APA Transmission Pty Limited

Aquatic Survey Report Crib Point Pakenham Pipeline Project

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TABLE OF CONTENTS

ANNEXURES

Tables

Appendices

Executive Summary

APA Transmission Pty Limited, a wholly owned subsidiary of the APA Group (together referred to as APA) is proposing to construct and operate a high pressure gas pipeline to connect AGL's proposed Gas Import Jetty at Crib Point to the Victorian Transmission System (VTS), east of Pakenham.

Monarc Environmental is providing ecological and environmental services to support the regulatory approval process for the CPP Pipeline on behalf of APA, including undertaking of targeted fauna surveys to inform State and Commonwealth Referral applications.

This report summarises the findings from targeted aquatic surveys conducted in 16 waterbodies between Crib Point and Pakenham. The aim of the aquatic surveys was to determine if any fish or other aquatic species listed under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) or Flora and Fauna Guarantee Act 1988 (FFG Act) were present in the waterbodies.

Scope of Works

The scope of works comprised the following:

- A desktop review of the Commonwealth Government's EPBC Act Protected Matters Search Tool (PMST) and the Victorian Department of Environment, Land, Water and Planning (DELWP's) Victorian Biodiversity Atlas (VBA version 2018) to ascertain if any EPBC Act and FFG Act listed aquatic species were potentially present, to assist with targeting the field surveys.
- Selection of 16 waterbodies for field surveys:
  - Warringine Creek KP4.98;
  - Watson Creek KP19.12;
  - Pearcedale South Creek KP19.5;
  - Langwarrin Creek KP21.08;
  - Lachies Marsh KP21.21;
  - Farm Dam and connected drainage channel KP21.65;
  - Vowell Drive KP23.0 – 1st Constructed Wetland to the north of Vowell Drive;
  - Vowell Drive KP23.0 – 2nd Constructed Wetland to the north of Vowell Drive;
  - Craigs Lane KP23.95 – drainage channel;
  - Rutherford Creek KP29.78;
  - Western Outfall Drain KP31.06;
  - Cardinia Creek KP40. 1st location (Ballarto Road);
  - Cardinia Creek KP40. 2nd location (Bloomfield Lane);
  - Toomuc Creek KP41.45;
  - Deep Creek KP41.5;
  - Pakenham Creek KP48.2.
- Obtaining required approvals and permit to proceed with field studies.

- Eight two-day/one-night aquatic surveys, conducted on 16/17 April 2018, 14/15 May 2018, 25/26 June 2018 and 26/27 July 2018. Aquatic surveys were undertaken using a combination of visual observation, hand-held dip-netting, bait traps, fyke netting and electrofishing (backpack), and in situ water quality sampling using a multiparameter water quality meter.
- Preparation of this report summarising the works undertaken, methodologies, results – including likelihood of occurrence, and recommendations.

Results

The desktop review identified three EPBC Act or FFG Act listed species as potentially occurring within the study area: Dwarf Galaxias (*Galaxiella pusilla*), Australian Grayling (*Prototroctes maraena*), and Flatback Mangrove Goby (*Mugilogobius platynotus*).

The likelihood of occurrence assessment found that the Dwarf Galaxias has a "High' to 'Moderate' likelihood of occurrence, due to either being a known resident, having recent records (<5 years) or there being suitable habitat in the following sites:

- Warringine Creek
- Pearcedale South
- Langwarrin Creek
- CPT 60 (dam and Lachies Marsh)
- Craigs Lane Drain
- Western Outfall Drain
- Cardinia Creek (Ballarto Road and Bloomfield Lane ends)
- Toomuc Creek
- Deep Creek
- Pakenham Creek

Dwarf Galaxias may also occur in several other locations which were dry at the time of surveys and thus weren't surveyed for habitat characteristics that may suit Dwarf Galaxias. Being dry for part of the year does not significantly reduce the likelihood of Dwarf Galaxias occurring at these sites during wetter times of the year.

Australian Grayling has a 'High' likelihood of occurring, due to nearby records, in Cardinia Creek (Ballarto Road and Bloomfield Lane ends).

Flatback Mangrove Goby has a 'High' likelihood of occurrence in the Western Outfall Drain (recent records) and 'Moderate' likelihood in Watson Creek (possible regular visitor).

Neither the Dwarf Galaxias, Australian Grayling or Flatback Mangrove Goby were detected during field surveys. Four factors may account for the lack of detection of Dwarf Galaxias, Australian Grayling and Flatback Mangrove Goby species in waterways:

- Low quality habitat values or absence of suitable aquatic or emergent vegetation.
- Waterway degradation (habitat and water quality).

- High abundance of competitive and predatory fish such as Gambusia (Unmack & Paras 1995), (Wager & Jackson 1993).
- Lack of nearby populations and limited connectivity of survey sites to areas of higher habitat values (Wager & Jackson 1993).

1 Introduction

1.1 Project Overview

APA Transmission Pty Limited, a wholly owned subsidiary of the APA Group (together referred to as APA) is proposing to construct and operate a high pressure gas pipeline to connect AGL's proposed Gas Import Jetty at Crib Point to the Victorian Transmission System (VTS), near Pakenham.

Refer to the Flora and Fauna Assessment – Crib Point Pakenham Pipeline (Monarc 2018) for a full description of the project.

1.2 Purpose of this Report

Monarc Environmental (Monarc) is providing ecological and environmental services to support the regulatory approval process for the CPP Pipeline on behalf of APA, including undertaking of targeted fauna surveys to inform State and Commonwealth Referral applications.

A range of assessments and ecological surveys of the proposed alignment have previously been completed by Monarc to meet the project's requirements and contingency planning. These assessments identified that the alignment will cross at least 60 waterways or waterbodies.

Aquatic surveys were carried out to identify the aquatic species present in select waterways to inform future management actions. In late 2017 and early 2018 Monarc assessed the condition of these 'priority crossings' to determine the requirement for undertaking aquatic surveys (i.e. was there water present and/or sufficient aquatic habitat to warrant surveys). Based on these condition assessments Monarc determined that several crossings would require aquatic surveys as they were found to have adequate water and instream habitat at the time of the assessments.

This report outlines the methodology used to conduct the aquatic surveys, describes the habitat characteristics of each crossing, and presents the results of the surveys in terms of the species present and numbers of fish observed.

1.3 Study Area

The proposed pipeline is to be installed between Crib Point, approximately 63km south-south-east of Melbourne on Victoria's Mornington Peninsula and Pakenham, about 56km east-south-east of Melbourne. Refer to Table 1 for an overview of the pipeline alignment.

The total alignment will be approximately 56.2km in length, with a project corridor up to 30 metres in width. In environmentally sensitive areas, subject to the results of studies undertaken for the project, the project corridor may be reduced to avoid or minimise impacts to sensitive features.

The following is a brief description of the proposed route:

- From the Crib Point jetty, the route heads in a westward direction, crossing The Esplanade and entering private property (BP owned) where it turns north heading towards Woolleys Road. It then travels north-west, adjacent to Woolleys Road within the Esso/APA easement (PL11/46) before crossing Woolleys Road. It continues in a north-westerly direction through private property and entering Warringine Park at approximately KP3.25.

- The route travels in a north-westerly direction until approximately KP3.8 where it turns and heads directly north. It travels in this direction through the park for approximately 1.1km before turning westwards inside the park, along Reid Parade, before exiting Warringine Park, (KP 5.2). From here it turns northwards to follow the Frankston-Flinders Road service lane for approximately 900 metres. At this point it turns east into High St where it enters the Stony Point rail easement for 500 metres before heading turning left into Cool Store Road at KP6.8. It then turns back into Frankston-Flinders Road to continue northwards for a further two kilometres on the eastern side of the road.
- The route crosses Graydens Road then heads northwards, then east through private land, crossing the Stony Point Rail line and Frankston-Flinders Road to the north of Hastings at approximately KP9.8 to travel in a north-easterly direction for the remainder of the route through to Pakenham.
- As it heads north-easterly, the route follows Esso's pipeline easement (PL27/35) from KP10.4, south of Denhams Road, Hastings to KP29.7 near the South Gippsland Highway. The route is directly adjacent to the Esso easement for this component and travels through private land parcels, crossing several major and minor road easements and key drainage lines connected to the Western Port Ramsar Wetland.
- From the South Gippsland Highway, the route branches away from the Esso easement, travelling north-easterly through private land parcels, major and minor road easements and drainage lines before crossing the Princes Freeway and Princes Highway to meet PL75 within private land.

APA is proposing to HDD 16 locations across the construction footprint. The HDD and reasoning for the method is described in **Table 1**.

Table 1: Location of HDD across the project Right of Way

#	KP	Location of HDD	Feature Description	Max. Depth of HDD (mAHD)
1	4 – 4.4	Warringine Park	HDD to avoid significant flora	14.5
2	4.6-5	Warringine Creek	HDD under Warringine Creek	12
3	7.25 – 7.75	Kings Creek	HDD under Kings Creek and Hastings Leisure Centre Reserve – Significant vegetation avoidance	8.5
4	8.9-9	Craydens Road	HDD under Road crossing Craydens Road to avoid a number of essential services	6
5	9.9-10.4	BlueScope Properties	HDD under Bluescope Properties to avoid ESSO underground pipelines	11
6	14.6-15.2	Significant Flora	HDD under Significant habitat and vegetation	12.5
7	17.1-17.4	Whitneys Road	HDD under Whitneys Road and avoidance of private infrastructure	10
8	18.7-19.6	Watson Creek	HDD under Ramsar Wetland and endangered salt marsh vegetation community	14
9	22.7-23.1	Vowell Road Wetland	HDD under significant aquatic habitat	14

#	KP	Location of HDD	Feature Description	Max. Depth of HDD (mAHD)
10	26.8 - 27.3	Fisheries Road crossing	HDD under Fisheries Road and avoidance of large trees	6
11	29.7 - 30.3	South Gippsland Hwy and high value agricultural land	HDD to avoid high value farm land and safely cross under South Gippsland Hwy dual carriage.	16
12	40 -40.3	Cardinia Creek	HDD under significant ecosystem	17
13 & 14	41.45 - 41.9	Deep Creek & Toomuc Creek - Ballarto Road	HDD under MW asset and significant aquatic habitat	16
15	54.4 - 54.7	Princes Fwy Crossing	HDD under Princes Fwy dual carriage	14
16	55.1 - 55.4	Princes Hwy Crossing	HDD under Princes Hwy dual carriage	12

Watercourse Crossing

Four watercourse crossings proposed to be open-cut (Oliver Creek, Langwarrin Creek, Rutherford Creek, Western Outfall Drain) may have the potential for low water-flow during the proposed construction period. Some of the construction mitigation measures that would be implemented through the CEMP for these features include:

- Installation of flume pipes across access tracks to allow flow and minimise damage to the bed and banks of the waterway;
- Installation of steel plates to block the flow across the water crossing together with high or low flow pumps to maintain flow during the installation of the pipeline. A grate, mesh or similar will be installed over the pump head to reduce the potential for vegetation disturbance or fish to travel into the pipe;
- Salvage of aquatic fauna after plates have been installed and prior to construction or excavation;
- Divert water to a dam or back to the waterway through a filtration system to prevent turbidity and sedimentation (e.g. rock drain or drain lined in geofabric).
- Implementation of suitable sedimentation control measures (such as silt curtains) where appropriate to minimise impacts to water quality; and
- Reinstate works area and re-establish vegetation as soon as possible.

The use of these measures is considered on a case-by-case basis appropriate to the requirements of the waterway and in consultation between environmental and construction site personnel. All waterway crossings will be restored after pipe installation. Restoration of these crossings may use a range of methods to ensure the area is stabilised after construction is complete and the reinstated works are in accordance with any requirements of Melbourne Water as the relevant Catchment Management Authority.

The design of the pipeline is such that its alignment and depth will not impact on the hydrology of the catchment. The remaining risks are limited to the construction phase, thus will be at a local scale and temporarily limited.

Timing the construction to coincide with the times of the year where the waterway crossing points are dry, or have very low flows, will be expected to result in minimal environmental impact during construction. The impact to stream flows is short-term as excavation works for open cut crossing are completed between three to six weeks. The excavation depth is generally to 2.7m to prevent long term erosion impacts and integrity.

Desktop assessment was conducted for all waterways in the areas described above. In late 2017 and early 2018 Monarc assessed the condition of priority crossings. Based on a combination of factors including species records, adequate water and instream habitat, a total of 16 waterways were selected for aquatic surveys (Appendix **2**).

1.4 Scope of Works

The scope of works comprised the following:

- A desktop review of relevant literature and online resources to identify potentially significant EPBC Act and FFG Act listed species at each priority crossing.
- Aquatic surveys designed to determine if EPBC Act and FFG Act listed fish and other aquatic species were present in the waterways.
- Preparation of this report, summarising the works undertaken, results of the aquatic surveys and recommendations.

1.5 Limitations and assumptions

Refer to the Flora and Fauna Assessment – Crib Point Pakenham Pipeline (Monarc 2018) for a discussion of limitations associated with all flora and fauna assessments undertaken for the project by Monarc. A specific limitation for the aquatic survey was that access to some properties was limited and/or delayed by the property owner. In addition, Pearcedale South Creek had the potential for listed aquatic species that more adapted to estuarine/marine environments, such as the Flatback Mangrove Goby (*Mugilogobius platynotus*) (see Section 3.1). Access wasn't available to the area over the pipeline route, due to the depth of water and deep impassable substrate.

The methodology employed for this assessment (i.e. field survey combined with information available from desktop information sources) is considered sufficient to determine if the development will have a significant impact on any threatened species, population or ecological community.

2 Assessment Methods

2.1 Desktop Review

A desktop review was undertaken to ascertain the EPBC Act and FFG Act listed aquatic species potentially present at each of the priority crossings and to assist with targeting the field survey for the identified species. The desktop review included a search using the following ecological databases:

- The Commonwealth Government's EPBC Act Protected Matters Search Tool (PMST) for potential species and species habitat within a 10km radius around each crossing; and
- DELWP's Victorian Biodiversity Atlas (VBA version 2018) for existing records of species occurring within a 10km radius around each crossing.

2.2 Site Selection

Sites selection was based on the results of the desktop review, which investigated the presence of listed species. Aerial imagery was used where available and ground-truthing for potential habitat was undertaken where access was approved and available.

Perennial waterways intersected by the project, such as Warringine Creek, Watson and Langwarrin Creeks that have potential to contain listed aquatic species (based on historical records) were selected for surveys. Western Outfall drain, Cardinia, Toomuc and Deep Creeks were selected because of listed species being recorded in database records. The waterbodies at Vowell Drive and CPT059 and 060 were chosen because of connectivity to creeks and Western Port. The drain on Craigs Lane was chosen because during the vegetation assessments Galaxias (*Galaxias* sp.) were observed in the drain. Pakenham Creek was chosen because it appeared to support habitat for Dwarf Galaxias.

Some drains were dry at the time of the assessments, such as Tooradin Inlet Drain and Hagelthornes Drain. At sites where water bodies were ephemeral (i.e. temporary or partially dry) Dwarf Galaxias is understood to undertake aestivation (dormancy in summer or dry seasons). The fish are only able to undertake aestivation when the water body they inhabit is also populated with burrowing crayfish (*Geocharax sp.*), where they utilise the crayfish holes in dry events (SWIFFT 2018).

Survey sites are shown on **Figures 1 – 7** included in **Appendix 2**.

2.3 Field Surveys

In April 2018, Monarc Environmental (Monarc) commissioned the services of Aaron Jenkin (Director & Principal Ecologist from Aquatica Environmental) to conduct aquatic surveys in 16 waterbodies between Crib Point and Pakenham in Victoria. The waterways included two constructed waterbodies at Vowell Drive, Pearcedale, a drainage line alongside Craigs Lane Pearcedale, Western Outfall Drain, Cardinia Creek (2 Locations), Toomuc, Deep and Pakenham Creeks.

Monarc and Aquatica Environmental undertook a series of two-day/one-night surveys for the target species in waterways and waterbodies in and near the project area. The surveys were undertaken on the 16th and 17th April, 14th and 15th May, 25th and 26th June and 26th and 27th July 2018. The surveys commenced with a reconnaissance of each site, to identify aquatic habitat that had the potential to support the target species' requirements.

The aim of the aquatic surveys was to determine if EPBC Act and FFG Act listed fish and other aquatic species were present in the waterways.

Aquatic surveys were undertaken using a combination of visual observation dip-netting, bait traps, fyke netting and electrofishing (backpack). The following 16 waterways and waterbodies were surveyed:

- Warringine Creek KP4.98;

- Watson Creek KP19.12;
- Pearcedale South Creek KP19.5;
- Langwarrin Creek KP21.08;
- Lachies Marsh KP21.21;
- Farm Dam and connected drainage channel KP21.65;
- Vowell Drive KP23.0 – 1st Constructed Wetland to the north of Vowell Drive;
- Vowell Drive KP23.0 – 2nd Constructed Wetland to the north of Vowell Drive;
- Craigs Lane KP23.95 – drainage channel;
- Rutherford Creek KP29.78;
- Western Outfall Drain KP31.06;
- Cardinia Creek KP40. 1st location (Ballarto Road);
- Cardinia Creek KP40. 2nd location (Bloomfield Lane);
- Toomuc Creek KP41.45;
- Deep Creek KP41.5;
- Pakenham Creek KP48.2.

Table 2 provides details of the site location of these waterways and waterbodies. All of these waterways and waterbodies are within the Cleared Hills and Coastal Plains catchment under the relevant State Environmental Protection Policy Waters of Western Port and Catchment (SEPP)(EPA 2001).

Table 2: Location coordinates for each potential crossing (Projection – GDA 94/MGA zone 55)

Crossing Location	Latitude	Longitude
Warringine Creek	-38.31660400°	145.18553600°
Watson Creek	-38.23216660°	145.24198845°
Pearcedale South Creek	-38.23067410°	145.24751325°
Langwarrin Creek	-38.21795393°	145.25497897°
CPT60 (Lachies Marsh)	-38.21539300°	145.25223900°
CPT60 Dam	-38.21393200°	145.25695600°
Vowell Drive Wetland North	-38.20883051°	145.27149267°
Vowell Drive Wetland South	-38.20925648°	145.27158983°
Craigs Lane Drainage channel	-38.20521528°	145.28071478°

Western Outfall Drain	-38.18199773°	145.35141405°
Cardinia Creek - 650m South of Ballarto Road	-38.15153257°	145.43614218°
Cardinia Creek – End of Bloomfield Lane	-38.15741973°	145.44159913°
Toomuc Creek	-38.14859438°	145.44819360°
Deep Creek	-38.14817009°	145.44903410°
Pakenham Creek	-38.11183039°	145.50963244°

2.3.1 Fish Survey

Where potentially suitable habitat for the targeted species was identified, a survey of that habitat was undertaken in accordance with the relevant guidelines (SPRAT [DoEE 2017], Survey Guidelines for Australia's Threatened Fish [DSEWPaC 2004] and Biodiversity Precinct Structure Planning Kit [DSE 2010]).

A combination of dip netting, electrofishing (backpack), bait traps, fyke nets and visual observation were adopted for the aquatic surveys with the actual methods used at each priority crossing dependent on waterway conditions. The survey method utilised included a site and species appropriate mix of:

- Hand-held dip-net: Dip-netting was undertaken in and around the range of available aquatic habitats at each site using a fine and soft mesh dip-net.
- Bait traps: Up to six bait traps were deployed at each priority crossing overnight. Traps with or without glow sticks were used. Unbaited traps are as successful as baited traps in capturing fish according to Arthington & Marshall 1993 & DSEWPC 2011. As part of Animal Ethics Committee (AEC) approval requirements the bait traps were set no earlier than dusk each night and retrieved early the following morning.
- Fyke nets: Up to two single-wing fyke nets nets were deployed overnight where waterway conditions allowed. To minimise the nets clogging with floating material, they were all set facing downstream. In addition, and to minimise the risk to air-breathing animals, intermediate chambers and the cod/trap end of all nets were set above water to allow a breathing space.
- Backpack electrofishing: Backpack Electrofishing was carried out using a Halltech HT-2000 Battery Backpack Electrofisher in accordance with the Australian Code of Electrofishing Practice (SCFFA, 1997) by certified senior electrofisher operator Aaron Jenkin from Aquatica Environmental. Electrofishing was undertaken in and around the range of available aquatic habitats at each site.
- Visual observation: Incidental observations of aquatic fauna were made throughout the surveys. This included looking through riparian and emergent zones for small fish, amphibians and reptiles.

Table 3 provides details of the methods employed at each site.

Table 3: Summary of survey location and methods employed.

Kilometre Point (approx.)	Date of Survey	Location	Methods Employed
4.85	14 & 15 May 2018	Warringine Creek	Dip nets from the channel during the day. Bait traps overnight
19.12	14 & 15 May 2018	Watson Creek	Dip nets from the channel during the day. Bait traps overnight
19.5	26 & 27 July 2018	Pearcedale south Creek	Dip nets from the dam during the day. Bait traps overnight
21.08	25 & 26 June 2018	Langwarrin Creek	Dip nets from the channel during the day. Bait traps overnight
21.21	26 & 27 July 2018	Lachies Marsh	Dip nets from the dam during the day. Bait traps overnight
21.65	25 & 26 June and 26 & 27 July 2018	Property CPT 60 Dam and connected drainage channel	Dip nets from the dam during the day. Bait traps overnight
23.5	16 & 17 April 2018	Vowell Drive – 1st large constructed wetland in private property	Dip nets from the wetlands during the day
23.5	16 & 17 April 2018	Vowell Drive – 2nd large constructed wetland in private property	Dip nets from the wetlands during the day
24.5	16 & 17 April 2018	Craigs Lane -Road reserve	Dip Nets from the channel during the day.
29.78	25 & 26 June 2018	Rutherford Creek (aka Wylies Drain Main Branch)	Dip nets from the channel during the day. Bait traps overnight
31.06	16 & 17 April 2018	Western Outfall drain	Dip nets and backpack electrofishing from the channel during the day and bait traps overnight
40	16 & 17 April 2018	Cardinia Creek – Ballarto Road end	Dip nets and backpack electrofishing during daylight hours, bait traps and a Fyke net left overnight.
40	16 & 17 April 2018	Cardinia Creek – Bloomfield Lane end	Dip nets during daylight hours and a Fyke Net left overnight.
41.45	16 & 17 April 2018	Toomuc Creek	Dip nets from the bank during the day. Bait traps overnight
41.5	16 & 17 April 2018	Deep Creek	Dip nets from the bank during the day. Bait traps overnight
48.0	16 & 17 April 2018	Pakenham Creek (aka Deep Creek (Lower) & Hancocks Gully)	Dip nets from the channel during the day. Bait traps overnight

2.3.2 Water Quality Sampling

To provide context to the survey results, in situ water quality sampling was undertaken using a calibrated Hanna Instruments HI9829 multiparameter water quality meter. At each site, a single representative sample was taken and the following parameters measured:

- Water temperature (°C)
- Dissolved oxygen (% and mg/L)
- Electrical conductivity (µS/cm)
- pH (pH units)
- Turbidity (NTU)

Sites influenced by tides were not sampled, due to the wide range and rapid changes to water quality conditions.

2.3.3 Permits

The surveys were undertaken in accordance with Aquatica Environmental's approvals and permits including:

- Department of Economic Development, Jobs, Transport and Resources (DEDJTR) Wildlife and Small Institutions Animal Ethics Committee (WSIAEC) approval (No. 28.14 and then 18.11);
- Scientific Fieldwork Procedures Licence (No. SPFL20394);
- *Fisheries Act 1995* General Research permit (No. RP1312); and
- FFG Act and *Wildlife Act 1975* research permit/permit to take protected fish (No. 10007600 and then 10008802).

2.3.4 Likelihood of Occurrence Assessment

Habitat requirements of significant aquatic species previously recorded within 10km of the construction footprint, or that may potentially occur within the construction footprint, were assessed to determine their likelihood of occurrence within the construction footprint. The likelihood of a species occurring within the construction footprint was then ranked as Negligible, Low, Moderate or High in accordance with the categories outlined in **Table 4**.

Note that due to ongoing modification of the region and/or the surrounding landscape, species that have no records after 1984 have been excluded from this table unless otherwise advised by Government or local authorities that the species may be present. Some additional species with no VBA records in the area, however, have also been considered by Monarc where potentially suitable habitat was considered to exist.

Table 4: Likelihood of occurrence categories

Likelihood of Occurrence	Code	Criteria
High	H1	Known resident in the area based on site observations, database records or expert advice
	H2	Recent reputable records (within 5 years) of the species in the local area e.g. VBA
	H3	The construction footprint contains the species' preferred habitat
Moderate	M1	The species is likely to visit the area regularly (i.e. at least seasonally)
	M2	Previous reputable records of the species in the local area e.g. VBA
	M3	The construction footprint contains some characteristics of the species' preferred habitat
Low	L1	The species is likely to visit the area occasionally or opportunistically whilst en-route to more suitable sites
	L2	There are only limited or historical records of the species in the local area (i.e. more than 20 years old)
	L3	The construction footprint contains few or no characteristics of the species' preferred habitat
Negligible	N1	No previous records of the species in the local area; or
	N2	Previous records of the species in the local area (eg VBA) but > 30 years old
	N3	The species may travel through the watercourse when moving between areas of more suitable habitat
	N4	Out of the species' range
	N5	No suitable habitat present within construction footprint
	N6	Species regionally extinct

3 Results

3.1 Desktop Review

The desktop review identified three EPBC or FFG Act listed species as having been recorded or that potentially occur in the study area, as follows:

- Galaxias (*Galaxiella pusilla*). Dwarf Galaxias has previously been found in Cardinia Creek in 1936,1941,1954 and 2012, Langwarrin Creek in 1964, and Watson Creek in 2010.
- Australian Grayling (*Prototroctes maraena*). Australian Grayling has previously been found in Cardinia Creek in 2001.
- Flatback Mangrove Goby (*Mugilogobius platynotus*) has been found in Western Outfall drain in 1989 and 1991 and Cardinia Creek in 2014.

The results of the PMST and VBA search are included in **Table 5** and **Table 6**.

3.2 Likelihood of Occurrence

The likelihood of occurrence assessment (Appendix 3) found the following:

- Dwarf Galaxias has a "High' to 'Moderate' likelihood of occurrence, due to either being a known resident, having recent records (<5 years) or there being suitable habitat in:
    - Warringine Creek
    - Watson Creek*
    - Pearcedale South
    - Langwarrin Creek
    - CPT 60 (dam and Lachies Marsh)
    - Craigs Lane Drain
    - Western Outfall Drain
    - Cardinia Creek (Ballarto Road and Bloomfield Lane ends)
    - Toomuc Creek
    - Deep Creek
    - Pakenham Creek

  *The likelihood of occurrence of Dwarf Galaxia in Watson Creek is likely to be low. However, considering the Dwarf Galaxia Action Statement (DELWP 2015) refers to historical records in Watson Creek as an important population, it has been included in this list for the low probability that it may be present during construction of the pipeline.
- Australian Grayling has a 'High' likelihood of occurring, due to nearby records, in Cardinia Creek (Ballarto Road and Bloomfield Lane ends)
- Flatback Mangrove Goby has a 'High' likelihood of occurrence in the Western Outfall Drain (recent records) and 'Moderate' likelihood in Watson Creek (possible regular visitor).

It should be noted that several waterways were dry at the time of surveys and they weren't investigated or surveyed for signs of habitat characteristics that may suit Dwarf Galaxias (i.e. crayfish burrows). Being dry does not significantly reduce the likelihood of Dwarf Galaxias occurring or utilising these sites during wetter times of the year. The watercourses include

- Muddy Gates Drain
- Hagelthornes Drain
- Tooradin Inlet Drain.

3.3 Survey Sites

A brief description of habitat in each aquatic survey site is provided below and photographs illustrating the condition of the waterways at each crossing are presented in Appendix 1

3.3.1 Warringine Creek

Warringine Creek is located on crown land southeast of Hastings. Near the crossing, Warringine Creek stream width ranged from approximately 4 to 8 m. At the time of survey, the water was shallow with an estimated depth of around 40 cm interspersed with several deeper (> 100cm) pools. The substrate of Warringine Creek was dominated by mud and organic matter.

The riparian vegetation at Warringine Creek consisted of Grassy Woodland (EVC175) which dominated the riparian zone. An extensive area of Grassy Woodland species including eucalypts, melaleuca, tea tree with a shrub layer dominated the riparian zone. Instream macrophytes included large areas of water ribbons (*Triglochin procera*), slender knotweed (*Persicaria decipiens*) and pondweed (*Potamogeton* spp). Other forms of instream habitat included large woody debris, and emergent melaleuca spp.

3.3.2 Watson Creek

Watson Creek is located on crown land northeast of Hastings. Near the crossing, Watson Creek was generally narrow and stream width ranged from approximately 4 to 6m. The creek is heavily influenced by tidal movements and at the time of survey the water ranged from deep (>100 cm) upstream flows (incoming tide) to shallow (low tide) with an estimated average depth of <40 cm interspersed with several deeper (> 80cm) pools. The substrate of Watson Creek was dominated by mud some short sections of gravel and hard-pack clay.

The riparian vegetation at Watson Creek consisted of Coastal Saltmarsh (EVC 9) which dominated the riparian zone. Instream macrophytes were not visible. Other forms of instream habitat included large woody debris.

3.3.3 Pearcedale South Creek

The area that was assessed was located upstream of the pipeline route, due to inaccessible coastal saltmarsh community and a wide-open area of water. The area that was sampled is connected to the wider water body and any fauna found in the assessment area may be found in the wider area. The vegetation over the pipeline route can be classified as EVC 9 Coastal Saltmarsh community and this community extends towards the location of the samples.

The Creek was shallow with an estimated average depth of around 40cm interspersed with a few deeper (> 80cm) pools. The substrate of Pearcedale South Creek was dominated by mud.

The site location for the dip netting and bait traps is modelled as EVC 48 Heathy Woodland. included exotic species such as kikuyu (*Pennisetum clandestinum*) and blackberries (*Rubus fruticosus* L. agg) and this vegetation extended along the drain to outside the construction footprint.

3.3.4 Langwarrin Creek

Langwarrin Creek is located on private land northeast of Hastings. Langwarrin Creek was generally narrow and stream width ranged from approximately 1 to 3m. The Creek was shallow with an estimated average depth of around 40cm interspersed with a few deeper (>100cm) pools. The substrate of Langwarrin Creek was dominated by mud.

The riparian vegetation at Langwarrin Creek consisted of low quality Swamp Scrub vegetation (EVC53) and blackberries. Instream macrophytes were restricted to isolated plants such as *Triglochin* sp. and *Potamogeton* sp. Other forms of instream habitat included large woody debris and undercut banks. Although both banks of Langwarrin Creek are fenced to exclude access, there is still evidence of some bank erosion and slumping throughout the reach.

3.3.5 CPT 60 (Lachies Marsh)

The wetland is located on private land near Pearcedale. It is a constructed wetland and has been planted with indigenous vegetation with government grants. The wetland abuts the construction footprint. Near the crossing, the dam is connected to a drainage channel that flows towards Western Port. The dam was shallow with an estimated average depth of around 70cm it contained typha (*Typha orientalis*) and phragmites (*Phragmites australis*) with an open area of water. The substrate was dominated by mud. Cape Barren Geese (*Cereopsis novaehollandiae*) and Black Shouldered Kites (*Elanus axillaris*) were in the area. The Cape Barren Geese appear to be nesting on the nearby dam in the same property. There were 2 species of frog spawn observed in the water.

The riparian vegetation consisted of planted indigenous vegetation, planted under a government grant. Including *Acacia melanoxylon, Acacia mearnsii*, *Leptospermum continentale*, *Banksia marginate, Eucalyptus ovata* and *E. radiata* subsp *radiata*, and *Lomandra longifolia*. Instream macrophytes included typha and common reed (*Phragmites australis*). Other forms of instream habitat included woody debris.

3.3.6 CPT 60 (Dam)

The dam is located on private land near Pearcedale. Near the crossing, the dam is connected to drainage channels that flow towards Western Port. The drainage channels were generally narrow, approximately 1-2m and depth ranged from approximately 20-40cm and contained large areas of water ferns (*Azolla pinnata)* and duckweed (*Lemna minor*). The dam was shallow with an estimated average depth of around 70 cm it also contained water ferns and duckweed and an unidentified plant that was restricting ducks from moving easily. The substrate was dominated by mud. The dam contained a small island on which Cape Barren Geese were nesting.

The riparian vegetation at consisted of low quality Swamp Scrub vegetation (EVC 53), Melaleucas, Eucalypts, blackberries and Pampas Grass. Instream macrophytes were restricted to water ferns and duckweed. Other forms of instream habitat included woody debris.

3.3.7 Vowell Drive Wetlands

The potential crossing of the pipeline is north of the wetlands, which are located on private land in Pearcedale. The two constructed wetlands are south of the pipeline crossing. The wetlands are generally shallow and wetland depth ranged from approximately 30 to 60cm. The substrate of the wetlands was dominated by mud.

The riparian vegetation at the wetlands was restricted to a narrow, semi-continuous band of predominately Swamp Scrub (EVC53) less than 5m wide around the banks. There was very little emergent vegetation and macrophytes were restricted to isolated patches of submerged vegetation *Triglochin* sp.

3.3.8 Craigs Lane Drain

A narrow drainage channel located along Craigs Lane, Pearcedale. The drain was approximately 1 to 1.5m wide. Water depth was ~20cm and the substrate was dominated by mud.

The vegetation found in the road reserve and table drain included exotic species such as kikuyu, dock and blackberries and this vegetation extended along the drain to outside the construction footprint.

3.3.9 Rutherford Creek

Rutherford Creek is located on private land east of Tooradin Near the crossing, Rutherford Creek was generally narrow and stream width ranged from approximately 1 to 3m. The Creek was shallow with an estimated average depth of around 20cm. The substrate of Rutherford Creek was dominated by mud.

The riparian vegetation at Rutherford Creek consisted of pasture species and blackberries. Instream macrophytes were restricted to isolated plants of *Triglochin* sp. Other forms of instream habitat included small woody debris, waste iron being used as a barrier and undercut banks.

3.3.10 Western Outfall Drain

Western Outfall Drain is located on private land northwest of Tooradin. Near the crossing, the drain width ranged from approximately 4 to 7m. The drain was shallow with an estimated average depth of around 50 cm interspersed with several deeper (>90cm) pools. The substrate of Western Outfall Drain was dominated by sand.

The riparian vegetation at Western Outfall Drain was restricted to a narrow, semi-continuous band of a mixture of native and exotic species less than 2m wide on either bank. Instream macrophytes were dominated by large patches of emergent vegetation, including typha and common reed which blocked areas of the drain so that it was reduced to a 1m wide section. Slender knotweed and an exotic grass water couch (*Paspalum distichum*) occupied areas that were not filled with typha or phragmites, leaving a narrow channel (1-1.5m) for water to flow through.

3.3.11 Cardinia Creek – Ballarto Road end

The Ballarto Road crossing of Cardinia Creek is located within a Melbourne Water easement northeast of Tooradin. Near the location, Cardinia Creek was generally 6-8m in width. The Creek was shallow with an estimated average depth of around 40cm interspersed with several deeper (>70cm) pools. The substrate of Cardinia Creek was dominated by sand.

There is a Melbourne Water access track which is maintained and abuts Cardinia Creek, any riparian vegetation at Cardinia Creek was restricted to the levy bank separating this creek from the smaller (and dry) creek that parallels Cardinia Creek. The vegetation between the two creeks includes black wattles (*Acacia mearnsii*), interspersed with gorse (*Ulex europaeus*) and blackberry, with pasture species underneath. The vegetation on the eastern side of the creek includes black wattle, Blackberry, gorse and hawthorn *(Crataegus monogyna)* Instream macrophytes were dominated by large patches of emergent vegetation, including typha and common reed, these plants occupied large sections of the creek between each bank, leaving large pools in between. A large proportion of filamentous algae were also observed throughout the reach. Other forms of instream habitat included undercut banks. Although both banks of Cardinia Creek are fenced to exclude stock access, there is still evidence of some bank erosion and slumping throughout the reach.

3.3.12 Cardinia Creek – Bloomfield Lane end

The Bloomfield Lane crossing at Cardinia Creek is located within a Melbourne Water easement northeast of Tooradin. It is the alternative crossing along Cardinia Creek and is found at the end of Bloomfield Lane. Near the crossing, Cardinia Creek was generally 6-8m in width. The Creek was shallow with an estimated average depth of around 40 cm interspersed with many deeper (>70cm) pools. The substrate of Cardinia Creek was dominated by sand.

There is a Melbourne Water access track which is maintained and abuts Cardinia Creek, any riparian vegetation at Cardinia Creek was restricted to the levy bank separating this creek from the smaller (and dry) creek that parallels Cardinia Creek. The vegetation between the two creeks includes black wattle, interspersed with gorse and blackberry, with pasture species underneath. The vegetation on the eastern side of the creek includes black wattle, blackberry, gorse and hawthorn. Instream macrophytes were dominated by large patches of emergent vegetation, including typha and common reed, these plants occupied large sections of the creek between each bank, leaving large pools in between. A large proportion of filamentous algae were also observed throughout the reach. Other forms of instream habitat included undercut banks. Although both banks of Cardinia Creek are fenced to exclude stock access, there is still evidence of some bank erosion and slumping throughout the reach.

3.3.13 Toomuc Creek

The crossing at Toomuc Creek is located on private land northeast of Tooradin. It is a DELWP managed creek system. Near the crossing, Toomuc Creek was approximately 6m in width. The Creek was deep with an estimated depth of 120-150cm. The substrate of Toomuc Creek was dominated by large rocks.

The riparian vegetation at Toomuc Creek was restricted to a band of exotic with few native species occupying an area approximately 5m wide on either bank. A levy bank is on the eastern side of the creek and this was dominated by blackberry and phalaris. The instream macrophytes included common reed which formed large patches across the channel, leaving pooled areas in between these patches.

3.3.14 Deep Creek

The crossing at Deep Creek is located on private land northeast of Tooradin. It is a DELWP managed creek system. Near the crossing, Deep Creek was approximately 6-8m in width. Deep Creek was deep with an estimated depth of 130-160cm and the substrate was dominated by mud.

The riparian vegetation at Toomuc Creek was restricted to a band of exotic and few native species less than 5m wide on either bank. Blackberry was dominant. The Instream macrophytes included common reed which formed large patches across the channel, leaving pool areas in between these patches.

3.3.15 Pakenham Creek

The crossing at Pakenham Creek is located southeast of Pakenham. It is a Melbourne Water managed creek system. Near the crossing, Pakenham Creek was approximately 40cm deep and stream width ranged from 4 to 6m. The substrate of Pakenham Creek was dominated by sand.

The riparian vegetation at Pakenham Creek was restricted to a mixture of native and introduced species less than 5m wide on either bank. The species include Swamp Scrub (EVC53) gorse and blackberry (dominant) and *Melaleuca* spp and *Leptospermum* spp. Instream macrophytes included typha, common reed and slender knotweed. A large proportion of filamentous algae was also observed throughout the reach. Other forms of instream habitat included woody debris and undercut banks.

3.4 Water Quality

The results from the in-situ water quality assessment are included in **Table 7**. The in-situ water quality results indicated that electrical conductivity half the crossings were at satisfactory levels and complied with the SEPP Waters of Western Port and catchment, lowlands and Phillip Island (EPA 2001). Dissolved oxygen was low at half of the crossings pH exceeded the guidelines at 3 locations and turbidity exceeded the guidelines at all sites. Overall the results are within the range(s) to be expected, given the landscape and region the waterways and waterbodies occur.

3.5 Field Survey

The surveys of the waterbodies resulted in the identification of 17 species, as summarised in **Table 8,** comprised of:

- 6 species of indigenous native freshwater fish
- 1 native, but not indigenous species of fish (i.e. introduced and indigenous to Qld/NSW)
- 1 species of estuarine/marine fish
- 7 species of introduced fish including 2 species that are listed as noxious under Section 75 of the Fisheries Act (European Carp and Gambusia)
- 2 species of common freshwater crustacean (shield and glass shrimp)
- 1 species of common estuarine/marine crustacean (crab)
- Likely 1 species of native aquatic mammal (as determined by the identification of an active and likely native water rat burrow)

No species listed under either the FFG Act or EPBC Act were detected.

The greatest numbers of fish retrieved were all introduced species, with Gambusia being collected from nine waterways and waterbodies. No Commonwealth or State listed species were recorded. The presence of predatory and competitive fish such as Gambusia and Redfin Perch may impact on the likely presence of native species.

In general, a number of key factors may account for the lack of detection of any of the three Commonwealth or State listed fish species in the waterways including:

- Low quality habitat values or absence of suitable aquatic or emergent vegetation;
- Waterway degradation (habitat and water quality);
- High abundance of competitive and predatory fish such as Gambusia (Unmack & Paras 1995), (Wager & Jackson 1993);

Lack of nearby populations and limited connectivity of survey sites to areas of higher habitat values (Wager & Jackson 1993).

A non-indigenous Firetail or Western Carp Gudgeon (*Hypseleotris galii* or *H. klunzingeri*) was found in the dam at KP21.65. Firetail/Western Carp Gudgeon is a small freshwater fish that is normally found in freshwater systems between southern NSW and Southern Qld. Common Galaxias was found in six waterways including the table drain in Craigs Lane road reserve. Warringine & Watson Creeks resulted in four species each being recorded in those waterways. Watson Creek and Pearcedale South Creek are both influenced by tidal movements and provide habitat for estuarine species.

4 References

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Table 5: Results from the desktop review from the Commonwealth Government's EPBC Act 1999 Protected Matters Search Tool (PMST) for potential species and species habitat within a 10km radius around each crossing

Common Name	Scientific Name	Conservation Status			Watercourse/Waterbody														
		EPBC ACT	FFG ACT	DELWP Advisory lists	Warringine Creek	Watson Creek	Pearcedale South Creek	Langwarrin Creek	CPT 60 (Lachies Marsh)	CPT 60 (Dam)	Vowell Drive Wetland -North	Vowell Drive Wetland -South	Craigs Lane Drain	Rutherford Creek	Western Outfall Drain	Cardinia Creek (Ballarto Rd end)	Cardinia Creek (Bloomfield Ln end)	Toomuc Creek	Deep Creek	Pakenham Creek
Dwarf Galaxias	*Galaxiella pusilla*	VU	L	EN		✓		✓								✓	✓			
Australian Grayling	*Prototroctes maraena*	VU	L	VU												✓	✓			

Note:

VU = Vulnerable; EN = Endangered; CE = Critically Endangered; L = Listed; DD = Data Deficient; ✓ = Recorded in database ✓ = Recorded in field survey

Table 6: Results from the Desktop review from the DELWP Victorian Biodiversity Atlas (VBA version 2018) database search for existing records of species within a 10km radius around each priority crossing

Common Name	Scientific Name	Conservation Status			Watercourse/Waterbody														
		EPBC ACT	FFG ACT	DELWP Advisory lists	Warringine Creek	Watson Creek	Pearcedale South Creek	Langwarrin Creek	CPT 60 (Lachies Marsh)	CPT 60 (Dam)	Vowell Drive Wetland -North	Vowell Drive Wetland -South	Craigs Lane Drain	Rutherford Creek	Western Outfall Drain	Cardinia Creek (Ballarto Rd end)	Cardinia Creek (Bloomfield Ln end)	Toomuc Creek	Deep Creek	Pakenham Creek
Dwarf Galaxias	*Galaxiella pusilla*	VU	L	EN		✓		✓								✓	✓			
Australian Grayling	*Prototroctes maraena*	VU	L	VU												✓	✓			
Flatback Mangrove Goby	*Mugilogobius platynotus*		L	VU											✓	✓	✓			
Gambusia*	*Gambusia holbrookii*				✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
European Carp*	*Cyprinus carpio*														✓	✓	✓	✓	✓	✓

Common name	Scientific name	Conservation Status				Watercourse/Waterbody													
		EPBC ACT	FFG ACT	DELWP Advisory lists	Warringine Creek	Watson Creek	Pearcedale South Creek	Langwarrin Creek	CPT 60 (Lachies Marsh)	CPT 60 (Dam)	Vowell Drive Wetland -North	Vowell Drive Wetland -South	Craigs Lane Drain	Rutherford Creek	Western Outfall Drain	Cardinia Creek (Ballarto Rd end)	Cardinia Creek (Bloomfield Ln end)	Toomuc Creek	Deep Creek	Pakenham Creek
Goldfish*	*Carassius auratus**				✓	✓									✓	✓	✓	✓	✓	✓
Rainbow Trout*	*Oncorhynchus mykiss*				✓	✓									✓	✓	✓	✓	✓	✓
Redfin*	*Perca fluviatilis*				✓	✓									✓	✓	✓	✓	✓	✓
Roach*	*Rutilus rutilus*				✓	✓									✓	✓	✓	✓	✓	✓
Tench*	*Tinca tinca*				✓	✓									✓	✓	✓	✓	✓	✓
Yellow Fin Goby*	*Acanthogobius flavimanus*				✓	✓	✓								✓					

Note:

VU = Vulnerable; EN = Endangered; CE = Critically Endangered; L = Listed; DD = Data Deficient; ✓ = Recorded in database; ***** = Introduced species

Table 7: In situ water quality results from each of the potential crossings and comparisons to relevant SEPP (Waters of Victoria) guidelines

Water Quality Objectives		Crossing Location														
	Cleared Hills & Coastal Plains	Warringine Creek	Watson Creek	Pearcedale South Creek Upstream / Downstream	Langwarrin Creek	CPT 60 (Lachies Marsh)	CPT 60 (Dam)	Vowell Drive Wetland -North	Vowell Drive Wetland -South	Craigs Lane Drain	Rutherford Creek	Western Outfall Drain	Cardinia Creek (Ballarto Rd end)	Cardinia Creek (Bloomfield Ln end)	Toomuc Creek	Deep Creek	Pakenham Creek
Temperature (°C)	*NA*	10.6	Not assessed as tidal	9.59 / 11.16	9.14	9.53	9.21	25.1	22.2		9.41	18.3	19.6	19.6	19.2	19.2	19.4
Dissolved Oxygen (mg/L)	*NA*	2.86		3.73 / 7.49	3.99	3.95	4.86	5.5	9.8		1.91	3.0	10.1	10.1	10.5	10.5	4.4
Dissolved Oxygen (% Saturation)	*min. >80*	29.5		**32.9 / 70.3**	**34.5**	**33.9**	**42.3**	**40.2**	97.4		**16.7**	**19.4**	101.2	101.2	**116.5**	**116.5**	**31.2**
Electrical Conductivity (µS/cm)	*75th percentile ≤500*	615		1536 / 8944	670	1056	1700	115	1097		2247	**774**	194	194	**712**	**712**	253
pH	*6.5-9.0*	7.32		7.55 / 8.22	7.23	8.11	**9.83**	7.57	8.27		7.25	7.03	7.63	7.63	7.88	7.88	7
Turbidity (NTU)	75th percentile ≤30	1.6		**197 / 39.5**	6.7	**35.2**	2.9	12.0	13.9		**44.9**	19.7	**86.1**	**86.1**	13.7	13.7	**42.6**

Bold values did not comply with the relevant guideline.

Table 8: Aquatic survey results

Common Name	Scientific Name	Conservation Status			Watercourse/Waterbody															
		EPBC ACT	FFG ACT	DELWP Advisory lists	Warringine Creek	Watson Creek	Pearcedale South Creek	Langwarrin Creek	CPT 60 (Lachies Marsh)	CPT 60 (Dam)	Vowell Drive Wetland -North	Vowell Drive Wetland -South	Craigs Lane Drain	Rutherford Creek	Western Outfall Drain	Cardinia Creek (Ballarto Rd end)	Cardinia Creek (Bloomfield Ln	Toomuc Creek	Deep Creek	Pakenham Creek
Southern Pygmy Perch	*Nannoperca australis*				✓10											✓1				
Flathead Gudgeon	*Philypnodon grandicep*				✓1															
Common Galaxias	*Galaxias maculatus*				✓30	✓ 6	✓ 2	✓ 9					✓ 11	✓ 9						✓1
Unidentified Juvenile Goby						✓ 3														
Short Finned Eel	*Anguilla australis*						✓									✓11	✓			✓
Firetail/Western Carp Gudgeon	*Hypseleotris galii or H.*								✓ 10											
Tupong	*Pseudaphritis urvillii*				✓1	✓ 2														
European Carp*	*Cyprinus carpio*																✓	✓	✓	
Brown Trout*	*Salmo trutta*																✓	✓		

Continued on next page …

Common Name	Scientific Name	Conservation Status			Watercourse/Waterbody															
		EPBC ACT	FFG ACT	DELWP Advisory lists	Warringine Creek	Watson Creek	Pearcedale South Creek	Langwarrin Creek	CPT 60 (Lachies Marsh)	CPT 60 (Dam)	Vowell Drive Wetland -North	Vowell Drive Wetland -South	Craigs Lane Drain	Rutherford Creek	Western Outfall Drain	Cardinia Creek (Ballarto Rd end)	Cardinia Creek (Bloomfield Ln	Toomuc Creek	Deep Creek	Pakenham Creek
Goldfish*	*Carassius auratus*					✓										✓	✓1	✓		
Eastern Gambusia*	*Gambusia holbrookii*					✓	✓ 12	✓ 5	✓ 5						✓	✓6	✓	✓		✓90
Redfin*	*Perca fluviatilis*					✓											✓	✓		
Smooth Toadfish	*Tetractenos glaber*					1														
Glass shrimp	*Paratya australiensis*						✓ 6										✓20			
Shield shrimp	*Lepidurus apus viridus*								✓											
Mottle shore crab	*Paragrapsus laevis*					2														
Water Rat/Rakali	*Hydromys chrysogaster*										#									

A burrow was identified that best matched that used by native water rats.

Note: Taxa listed with * are introduced species
Following capture all aquatic fauna was identified, enumerated, photographed (where required) and released unharmed as close to the point of capture as was practicable and safe. All species listed as noxious under Section 75 of the *Fisheries Act 1995* were euthanised and their carcases disposed, as required under Aquatica Environmental's permit.

Appendix 1: Site Photos

Photo 1: Warringine Creek upstream of pipeline

Photo 2: Warringine Park upstream of pipeline

Photo 3: Watson Creek

Photo 4: Watson Creek

Photo 5: Pearcedale South Creek

Photo 6: Pearcedale South Creek

Appendix 1: Site Photos

Photo 7: Langwarrin Creek

Photo 8: Langwarrin Creek

Photo 9: CPT 060 Dam

Photo 10: CPT 060 Dam – Firetail/Western Carp Gudgeon

Photo 11: CPT 060 – Lachies Marsh

Photo 12: CPT 060 – Lachies Marsh

Appendix 1: Site Photos

Photo 13: Rutherford Creek

Photo 14: Rutherford Creek

Photo 15: Vowell Drive Wetland - North

Photo 16: Vowell Drive Wetland - North

Photo 17: Vowell Drive Wetland - South

Photo 18: Vowell Drive Wetland - South

Appendix 1: Site Photos

Photo 19: Craigs Lane Drain

Photo 20: Craigs Lane Drain

Photo 21: Western Outfall Drain

Photo 22: Western Outfall Drain

Photo 23: Cardinia Creek – Ballarto Rd

Photo 24: Cardinia Creek – Ballarto Rd

Appendix 1: Site Photos

Photo 25: Cardinia Creek – Ballarto Rd – Short-finned Eels

Photo 26: Cardinia Creek – Ballarto Rd – Southern Pygmy Perch

Photo 27: Cardinia Creek – Bloomfield Ln

Photo 28: Cardinia Creek – Bloomfield Ln

Photo 29: Toomuc Creek - Redfin

Photo 30: Toomuc Creek- Mosquito Fish

Appendix 1: Site Photos

Photo 31: Toomuc Creek

Photo 32: Deep Creek

Photo 33: Pakenham Creek- Short-finned Eel, Mosquito Fish and Common Galaxias

Photo 34: Pakenham Creek

Appendix 2: Location Maps

KP6.5
KP6
KP5.5
KP5
KP4.5
KP4
KP3.5
CPT014
Hastings
Western Port

APA Transmission Pty Limited - 31-02984.00

Crib Point Pakenham Pipeline Project
APPENDIX 2: Aquatic Survey Locations
Figure 1 of 7

WORK REQUEST NUMBER: 31-02984.00

DATA SOURCES:
Service Layer Credits: Reference/World_Boundaries_and_Places: Esri, HERE, Garmin
DeLorme World Basemap: Copyright:© 2018 Garmin
World_Imagery: DigitalGlobe

LEGEND

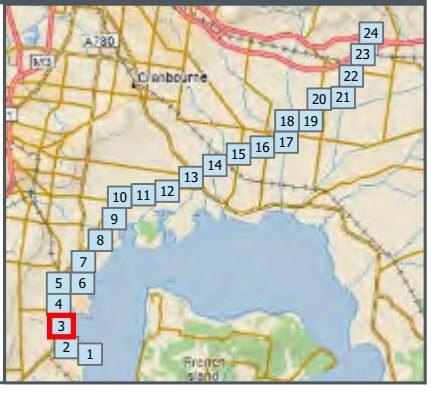
- Aquatic Survey Site
- Potential Habitat
  - Ausralian Grayling
  - Dwarf Galaxia
- Pipeline Alignment
- HDD Area
- Construction Footprint

ISSUE DATE	AUTHOR	QA CHECK	APPROVED	MAP REV.	REVISION NOTE
21/08/2018	AB	JH	MV	B	Issued for Review
30/07/2018	KH	JH	CC	A	Issued for Review

0 100
Metres
1:8,500

(A3) GDA 1994 MGA Zone 55

LOCATION DIAGRAM



Path: L:\Monarc\ESRI\Clients\APAGasnet\Crib Point to Pakenham\Ecological Assessments\FloraFaunaReport.aprx

KP22
CPT060
KP21.5
CPT059
CPT059
KP20.5
KP20
KP19.5
CPT054
CPT052
KP19

APA Transmission Pty Limited - 31-02984.00

Crib Point Pakenham Pipeline Project
APPENDIX 2: Aquatic Survey Locations
Figure 2 of 7

WORK REQUEST NUMBER: 31-02984.00

DATA SOURCES:
Service Layer Credits: Reference/World_Boundaries_and_Places: Esri, HERE, Garmin
DeLorme World Basemap: Copyright:© 2018 Garmin
World_Imagery: DigitalGlobe

LEGEND

- Aquatic Survey Site
- Potential Habitat
  - Ausralian Grayling
  - Dwarf Galaxia
- Pipeline Alignment
- HDD Area
- Construction Footprint

ISSUE DATE	AUTHOR	QA CHECK	APPROVED	MAP REV.	REVISION NOTE
21/08/2018	AB	JH	MV	B	Issued for Review
30/07/2018	KH	JH	CC	A	Issued for Review

0 100
Metres
1:8,500

(A3) GDA 1994 MGA Zone 55

LOCATION DIAGRAM

Path: L:\Monarc\ESRI\Clients\APAGasnet\Crib Point to Pakenham\Ecological Assessments\FloraFaunaReport.aprx

APA Transmission Pty Limited - 31-02984.00

Crib Point Pakenham Pipeline Project
APPENDIX 2: Aquatic Survey Locations
Figure 3 of 7

WORK REQUEST NUMBER: 31-02984.00

DATA SOURCES:
Service Layer Credits: Reference/World_Boundaries_and_Places: Esri, HERE, Garmin
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World_Imagery: DigitalGlobe

LEGEND

- Aquatic Survey Site
- Potential Habitat
  - Ausralian Grayling
  - Dwarf Galaxia
- Pipeline Alignment
- HDD Area
- Construction Footprint

ISSUE DATE	AUTHOR	QA CHECK	APPROVED	MAP REV.	REVISION NOTE
21/08/2018	AB	JH	MV	B	Issued for Review
30/07/2018	KH	JH	CC	A	Issued for Review

0 100
Metres
1:8,500

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Figure 4 of 7

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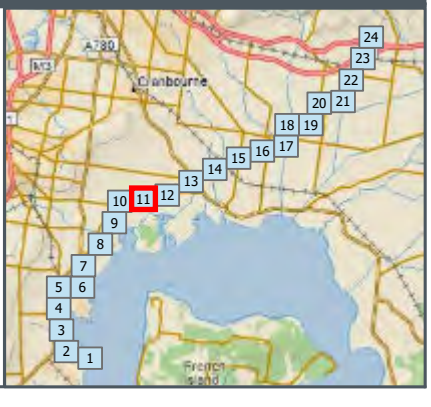
(A3) GDA 1994 MGA Zone 55

LOCATION DIAGRAM



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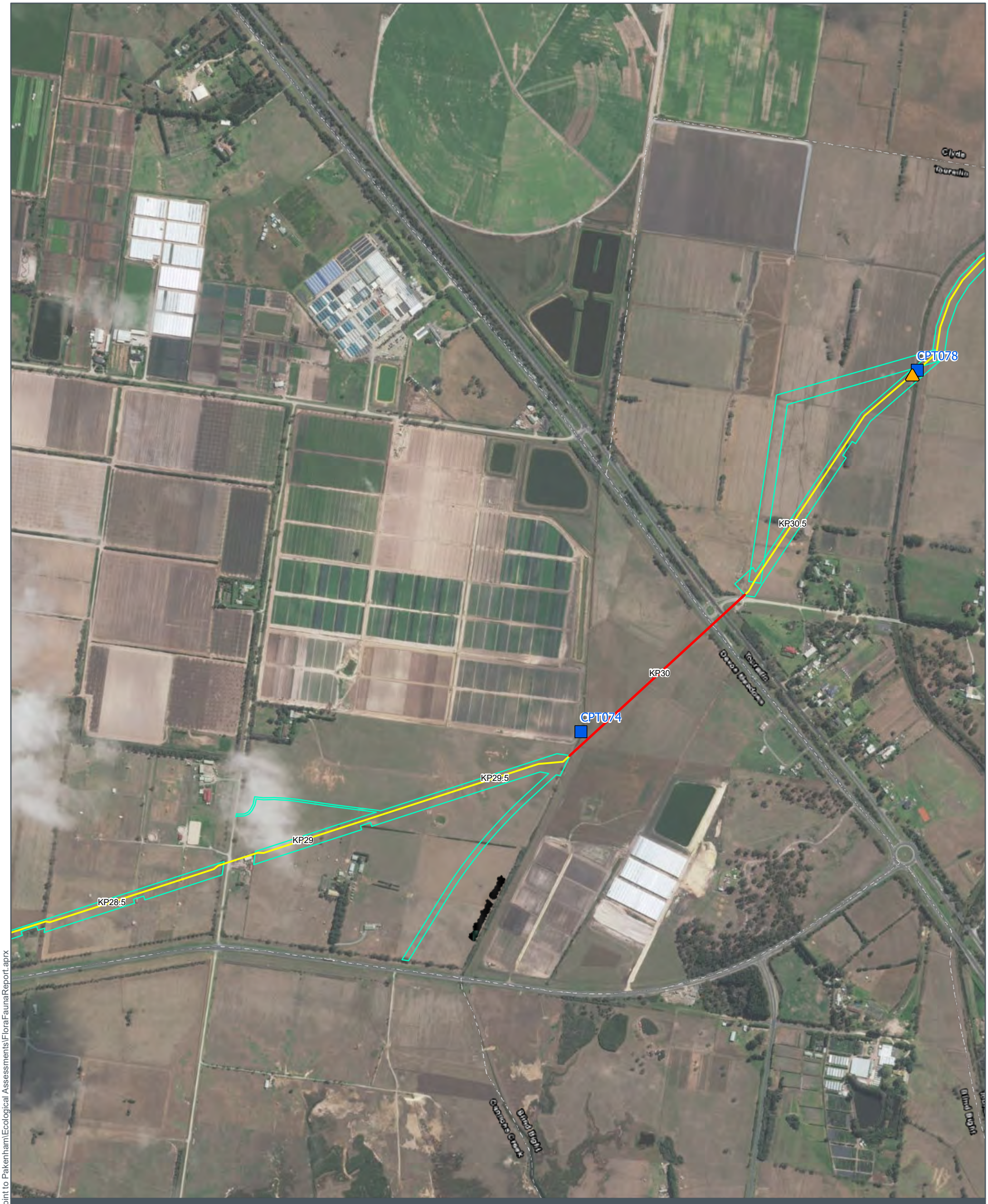

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Crib Point Pakenham Pipeline Project
APPENDIX 2: Aquatic Survey Locations
Figure 5 of 7

WORK REQUEST NUMBER: 31-02984.00

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30/07/2018	KH	JH	CC	A	Issued for Review

monarc ENVIRONMENTAL
apa

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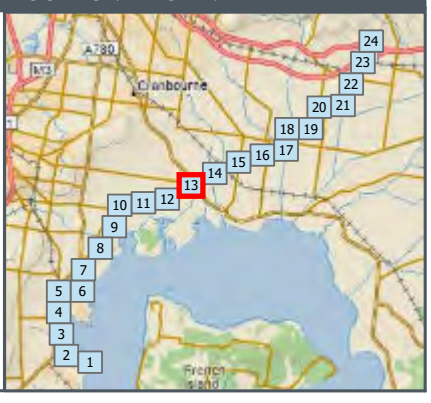
0 100
Metres
1:8,500

(A3) GDA 1994 MGA Zone 55

LOCATION DIAGRAM



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KP42
CPT105
KP41.5
CPT108
Rythdale
Koo Wee Rup
KP41
KP39.5
CPT106
KP40.5
Cardinia
Koo Wee Rup
Delmore
Koo Wee Rup

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Crib Point Pakenham Pipeline Project
APPENDIX 2: Aquatic Survey Locations
Figure 6 of 7

WORK REQUEST NUMBER: 31-02984.00

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apa

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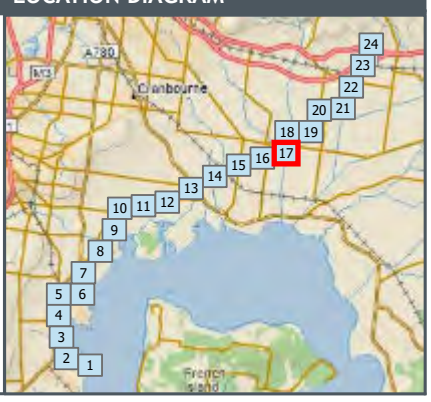
LOCATION DIAGRAM



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KP49

KP48.5

CPT125

KP48

KP47.5

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Crib Point Pakenham Pipeline Project
APPENDIX 2: Aquatic Survey Locations
Figure 7 of 7

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Appendix 3: Likelihood of Occurrence

Common Name	Scientific Name	Conservation Status			Most Recent Record	Habitat Requirements	Watercourse/Waterbody															
		EPBC ACT	FFG ACT	DELWP Advisory lists			Warringine Creek	Watson Creek	Pearcedale South Creek	Langwarrin Creek	CPT 60 (Lachies Marsh)	CPT 60 (Dam)	Vowell Drive Wetland -North	Vowell Drive Wetland -South	Craigs Lane Drain	Rutherford Creek	Western Outfall Drain	Cardinia Creek (Ballarto Rd end)	Cardinia Creek (Bloomfield Ln end)	Toomuc Creek	Deep Creek	Pakenham Creek
Dwarf Galaxias	*Galaxiella pusilla*	VU	L	EN	13 Feb 2012	Dwarf Galaxias have a wide range of habitat requirements but typically occur in slow flowing and still, shallow, permanent and temporary, freshwater waterways including swamps, the backwaters of streams and creeks, drains and ditches, usually with dense aquatic, emergent or flooded vegetation.	N1 M3	H1 N2 N5	N1 M3	H2 M3	N1 M3	N1 M3	N1 N5	N1 N5	N1 M3	N1 N5	N1 M3	H1 M3	H1 M3	N2 M3	N2 M3	N1 M3

Common Name	Scientific Name	Conservation Status			Most Recent Record	Habitat Requirements	Watercourse/Waterbody															
		EPBC ACT	FFG ACT	DELWP Advisory lists			Warringine Creek	Watson Creek	Pearcedale South Creek	Langwarrin Creek	CPT 60 (Lachies Marsh)	CPT 60 (Dam)	Vowell Drive Wetland -North	Vowell Drive Wetland -South	Craigs Lane Drain	Rutherford Creek	Western Outfall Drain	Cardinia Creek (Ballarto Rd end)	Cardinia Creek (Bloomfield Ln end)	Toomuc Creek	Deep Creek	Pakenham Creek
Australian Grayling	*Prototroctes maraena*	VU	L	VU	26 May 2014	The species is known from coastal rivers and creeks with permanent or intermittent connection to the sea, south and east of the Great Dividing Range. Adults prefer moderate to fast-flowing water in rivers and streams, usually in cool clear waters below altitudes of 200 m, although they have been recorded above 1000 m in Victoria. They often occur in pools with gravelly substrates, and may form large schools, especially before spawning.	N1	L1	N1	N1	N1	N1	N1	N1	N1	N1	N1	H1	H1	N1	N1	N1
Flatback Mangrove Goby	*Mugilogobius platynotus*		VU	VU	19 Feb 2014	Inhabits soft silty bottoms in estuaries, usually amongst mangroves. Able to tolerate periods of freshwater.	N1	M1	N1	N1	N1	N1	N1	N1	N1	N1	H2	N1	N1	N1	N1	N1