grieves Road has resulted in constructed waterways that have not been suitable for the dwarf galaxias, which have favoured the establishment of a range of exotic fish species.

The three exotic species captured in this investigation in the Croskell PSP Study Area, are all expected to have originated from downstream connected waterways. In addition to the eastern gambusia, goldfish and oriental weatherloach which were captured in this study, other species like roach, carp and redfin could all be expected to exist in the waterways connected to the Croskell PSP.

The proposed drainage concept to construct storage reserves with wetlands as part of the Croskell PSP is expected to allow for future establishment of exotic fish species in these waterways. Similar situations have occurred with constructed wetlands in residential development that exist both upstream and downstream in the drainage basin. If a dwarf galaxias facility was to be constructed as part of the development it would need to be offline and protected from accidentally inflows from surrounding waterways, like the wetland at the residential development of nearby Brompton Lodge in Cranbourne South.

4.3 Areas not surveyed

A number of properties within the Croskell PSP Study Area could not be assessed as part of this investigation. Watercourses on these properties have, therefore, not been investigated. Although it is unlikely that a population of dwarf galaxias could be found, it is still possible, as occurred in the sand scraps on a property in Cranbourne South, which are now part of the residential development called Brompton Lodge.

5.0 CONCLUSION

The dwarf galaxias was not found in the Croskell PSP Study Area. The existing waterways are all highly modified and have habitats favourable to exotic fish species.

Low lying, permanent wetlands may historically occurred, but these are long gone, having been first drained to allow for farming, and later, to improve drainage from residential developments near Cranbourne township.

If dwarf galaxias habitat is to be incorporated into the Croskell PSP development it should have features that are specific to the needs of the species. Constructed habitat would need to provide permanent water, appropriate plantings and exclusion from connected waterways that supports exotic fish.

6.0 RECOMMENDATION

- If a dwarf galaxias wetland is constructed as part of the Croskell PSP it should have similar features to that of the dwarf galaxias pond constructed as part of the Brompton Lodge residential development in Cranbourne South. The pond has been specifically designed to favour dwarf galaxias and allow for the establishment of a self-sustaining population.

7.0 REFERENCES

Department of Environment Land, Water and Planning, Department of Environment Land, Water and Planning, (2021). Flora and Fauna Guarantee Act 1988 – Threatened List.

Department of Sustainability, Environment, Water, Population and Communities (2011). Survey guidelines for Australia's threatened fish. Australian Government.

McGuckin, J (2021). Dwarf galaxias (*Galaxiella pusilla*) and the Hallam Valley 2020 study. Report prepared by Streamline Research Pty. Ltd. for Melbourne Water.

APPENDIX 1. SURVEY LOCATIONS



Main channel (site 1).



Main channel (site 2).



Main channel (site 3).



Main channel (site 4).



Main channel (site 5).



Main channel (site 6).



Main channel (site 7).



Main channel (site 8).



Main channel (site 9).



Main channel (site 10).



Tributary channel (site 11).



Tributary channel (site 12).



Tributary channel (site 13).



Tributary channel (site 14).



Wetland off a tributary channel (site 15).



Off stream wetland (site 16).



Farm dam (site 17).



Farm dam (site 18).