

Gas Import Jetty and Pipeline Project

Environment Effects Statement

July 2020



EES Technical Report B

Terrestrial and freshwater biodiversity impact assessment



Gas Import Jetty and Pipeline Project:
Terrestrial and freshwater biodiversity
existing conditions and impact assessment

10 June 2020

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Executive summary

This report assesses the potential impacts on terrestrial and freshwater biodiversity associated with the construction and operation of the Gas Import Jetty and Pipeline Project (the Project.)

The Project would establish a gas import jetty and pipeline in Victoria comprising:

- a floating storage and regasification unit (FSRU) at Crib Point Jetty – the Gas Import Jetty Works
- a gas pipeline between Crib Point and Pakenham to connect to the Victorian Transmission System (VTS) east of Pakenham – the Pipeline Works.

The Project would provide an additional supply of natural gas into the south-eastern Australian gas market for industrial, commercial and residential customers.

Potential supply gaps in Victoria's gas market are predicted from 2024. The Project would improve energy security for industrial, commercial and domestic customers and would increase competition in the market.

The Project was referred to the Victorian Government under the *Environment Effects Act 1978* as two separate projects consisting of the Gas Import Jetty Works and Pipeline Works on 13 September 2018. On 8 October 2018, the Minister for Planning issued a decision determining that an Environment Effects Statement (EES) is required for the Project as a whole due to the potential for a range of significant environmental effects.

The Gas Import Jetty Works and Pipeline Works were referred to the Commonwealth Government under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as separate projects and were each designated a controlled action.

The Pipeline Works was assigned controlling provisions under the EPBC Act, for:

- Wetlands of International Importance (s16 & s17B)
- Listed threatened species and ecological communities (s18 & s18A).

The Gas Import Jetty Works was assigned controlling provisions under the EPBC Act, for:

- Wetlands of International Importance (s16 & s17B)
- Listed threatened species and ecological communities (s18 & s18A)
- Listed migratory species (s20 & s20A).

The Project was accepted to be assessed under the assessment bilateral agreement between the Commonwealth and Victoria. The EES is accredited as the assessment process under the EPBC Act for the purposes of the bilateral agreement.

Scope of this report

This report addresses the following aspects of biodiversity of relevance to assessment of the Project:

- Flora and fauna of terrestrial and freshwater ecosystems
- Birds that utilise intertidal environments.

The report addresses the potential physical or direct impacts on those flora, fauna and habitat/s, as well as potential indirect impacts of the Project.

Impacts on these biodiversity values can include; direct removal of habitat, indirect removal of habitat, harm, disturbance or mortality of individuals, degradation or modification of habitat, disruption of an ecosystem or exacerbation of a process which may lead to any of the above.

Risk pathways for impacts may include, amongst others: noise and vibration, lighting, dust, contamination and spills, habitat fragmentation or edge effects and hydrological alterations.

While the Project would cause inherent and quantifiable impacts, such as direct vegetation removal, it also entails potential for impacts that are more difficult to assess and quantify, such as the potential for sedimentation to impact on the ecological character of the Western Port Ramsar site. The assessment of potential impacts therefore considers the context in which the impact may occur within the broader landscape.

This report discusses the risk pathways and the likelihood of impacts on relevant biodiversity values. As applicable, other technical reports completed for the Project are referred to. Risks and impacts are assessed for both the construction and operation phases of the Project. In some instances risks or impacts may be unique to either the Pipeline Works or to the Gas Import Jetty Works and in such cases are discussed separately.

Methodology

Information about the existing conditions for terrestrial and freshwater biodiversity values was used to inform the potential for impacts and risk pathways for the Project. This report follows the approach outlined below:

1. Review existing studies and undertake baseline surveys to establish the existing conditions for relevant biodiversity values.
2. Conduct a risk assessment to evaluate the potential impacts that the Project could have on relevant biodiversity values.
3. Quantify the level of impact on the existing conditions that would occur for each of the risks.
4. Develop and recommend environmental mitigation measures that can be implemented by the Project in order to avoid impacts where possible, or to mitigate risks during construction and operation of the Project.

Existing conditions

The Project study area for this assessment is generally restricted to a 30 metre wide Right of Way (ROW) following the path of the pipeline alignment, as well as ancillary components such as access and material laydown areas. It also covers the area required for the Gas Import Jetty Works. The Project study area contains a range of ecological values that support native vegetation and habitat for threatened flora and fauna. These values include; areas of native vegetation, waterways, areas of agricultural land, planted vegetation, and intertidal mudflats and shoreline of the Western Port Ramsar site. A number of individual assessments have contributed information about existing conditions for the Project. These include assessments by Monarc Environmental, Jacobs Engineering Group (Jacobs), AECOM Australia Pty Ltd (AECOM) and Biosis Pty Ltd (Biosis).

The baseline studies of existing conditions are presented in the context of either the Pipeline Works study area or Gas Import Jetty Works study area. These two components of the Project study area jointly contain the following key biodiversity values:

- Eleven ecological vegetation classes (EVCs):

- Five with a Bioregional Conservation Status of Endangered
- Three with a Bioregional Conservation Status of Vulnerable
- Three with a Bioregional Conservation Status of Least Concern.
- 50 large patch trees, 29 large scattered trees and 50 small scattered trees (Project impact area).
- Matters of National Environmental Significance (MNES) listed under the EPBC Act (including migratory species):
 - Individuals or populations of Southern Brown Bandicoot, Growling Grass Frog, River Swamp-Wallaby-grass, Latham's Snipe, Crested Tern and Double-banded Plover
 - Habitat for Grey-headed Flying-fox, Lesser Sand Plover, Greater Sand Plover, Eastern Curlew, Bar-tailed Godwit, Broad-billed Sandpiper, Curlew Sandpiper, Sharp-tailed Sandpiper, Red Knot, Great Knot, Pectoral Sandpiper, Red-necked Stint, Arctic Jaeger, Caspian Tern, Little Tern, Fairy Tern, Swift Parrot, White-throated Needletail, Fork-tailed Swift, Rufous Fantail, Satin Flycatcher, Australian Grayling and Dwarf Galaxias
 - One Vulnerable ecological community: Subtropical and Temperate Coastal Saltmarsh, totalling 0.134 hectares
 - One Wetland of International Importance: Western Port Ramsar site.
- Values listed under the Victorian *Flora and Fauna Guarantee Act 1988*:
 - Individuals or populations of Merran's Sun-orchid, Southern Brown Bandicoot Blue-billed Duck, Eastern Great Egret, Lewin's Rail, Swamp Skink, Growling Grass Frog and Flatback Mangrove Goby.
 - Habitat for Austral Crane's-bill, Creeping Rush, Grey-headed Flying-fox, Intermediate Egret, Little Egret, Australian Little Bittern, White-bellied Sea-eagle, Baillon's Crake, Grey-tailed Tattler, Great Knot, Caspian Tern, Little Tern, Fairy Tern, Powerful Owl, Swift Parrot, Chestnut-rumped Heathwren, Dwarf Galaxias and Australian Grayling.
- Values listed under a DELWP Advisory List:
 - Individuals or populations of Merran's Sun-orchid, Gaping Sun-orchid, Pallid Sun-orchid, Southern Brown Bandicoot, Blue-billed Duck, Hardhead, Australasian Shoveler, Eastern Great Egret, Lewin's Rail, Latham's Snipe, Southern Toadlet, Growling Grass Frog, Flatback Mangrove Goby.
 - Habitat for Marsh Sun-orchid, Pallid Sun-orchid, Gaping Sun-orchid, Crested Sun-orchid, Crimson Sun-orchid, Grey-headed Flying-fox, Musk Duck, Baillon's Crake, Eastern Curlew, Whimbrel, Ruddy Turnstone, Grey-tailed Tattler, Common Sandpiper, Curlew Sandpiper, Pectoral Sandpiper, Common Greenshank, Marsh Sandpiper, Lesser Sand Plover, Greater Sand Plover, Red Knot, Great Knot, Caspian Tern, Little Tern, Fairy Tern, Powerful Owl, White-throated Needletail, Swift Parrot, Chestnut-rumped Heathwren, Swamp Skink, Glossy Grass Skink, Australian Grayling, Dwarf Galaxias.
 - Modelled habitat for Tiny Arrowgrass, Coast Helmet-orchid, Coast Fescue, Creeping Rush, Coast Twin-leaf, Coast Wirilda, Coast Bitter-bush and King Quail.

Risk assessment

An assessment of risks to terrestrial and freshwater biodiversity posed by the Project was undertaken in order to inform the subsequent impact assessment. The risk assessment process developed for the Project

involved the assignment of consequence and likelihood ratings which combined to give an overall risk level for each identified risk, and a subsequent residual risk level following the consideration of proposed mitigation measures. The highest identified residual risks (ranked as medium, high or very high) apply to the construction phase of the Pipeline Works and relate to:

- The removal of native vegetation
- Invasion by environmental weeds, pathogens or animals within retained native vegetation
- Habitat fragmentation and effects on ecosystem function
- Noise and vibration impacts causing stress/displacement of native fauna
- Dust impacts on flora and fauna as an ecosystem function.

Impact assessment

The impacts of the Project on native vegetation and habitat for threatened species are summarised below. Impacts on terrestrial ecological values are reviewed in further detail in Section 7.

The Gas Import Jetty Works would result in the direct loss of 1.603 hectares of native vegetation comprising four habitat zones and two large patch trees. The Pipeline Works would result in the direct loss of 15.352 hectares of native vegetation comprising 111 habitat zones, 48 large patch trees, 29 large scattered trees and 50 small scattered trees. The Native Vegetation Removal Reports (NVR) combine these features into one overall extent of removal. In accordance with the NVR, the Project would require the removal of 16.955 hectares of native vegetation, comprising 11 ecological vegetation classes (EVCs), as follows:

- Five EVCs, 6.012 hectares of patch vegetation, Bioregional Conservation Status of Endangered
- Three EVCs, 1.395 hectares of patch vegetation, Bioregional Conservation Status of Vulnerable
- Three EVCs, 6.495 hectares of patch vegetation, Bioregional Conservation Status of Least Concern
- Tree removal accounts for the balance of total area of native vegetation removal.

This removal may also result in the modification of adjacent native vegetation over time through associated edge effects.

The extent of vegetation removal for the Project is estimated to be 0.06% of remaining native vegetation in the combined area of the Mornington Peninsula Shire, the City of Casey and the Cardinia Shire.

In order to compensate for losses of native vegetation and species habitats at a state level, Native Vegetation Removal Reports (NVR) prepared for the Pipeline Works and the Gas Import Jetty Works have outlined the following offset requirements that would ordinarily apply under the Guidelines if a planning permit was required for the Project:

- 1.007 general habitat units (when rounded: 0.985 units for the Pipeline Works and 0.021 units for the Gas Import Jetty Works).
- Species habitat units for the following DELWP Advisory Listed species for the Pipeline Works and Gas Import Jetty Works combined:
 - 0.177 species units of habitat for Tiny Arrowgrass
 - 8.617 species units of habitat for Coast Helmet-orchid
 - 5.186 species units of habitat for Coast Twin-leaf
 - 5.766 species units of habitat for Coast Wirilda
 - 5.076 species units of habitat for Coast Bitter-bush.

The Project would result in the short-term loss and fragmentation of habitat for Southern Brown Bandicoot, listed as Endangered under the EPBC Act.

The Project would have the following impacts on FFG Act-listed values:

- The short-term loss and fragmentation of habitat for Southern Brown Bandicoot
- Loss of potential habitat for Southern Toadlet
- Removal of habitat suitable for Swamp Skink.

A number of impacts in this report are assessed in conjunction with other technical studies completed for the Project. These include:

- Groundwater Impact Assessment (AECOM 2019a)
- Noise and Vibration Impact Assessment (AECOM 2020)
- Surface Water Impact Assessment (AECOM 2019c)
- Marine Environment Impact Assessment (CEE 2020).

Mitigation Measures

The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with Section 4.2 of Australian Standard AS2885.1-2012 (Pipelines – gas and liquid petroleum) and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets. These design refinements include reductions in the construction footprint, ROW, re-routing of the pipeline and underground boring through sensitive areas. A range of Mitigation Measures (MMs) to further reduce impacts during construction and operation of the Pipeline Works are outlined in Section 8.

Offset availability

The Project is anticipated to be able to satisfy all Victorian offset requirements that would ordinarily apply if a permit was required for native vegetation removal as offsets for all the required species are available on the credit register at this time. However, one species has limited availability on the credit register, Tiny Arrowgrass, and there is no guarantee that all species would still be available upon approval of the Project.

Therefore, an offset strategy is being prepared that will outline how the Project can satisfy its offset requirements. The offset strategy will outline that the AGL and APA would enter into a memorandum of understanding (MoU) with credit site owners, with the intention to purchase the credits upon approval of the Project. In the event that species habitat units become unavailable in the interim, the strategy will outline alternative arrangements for species offsets, including the steps outlined in Section 11.3 of the *Guidelines for the removal, destruction or lopping of native vegetation*:

- If a suitable species offset cannot be identified an applicant may:
 - consider further steps to avoid or minimise impacts to reduce offset requirements
 - appoint an ecologist to review offset requirements and/or species habitat units available at an offset site, as described in section 9.4 of the above Guidelines.
 - consider activities or alternative management actions that will generate additional gain for the species at an offset site
 - contact landowners or land managers of sites that may be able to be used to generate species habitat units that meet the offset requirements.

If the above actions do not address the inability to secure a species offset, the applicant can propose an alternative offset for the species habitat. The alternative offset must generate improvements for the species that provide equivalent compensation for the removal of its habitat.

The current assessment indicates that the Project is unlikely to result in a significant impact on any MNES. However, in the event that the Victorian Minister for Planning and/or the Australian Government Minister responsible for the Environment determines otherwise, an offsetting outcome would be negotiated to the satisfaction of the Minister for Planning and/or the Department of Agriculture, Water and the Environment and according to the EPBC Act environmental offsets policy.

Abbreviations

Abbreviation	Definition
AECOM	AECOM Australia Pty Ltd
AGL	AGL Wholesale Gas Limited
APA	APA Transmission Pty Limited
CaLP Act	<i>Catchment and Land Protection Act 1994</i>
CPS	Components, processes and services
CAMBA	China – Australia Migratory Bird Agreement
DAWE	Department of Agriculture, Water and the Environment
DELWP	Department of Environment, Land, Water and Planning
EES	Environment Effects Statement
EMF	Environmental Management Framework
EOLSS	End of Line Scraper Station
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>
FSRU	Floating storage and regasification unit
HDD	Horizontal Direction Drilling
HZ	Habitat zone
JAMBA	Japan-Australia Migratory Bird Agreement
KP	Kilometre point
LNG	Liquefied natural gas
MLA	Marine loading arms
MLV	Mainline valves
MM	Mitigation Measure
NVIM	Native Vegetation Information Management
PMST	Protected Matter Search Tool
PoHDA	Port of Hastings Development Authority
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
ROW	Right of Way
VTs	Victorian Transmission System
VQA	Vegetation Quality Assessment

1. Introduction

This report assesses the potential terrestrial and freshwater biodiversity impacts associated with the construction and operation of the Gas Import Jetty and Pipeline Project (the Project). In the context of this report, terrestrial and freshwater biodiversity includes all land-based and aquatic (freshwater) flora and fauna values which are found in both remnant and modified environments, including waterbirds and waders utilising the intertidal zone of Western Port. This report addresses the potential physical or direct impacts and indirect impacts on those flora, fauna and habitats.

The Project would provide an additional supply of natural gas into the south-eastern Australian gas market for industrial, commercial and residential customers.

The Australian Energy Market Operator has predicted potential supply gaps in Victoria's gas market from 2024 (AEMO, 2020). The Project would address energy security for industrial, commercial and domestic customers and would increase competition in the market.

The joint proponents of the Project are AGL Wholesale Gas Limited (AGL) and APA Transmission Pty Limited (APA).

The Project would establish a gas import jetty and pipeline comprising:

- a floating storage and regasification unit (FSRU) at Crib Point Jetty – the Gas Import Jetty Works
- a gas pipeline between Crib Point and Pakenham to connect to the Victorian Transmission System (VTS) east of Pakenham – the Pipeline Works.

The Project was referred by AGL and APA to the Victorian Government under the *Environment Effects Act 1978* (Vic) on 13 September 2018 as two separate projects consisting of the Gas Import Jetty Works and Pipeline Works.

On 8 October 2018 the Minister for Planning issued a decision determining that an Environment Effects Statement (EES) was required for the Project due to the potential for a range of significant environmental effects.

The Gas Import Jetty Works and the Pipeline Works were also referred to the Commonwealth Government under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as separate projects.

Each project was designated as a controlled action requiring impact assessment under the EPBC Act. The EES process is the accredited environmental assessment for the controlled action decisions under the EPBC Act in accordance with the bilateral agreement between the Commonwealth and Victorian governments.

1.1 Purpose

This report provides a terrestrial and freshwater biodiversity impact assessment for the EES and sets out mitigation measures for potential impacts of the Project. This report will inform the development of an Environmental Management Framework (EMF) for the Project. The mitigation measures listed in the EMF would be implemented in the approvals and management plans for the Project.

1.1.1 Why understanding terrestrial and freshwater biodiversity is important

Ecology is the study of organisms and how they interact with each other and their physical surroundings. An understanding of ecology and ecological processes is important for managing and maintaining populations of

flora and fauna species and the components and processes they rely on, and understanding how the environment responds to change. Terrestrial and freshwater biodiversity is the specific component of ecology that is addressed in this report, which also includes waders and waterbirds utilising the intertidal zone of Western Port.

Impacts on terrestrial and freshwater biodiversity can include; direct removal of habitat, indirect removal of habitat, degradation or modification of habitat, harm or mortality of individuals, disruption to an ecosystem or exacerbation of a process which may lead to any of the above.

1.2 Project description

The Project comprises two sets of works: the Gas Import Jetty Works and the Pipeline Works.

AGL would undertake the Gas Import Jetty Works. APA would undertake the Pipeline Works.

1.2.1 Gas Import Jetty Works

The Gas Import Jetty Works would consist of a liquefied natural gas (LNG) import facility, comprising:

- continuous mooring of an FSRU at Berth 2 of the Crib Point Jetty to store LNG and regasify LNG into natural gas.
- Jetty infrastructure on the Crib Point Jetty including marine loading arms (MLAs) and gas piping to transfer the gas from the FSRU to the Crib Point Receiving Facility.
- Crib Point Receiving Facility, including metering, odorant injection and nitrogen injection, which would be located on land adjacent to the Crib Point Jetty.

The FSRU vessel for the Project would be approximately 300 metres long and 50 metres wide. It would have capacity to store 170,000 cubic metres (m³) of LNG. Visiting vessels carrying LNG (LNG carriers) would berth alongside the FSRU to transfer their LNG to the FSRU which could take up to 36 hours.

The FSRU would store the LNG as a liquid and when required, return LNG back into a gaseous state by heating the LNG using either seawater or gas-fired boilers (a process known as regasification).

Following regasification, the natural gas would be transferred through gas piping along the jetty from the FSRU to the Crib Point Receiving Facility.

The Crib Point Receiving Facility would include treatment facilities to inject odorant and nitrogen (as required) into the natural gas to meet VTS gas quality specifications.

1.2.2 Pipeline Works

The Pipeline Works would comprise a bi-directional gas transmission pipeline to transport gas from the Crib Point Receiving Facility to the VTS east of Pakenham.

The pipeline would be approximately 57 kilometres long with a nominal diameter of 600 millimetres. The pipeline would be buried at a depth of generally 1.2 metres below ground (to the top of the pipe).

The Pipeline Works would also comprises the following facilities:

- the pigging facility at the Crib Point Receiving Facility to enable in-line inspections of the pipeline with a pipeline inspection gauge (pig)
- the above-ground Pakenham Delivery Facility situated adjacent to the Pakenham East rail depot to monitor and regulate the gas

-
- the below-ground End of Line Scraper Station (EOLSS) located at the connection point to the VTS, north of the Princes Highway in Pakenham
 - two above-ground mainline valves (MLVs) located at different points along the pipeline alignment to enable isolation of the pipeline in an emergency.

1.2.3 Construction

The key construction activities for the Gas Import Jetty Works would include:

- establishment of construction sites including laydown areas
- installation of Jetty Infrastructure on the Crib Point Jetty, including MLAs, gas piping mounted to the jetty, electrical and instrumentation equipment and a firefighting system
- construction of the Crib Point Receiving Facility.

Construction for the Gas Import Jetty Works would take approximately 18 to 27 months, depending on weather conditions.

The key construction activities for the Pipeline Works would include:

- establishment of laydown areas
- construction of the pigging facility at Crib Point Receiving Facility, Pakenham Delivery Facility, two MLVs and the EOLSS
- pipeline construction using construction techniques such as trenching, horizontal directional drilling (HDD) or boring, typically within a 30-metre-wide pipeline construction Right of Way (ROW).

Construction for the Pipeline Works would take approximately 18 to 24 months, depending on weather conditions. Pipeline construction would progress in a linear manner.

Subject to the staging of the works outlined above, construction for the entire Project is expected to take approximately 18 to 27 months.

1.2.4 Operation and maintenance

When commissioned, the FSRU would be operated by an experienced third-party operator. The Crib Point Receiving Facility and associated Jetty Infrastructure would be owned and operated by AGL or an experienced third-party operator. The Pipeline Works would be owned and operated by APA.

The FSRU may leave Western Port during the Project lifetime for activities such as scheduled maintenance and extreme weather events.

The gas import jetty would initially receive approximately 12 LNG carriers per year with capacity to increase to approximately 40 LNG carriers per year. The number and frequency of LNG carriers arriving each year would depend on their storage capacity and gas demand.

The Crib Point Receiving Facility is designed to be automated and may be operated unmanned under normal operating conditions.

An operational easement of generally 15 metres wide would apply to the pipeline alignment. The pipeline easement would be routinely inspected for any operational or maintenance issues in accordance with APA procedures.

The pipeline would also be designed and constructed so that pigging could be undertaken to inspect the integrity of the pipeline as required. Pigging would be undertaken around 10 years after construction and then at a frequency determined by the first inspection.

The Pakenham Delivery Facility is also designed to be automated and operate unmanned under normal operating conditions.

The EOLSS would be buried with valves contained within concrete pits. The connection to the VTS would operate unmanned. Excavation of the site to access the EOLSS would be required for the pigging activities.

1.2.5 Decommissioning

The FSRU is proposed to operate for 20 years, although this may be shortened or extended to address security and stability of gas supply to south-eastern Australia. When the Project was no longer required, the FSRU would leave Western Port.

The Jetty Infrastructure installed on the Crib Point Jetty and the Crib Point Receiving Facility would be decommissioned and removed when no longer required. The Crib Point Jetty would remain as an operational jetty under the management of the Port of Hastings Development Authority (PoHDA).

The pipeline would have a design life of 60 years. If the Pipeline Works were no longer required, they would be decommissioned in accordance with Australian Standard AS2885 Pipelines – gas and liquid petroleum and relevant legislative and approval requirements at the time of decommissioning.

1.2.6 Terrestrial and freshwater biodiversity considerations in the pipeline alignment design

A number of ecological considerations have been incorporated into the pipeline alignment design with the view to select and refine the alignment to avoid and minimise impacts to terrestrial biodiversity values, including native vegetation patches, as far as is practicable for a long linear project. Some of these refinements are listed below and described further in Section 7.1.7.

- Use of sub-surface trenchless crossings to avoid surface disturbance to:
 - all areas of the Western Port Ramsar site
 - multiple areas of dense native vegetation (i.e. King's Creek and Watson Creek)
 - a population of EPBC Act listed River Swamp Wallaby-grass
 - a large population of FFG Act listed Merran's Sun-orchid (Crib Point)
 - populations of DELWP advisory listed Gaping Sun-orchid and Pallid Sun-orchid (Crib Point)
 - a population of EPBC Act listed Swamp Everlasting
 - EPBC Act listed Growling Grass Frog habitat (Cardinia Creek)
 - areas of known and potential EPBC Act listed Southern Brown Bandicoot habitat (Appendix 8)
 - waterways supporting habitat for EPBC Act and FFG Act threatened aquatic fauna, including Warringine Creek, Watson Creek, Pearcedale South Creek, Langwarrin Creek, Lachies Marsh, Rutherford Creek, Western Outfall Drain, Cardinia Creek, Hagelthornes Drain and Pakenham Creek.
- Narrowing of the ROW in locations containing sensitive values (Appendix 8).
- Co-location of the pipeline alignment with the ESSO pipeline alignment as much as possible.
- Material laydown areas located within existing heavily disturbed areas (e.g. cleared farmland).

1.3 Project Area

The Project Area is situated between Crib Point and Pakenham East in Victoria within the local government areas of Mornington Peninsula Shire, the City of Casey and Cardinia Shire.

The Project Area includes the construction and operation footprints for the Gas Import Jetty Works and the Pipeline Works.

The Project Area is detailed in EES Attachment VII *Map book*. An overview of the Project Area showing the proposed pipeline alignment and current options is shown in Figure 1.

The Gas Import Jetty Works would be located at the existing Crib Point Jetty (Berth 2) and on land immediately adjacent. The Crib Point Jetty is located within the Port of Hastings and within an area designated as a wetland of international significance under the Ramsar Convention on Wetlands of International Importance (The Western Port Ramsar site).

The Pipeline Works would be located on land between the Crib Point Receiving Facility and a connection point to the VTS east of Pakenham.

The pipeline alignment was selected to minimise impacts on sensitive land uses and where possible follows existing pipeline easements.

The pipeline would be installed on land used for several purposes including rural residential living, road corridors, industry, conservation reserves, hobby farming, horse studs and agriculture. The pipeline would generally follow the Stony Point rail reserve through Hastings.

Towards Pakenham, the pipeline would cross the Gippsland rail line before reaching the proposed Pakenham Delivery Facility adjacent to the Pakenham East rail depot and connecting to the VTS north of the Princes Highway.

The pipeline alignment crosses seven main watercourses, as follows, as well as 57 minor watercourses (Coffey, 2018):

- Warringine Creek
- Rutherford Creek
- Watson Creek
- Cardinia Creek
- Lower Gum Scrub Creek
- Toomuc Creek.
- Deep Creek

The Western Outfall Drain, Cardinia Creek, Gum Scrub Creek and Toomuc Creek are constructed drains where crossed by the pipeline alignment.

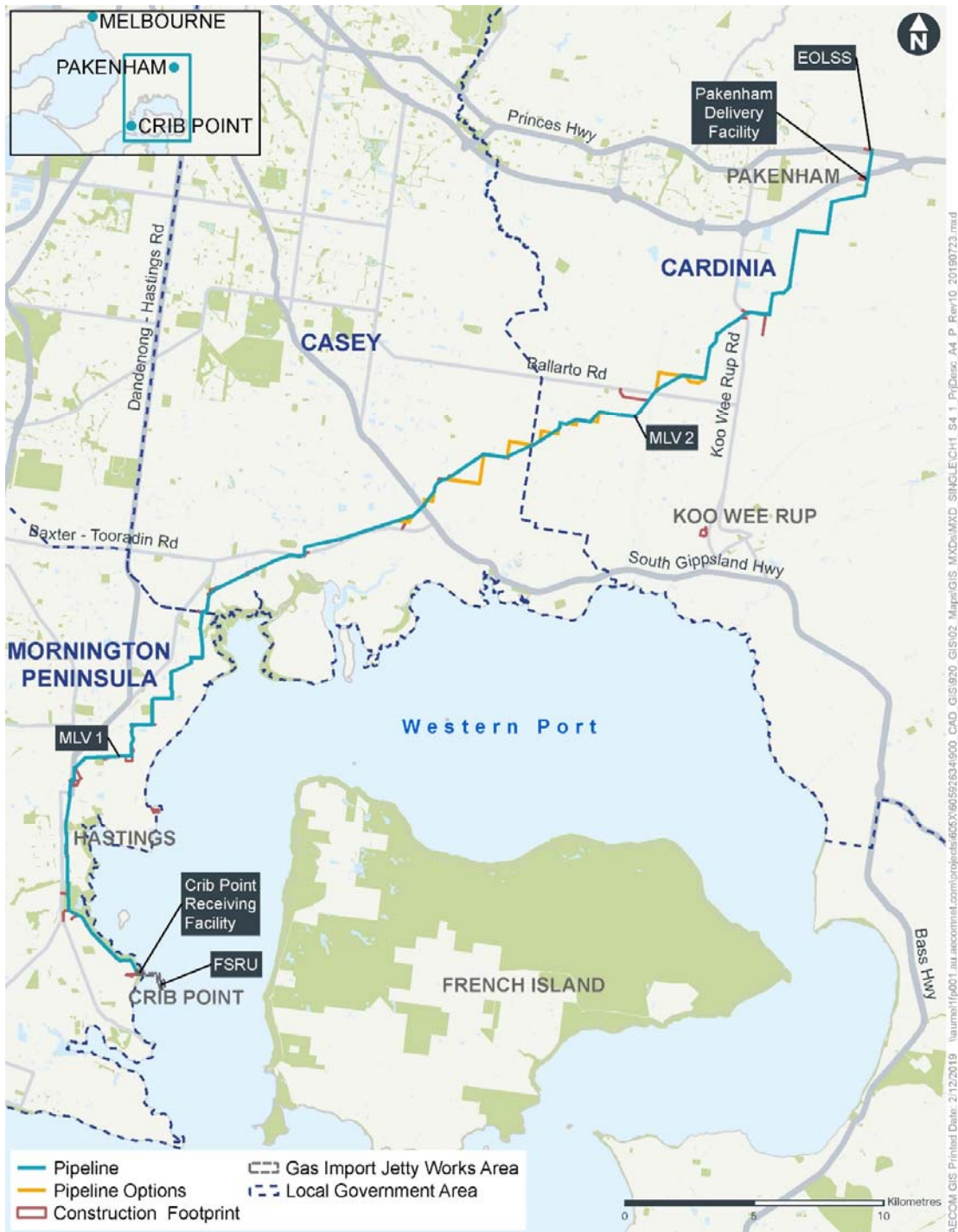


Figure 1 Project Area

1.3.1 Project study area

The study area is approximately 57 kilometres in length. The study area for the current assessment is generally restricted to a 30 metre wide ROW following the path of the pipeline, as well as ancillary components such as access and material laydown areas. Areas of the pipeline alignment not subject to impacts (i.e. due to use of boring and HDD) were not assessed (refer to Section 4.4). The Project study area also covers the area required for the Gas Import Jetty Works, including adjacent exposed intertidal and coastal habitats, in order to assess impacts to shorebirds. For the purpose of this assessment, intertidal and

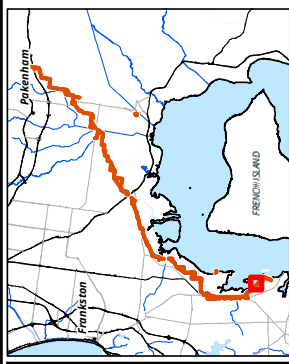
coastal habitats encompassed by roost areas and primary and secondary foraging habitats for waterbirds are those mapped by Hansen *et al.* (2011) and shown in Figure 5 of this report.

The Project study areas are referred to within the report, where relevant, as Pipeline Works study area or Gas Import Jetty Works study area, in order to define values that are unique to the relevant project component. These are shown, along with ecological features of the study area, in Figure 2.

Additional areas defined within this report comprise:

- Gas Import Jetty Works impact area or Pipeline works impact area, which is used to define areas where direct surface impacts are proposed. Collectively, these areas are referred to as the Project impact area.
- Crib Point Jetty (the existing physical jetty component of the Gas Import Jetty)
- Project search area (the Project study area with a 5-kilometre buffer, which was used to conduct database searches and determine significant species, migratory species and ecological communities in the broader area)
- Pipeline alignment (the position of the pipeline within the ROW).





Legend

Study area

- Pipeline Works
- Kilometre point

Proposed pipeline alignment

- Open - Cut
- Trenchless - Bore
- Trenchless - HDD

Vegetation assessor

- Biosis
- Monarc

Scattered Tree

- Large
- Small

Patch Tree

- Large

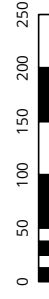
Ecological Vegetation Class (EVC)*

- GipP0048 - Heathy Woodland
- GipP0793 - Damp Heathy Woodland

Ramsar site

- Western Port

Figure 2.2 Ecological features of the study area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



Material: 28/05/20

Date: 22 May 2020

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Location: P:\389005\38957\Mapping\

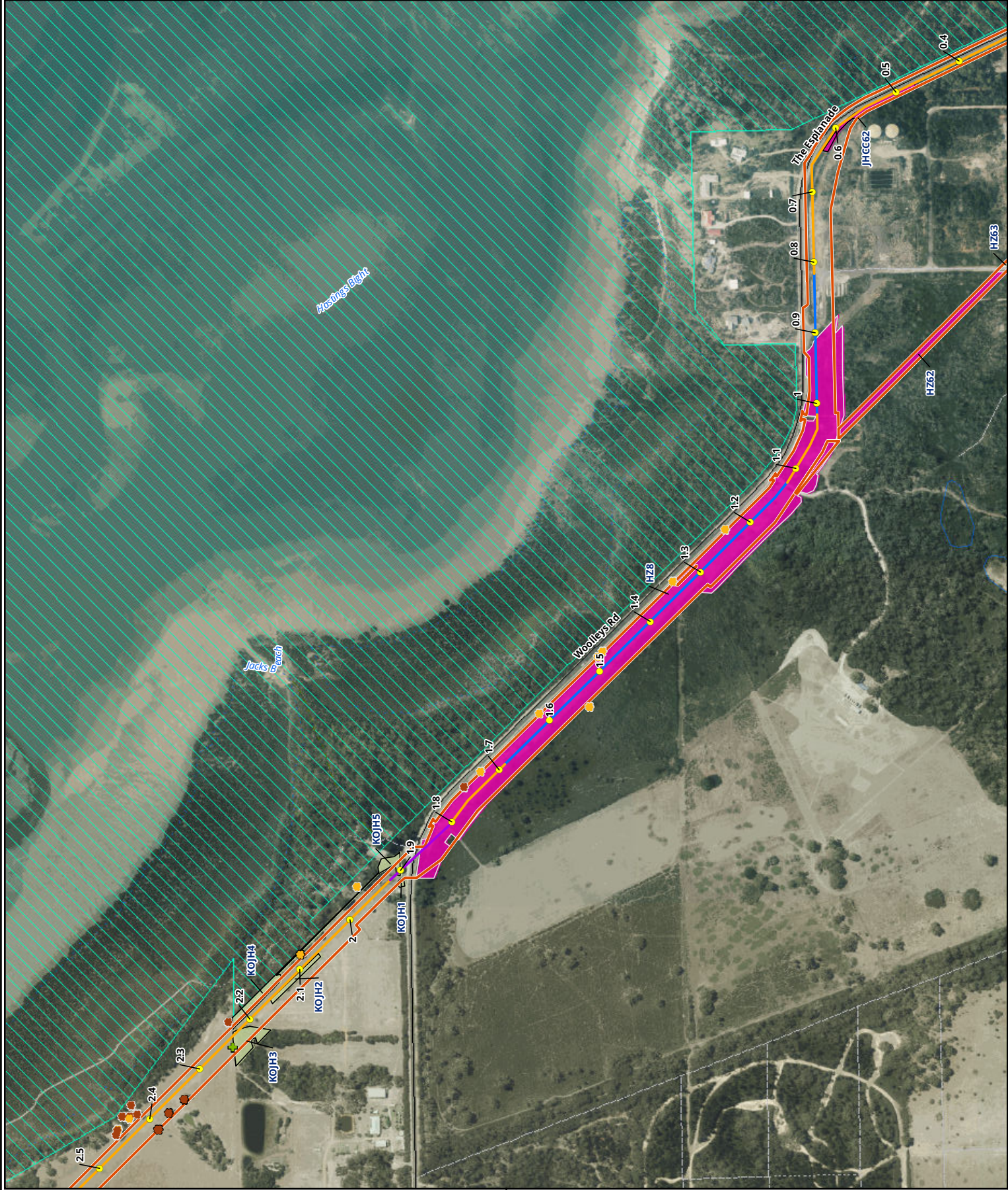
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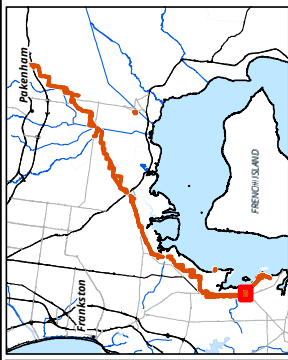
*Habitat zone

identifiers

labelled on

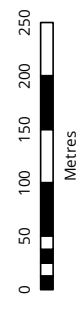
the figure





- Legend**
- Study area**
- Pipeline Works
 - Kilometre point
- Proposed pipeline alignment**
- Open - Cut
 - Trenchless - Bore
 - Trenchless - HDD
- Vegetation assessor**
- Biosis
 - Monarc
- Scattered Tree**
- Large
- Patch Tree**
- Large
- Ecological Vegetation Class (EVC)***
- GipP0053 - Swamp Scrub
- Ramsar site**
- Western Port

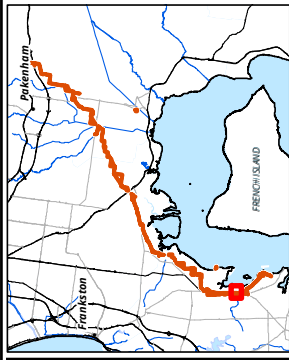
Figure 2.3 Ecological features of the study area



Scale: 1:5,000 @ A3
 Coordinate System: GDA 1994 MGA Zone 55
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***Habitat zone identifiers labelled on the figure**

Number: 28957
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- Legend**
- Study area**
- Pipeline Works
 - Kilometre point
- Proposed pipeline alignment**
- Open - Cut
 - Trenchless - HDD
- Vegetation assessor**
- Monarc
- Scattered Tree**
- Large
 - Small
- Patch Tree**
- Large
- Ecological Vegetation Class (EVC)***
- GipP0053 - Swamp Scrub
 - GipP0083 - Swampy Riparian
 - Woodland
 - GipP0175 - Grassy Woodland
- Ramsar site**
- Western Port

Figure 2.4 Ecological features of the study area

Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

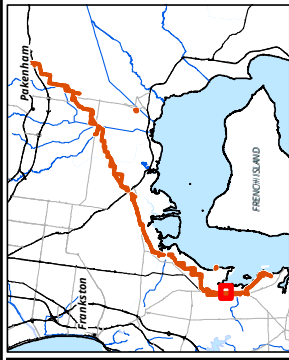
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Metres
0 50 100 150 200 250

Habitat zone identifiers labelled on the figure

Matrix: 38957
Date: 22 May 2020
Created by: CHW, Drawn by: LW, Last edited by: Wilson
Location: P:\38957\38957 Mapping\38957_2_Ecological features.mxd





Legend

Study area

Pipeline Works
Kilometre point

Proposed pipeline alignment

Open - Cut
Trenchless - HDD

Vegetation assessor

Biosis
Monarc

Scattered Tree

Large
Small

Patch Tree

Large

Ecological Vegetation Class (EVC)*

GipP0175 - Grassy Woodland
GipP0821 - Tall Marsh

Ramsar site

Western Port

Habitat zone

identifiers
labelled on
the figure

Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

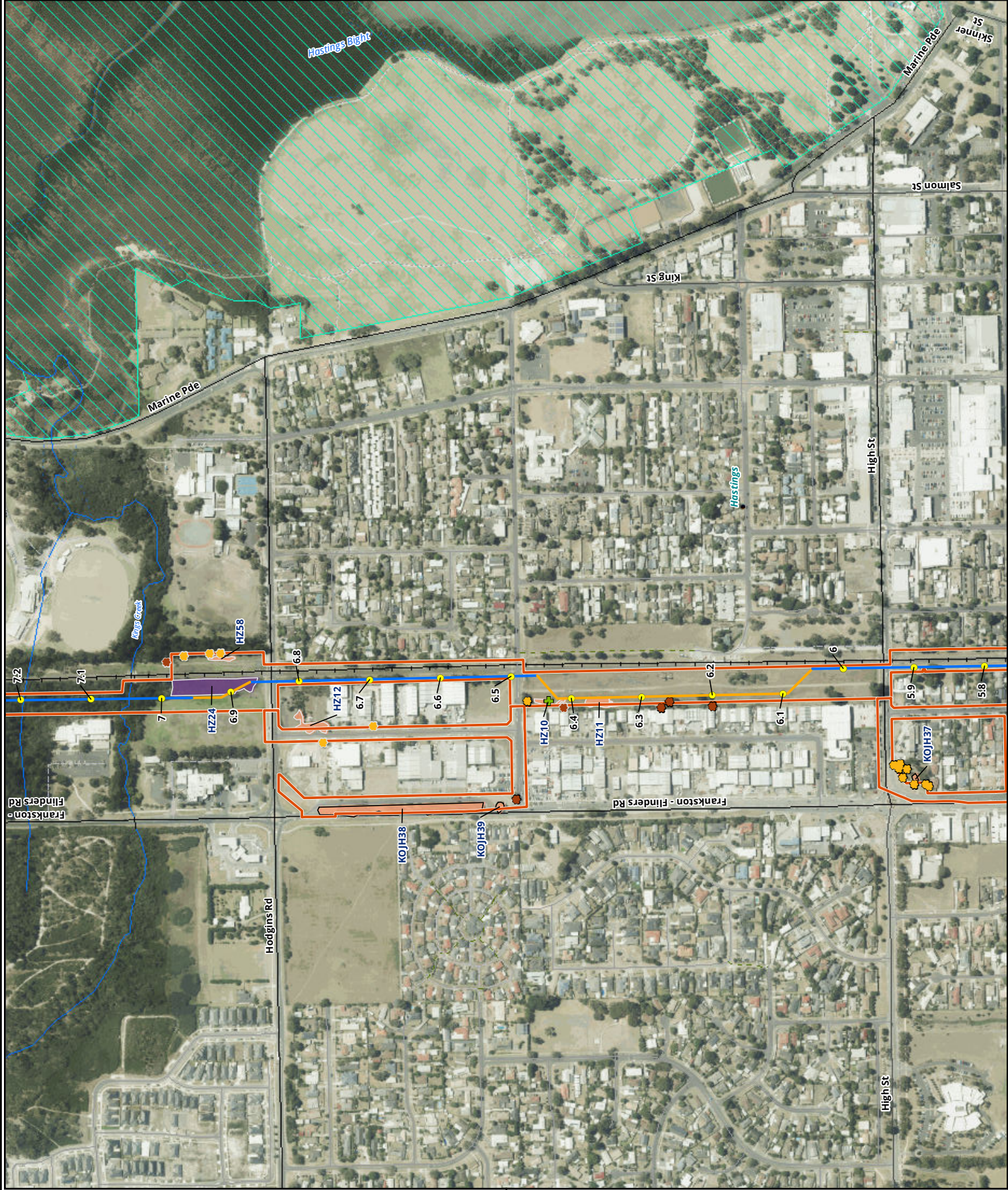
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Location: P:\038005\28057\Mapping\038005_7_2_Ecological_Features.mxd

0 50 100 150 200 250
Metres

Figure 2.5 Ecological features of the study area





Legend

Study area

- Pipeline Works
- Kilometre point

Proposed pipeline alignment

- Open - Cut
- Trenchless - Bore
- Trenchless - HDD

Vegetation assessor

- Biosis
- Monarc

Scattered Tree

- Large
- Small

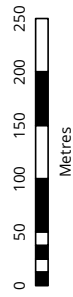
Patch Tree

- Large

Ecological Vegetation Class (EVC)*

- GipP0003 - Damp Sands Herb-rich Woodland
- GipP0053 - Swamp Scrub
- GipP0083 - Swampy Riparian Woodland
- GipP0821 - Tall Marsh
- GipP0937 - Swampy Woodland

Figure 2.7 Ecological features of the study area

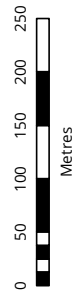




Legend

- Study area**
- Pipeline Works
 - Kilometre point
- Proposed pipeline alignment**
- Open - Cut
 - Trenchless - Bore
- Vegetation assessor**
- Monarc
- Scattered Tree**
- Large
 - Small
- Ecological Vegetation Class (EVC)***
- GipP0048 - Heathy Woodland
 - GipP0053 - Swamp Scrub

Figure 2.8 Ecological features of the study area

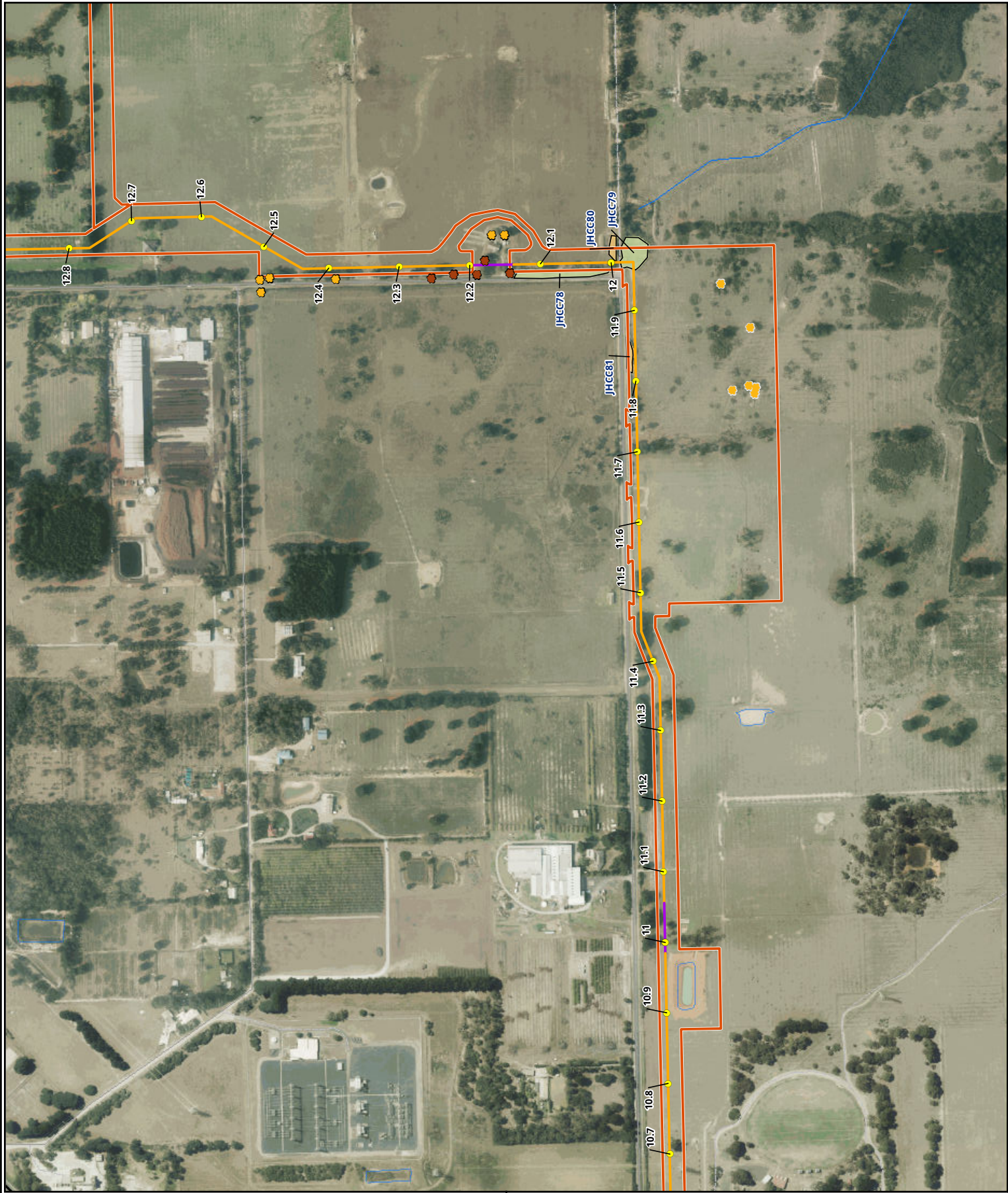


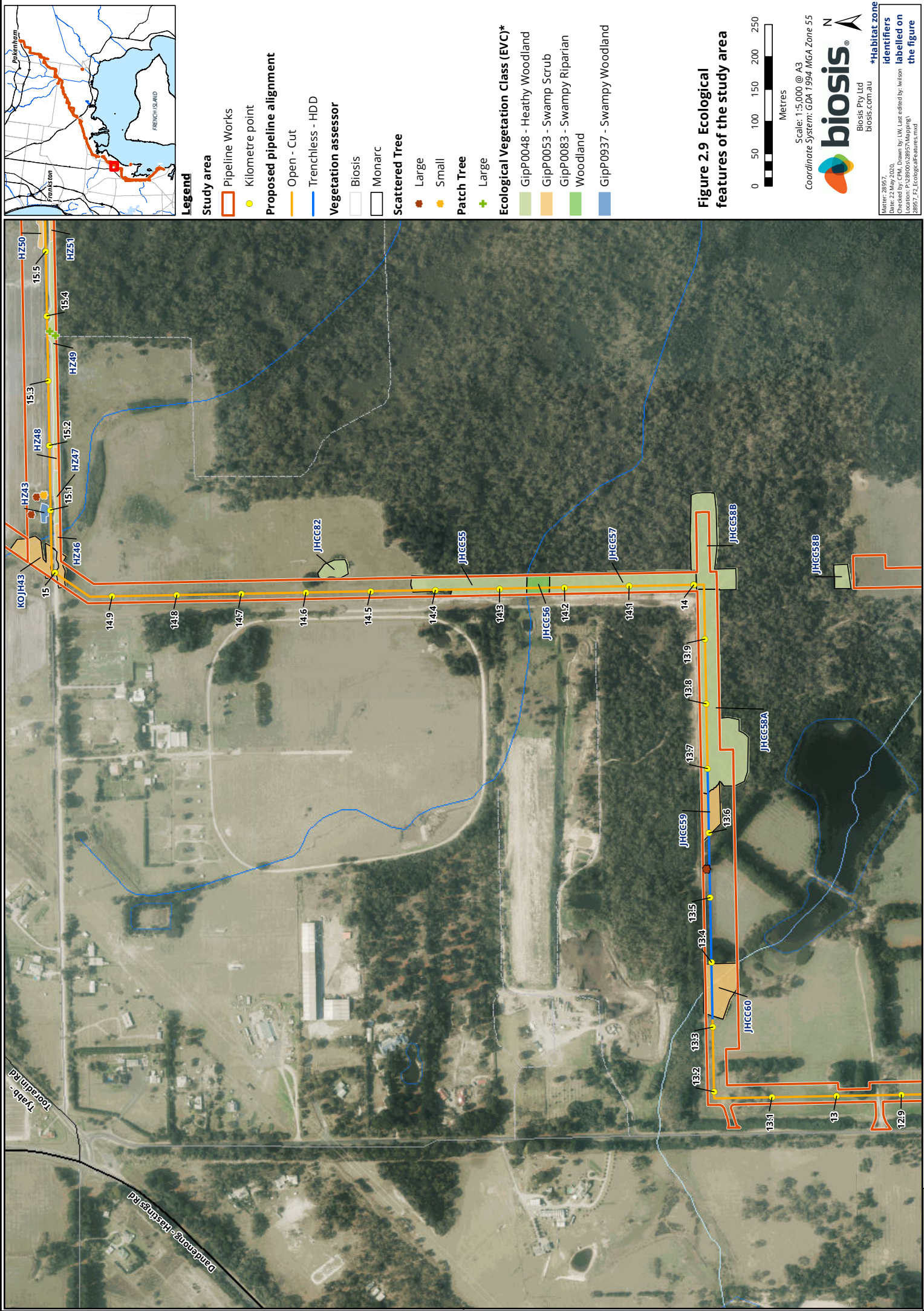
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*Habitat zone identifiers labelled on the figure

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Legend

Study area

Pipeline Works
Kilometre point

Proposed pipeline alignment

Open - Cut
Trenchless - HDD

Vegetation assessor

Biosis
Monarc

Scattered Tree

Large
Small

Patch Tree

Large

Ecological Vegetation Class (EVC)*

GipP0048 - Heathy Woodland
GipP0053 - Swamp Scrub

GipP0175 - Grassy Woodland
GipP0653 - Aquatic Herbland

GipP0937 - Swampy Woodland

Ramsar site

Western Port

Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

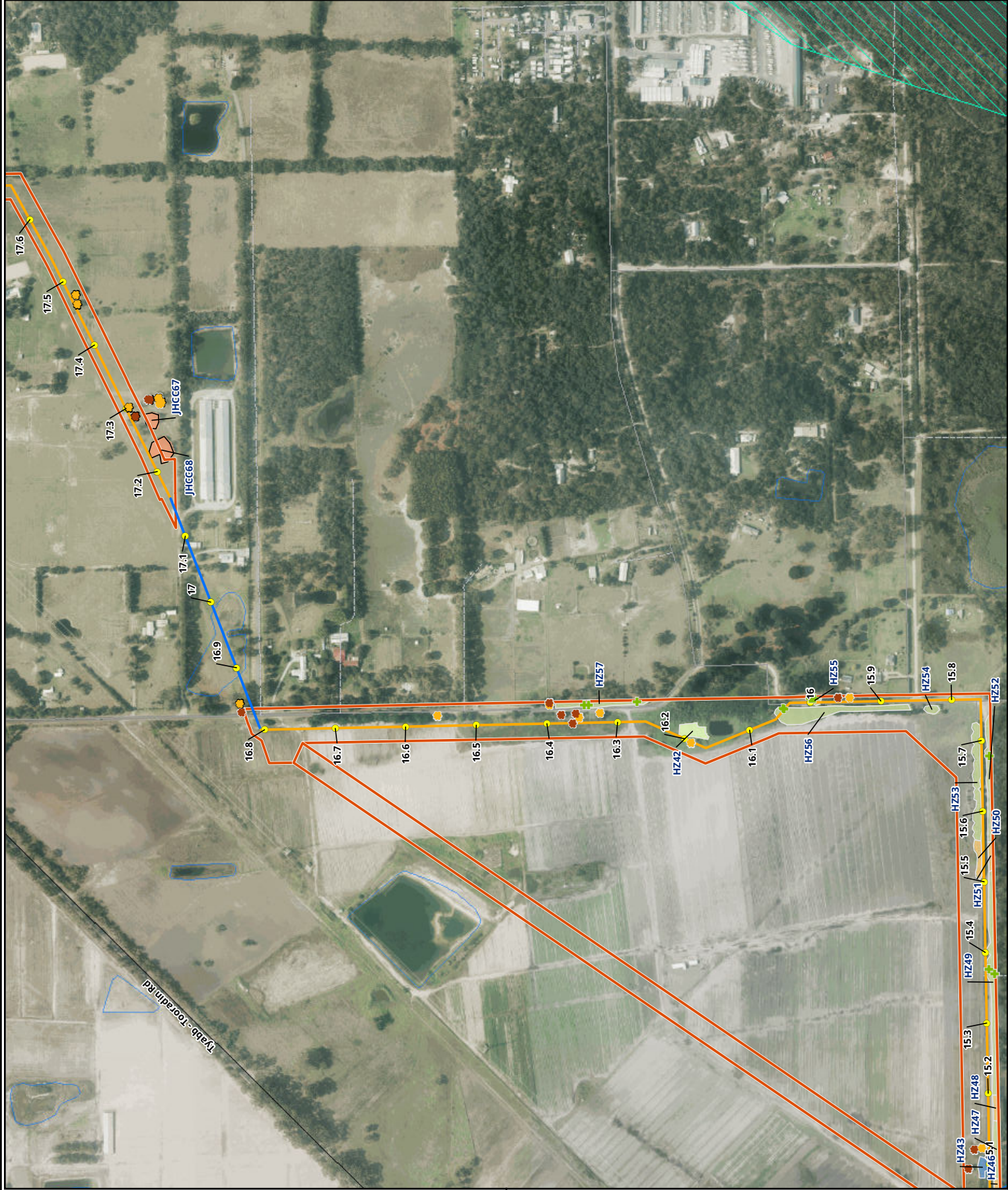
Figure 2.10 Ecological features of the study area

0 50 100 150 200 250
Metres

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Habitat zone
identifiers
labelled on
the figure

Matrix: 28987
Date: 22 May 2020
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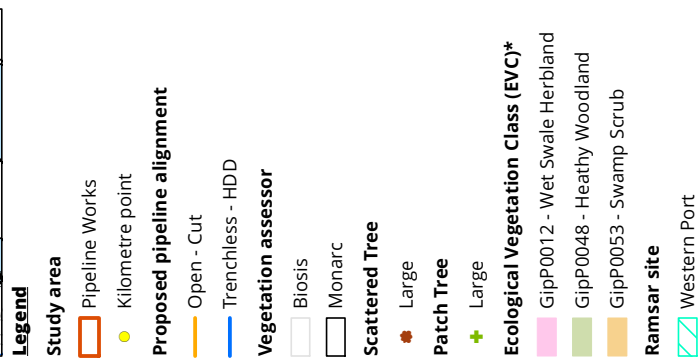
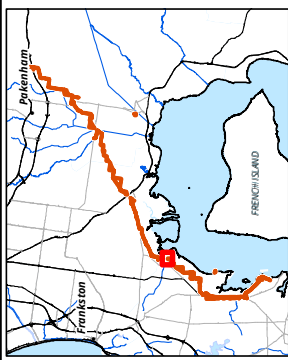
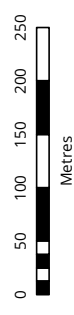


Figure 2.11 Ecological features of the study area

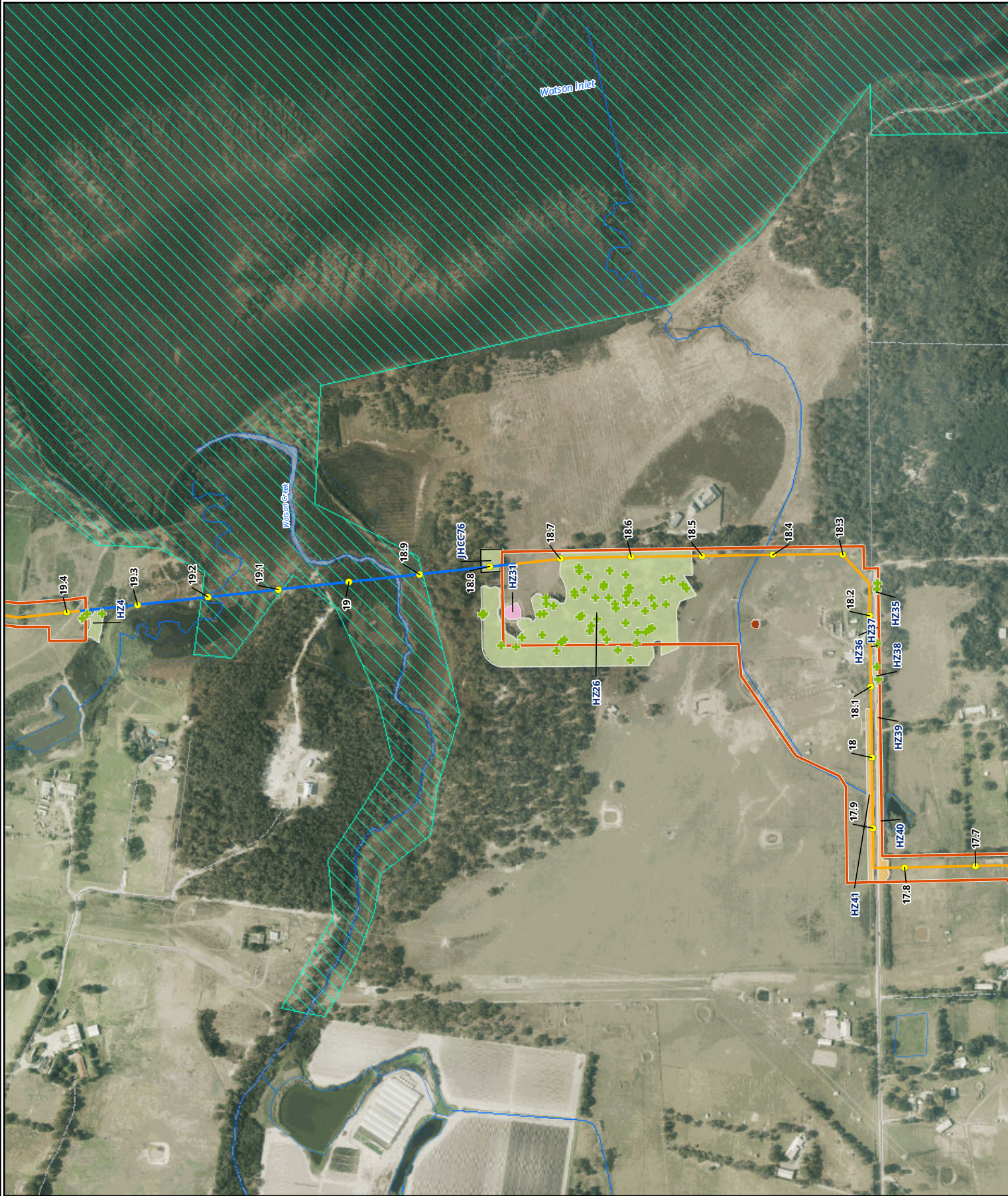


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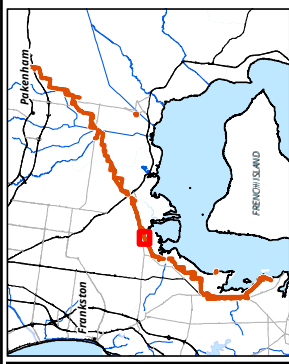


***Habitat zone identifiers labelled on the figure**

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Date: 22 May 2020
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Location: P:\389005\28957\Mapings\ 28957_12_EcologicalFeatures.mxd







Legend

Study area

Pipeline Works

Kilometre point

Proposed pipeline alignment

Open - Cut

Trenchless - Bore

Trenchless - HDD

Vegetation assessor

Monarc

Scattered Tree

Small

Ecological Vegetation Class (EVC)*

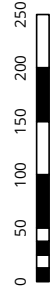
GipP0083 - Swampy Riparian

Woodland

Ramsar site

Western Port

Figure 2.14 Ecological features of the study area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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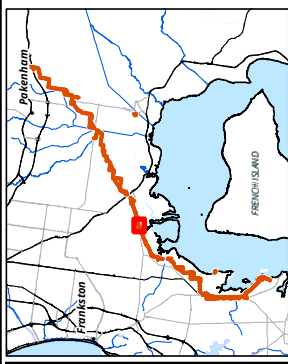
Number: 39957

Date: 22 May 2020

Checked by: CPW, Drawn by: LW, Last edited by: Wilson

Location: P:\389005\38957\Mapping\38957_F2_EcologicalFeatures.mxd





Legend

Study area

■ Pipeline Works

● Kilometre point

Proposed pipeline alignment

— Open - Cut

— Trenchless - Bore

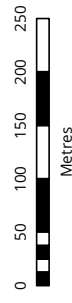
Scattered Tree

● Large

● Small



Figure 2.15 Ecological features of the study area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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***Habitat zone**

identifiers

labelled on

the figure

Number: 38957

Date: 22 May 2020

Checked by: CPW, Drawn by: LW, Last edited by: Wilson

Location: P:\389005\38957\Mapping\

38957_12_EcologicalFeatures.mxd

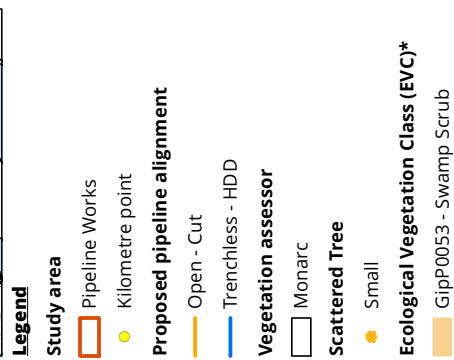
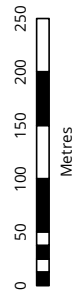


Figure 2.16 Ecological features of the study area

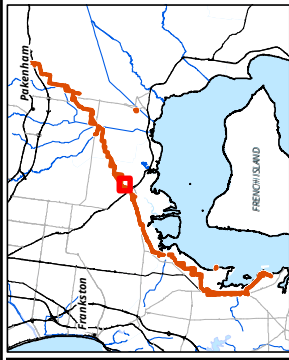


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***Habitat zone identifiers labelled on the figure**

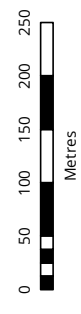
Matrix: 39957
Date: 22 May 2020
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- Legend**
- Study area**
- Pipeline Works
 - Kilometre point
- Proposed pipeline alignment**
- Open - Cut
- Vegetation assessor**
- Biosis
- Ecological Vegetation Class (EVC)***
- GipP0821 - Tall Marsh

Figure 2.18 Ecological features of the study area



Scale: 1:5,000 @ A3
 Coordinate System: GDA 1994 MGA Zone 55
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*Habitat zone identifiers labelled on the figure

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 Location: P:\389005\38957\Mapping\38957_F2_EcologicalFeatures.mxd





Legend

Study area

Pipeline Works

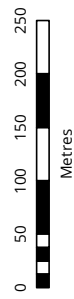
Kilometre point

Proposed pipeline alignment

Open - Cut

Trenchless - HDD

Figure 2.19 Ecological features of the study area



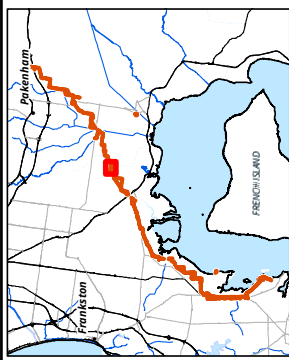
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Coordinate System: GDA 1994 MGA Zone 55



Matter: 38957
 Date: 22 May 2020
 Checked by: CPW, Drawn by: LW, Last edited by: Wilson
 Location: P:\389005\38957\Mapping\38957_12_EcologicalFeatures.mxd
 *Habitat zone identifiers labelled on the figure





Legend

Study area

Pipeline Works

Kilometre point

Proposed pipeline alignment

Open - Cut

Trenchless - Bore

Vegetation assessor

Biosis

Ecological Vegetation Class (EVC)*

GipP0053 - Swamp Scrub

Figure 2.20 Ecological features of the study area



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*Habitat zone identifiers labelled on the figure



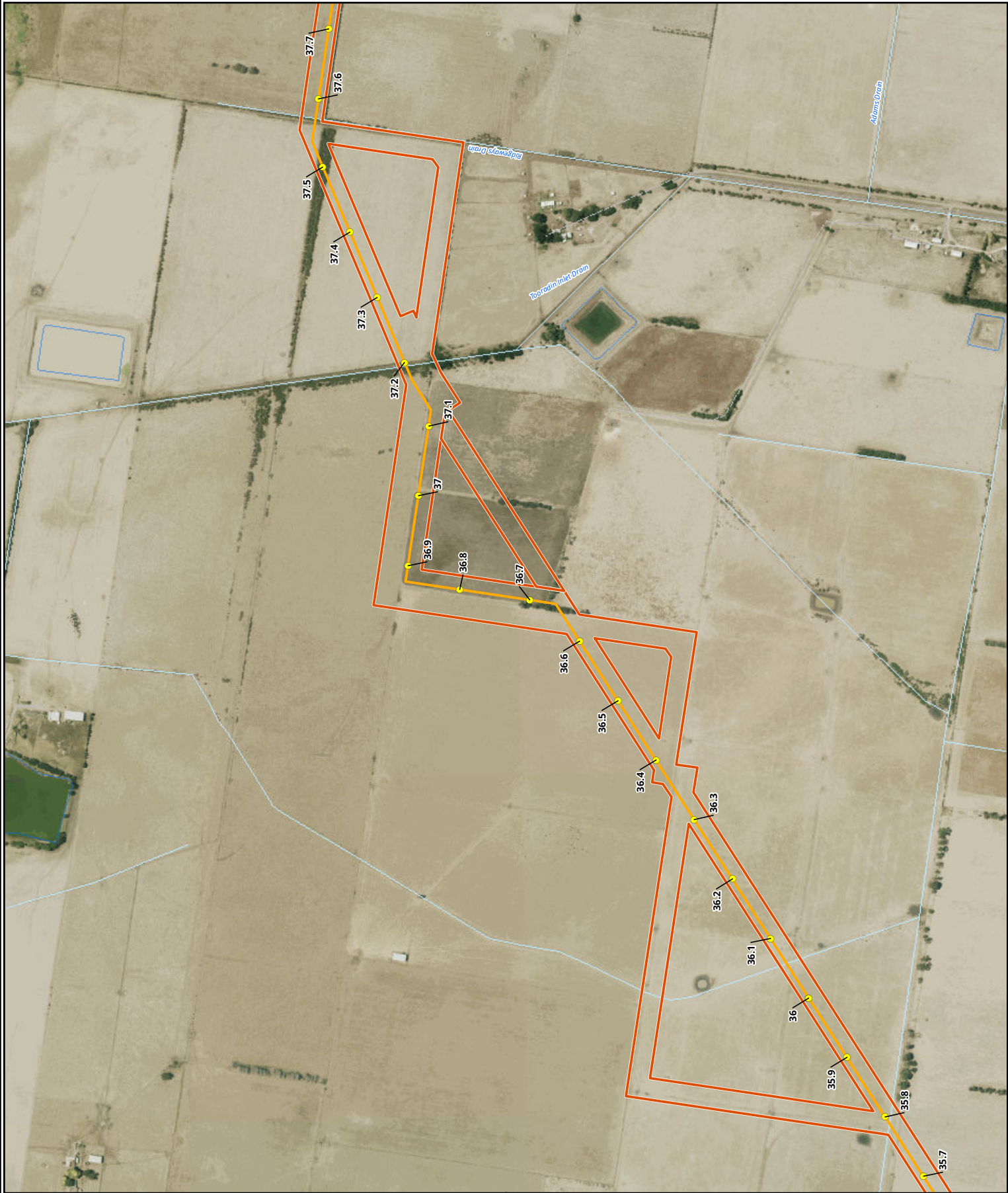
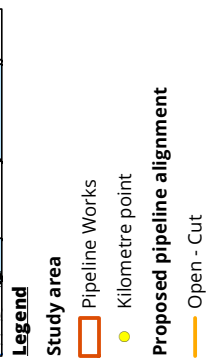
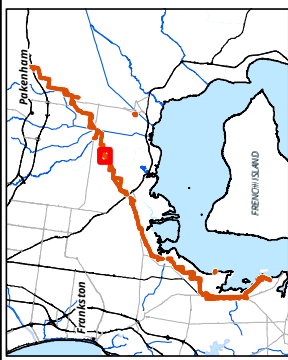
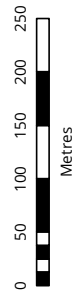
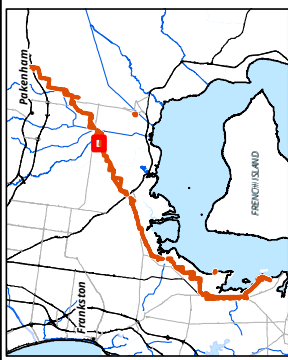


Figure 2.21 Ecological features of the study area



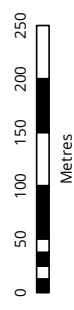
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- Legend**
- Study area**
- Pipeline Works
 - Kilometre point
- Proposed pipeline alignment**
- Open - Cut
 - Trenchless - Bore
- Vegetation assessor**
- Monarc
- Ecological Vegetation Class (EVC)***
- GipP0053 - Swamp Scrub

Figure 2.22 Ecological features of the study area

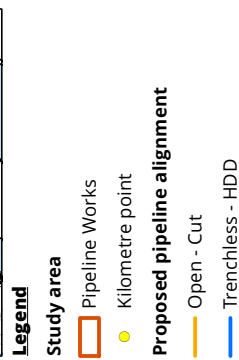


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Legend

Study area

Pipeline Works

Kilometre point

Proposed pipeline alignment

Open - Cut

Trenchless - Bore

Vegetation assessor

Monarc

Ecological Vegetation Class (EVC)*

GipP0053 - Swamp Scrub

Figure 2.24 Ecological features of the study area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



Material: 28/07/20

Date: 22 May 2020

Checked by: CPW, Drawn by: LW, Last edited by: Wilson

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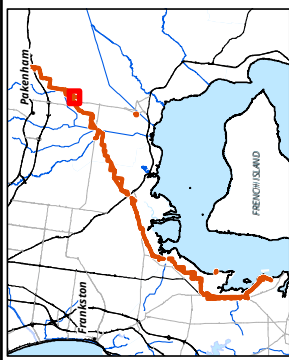
*Habitat zone

Identifiers

labelled on

the figure





Legend

Study area

Pipeline Works

Kilometre point

Proposed pipeline alignment

Open - Cut

Trenchless - HDD

Vegetation assessor

Biosis

Monarc

Ecological Vegetation Class (EVC)*

GipP0053 - Swamp Scrub

GipP0821 - Tall Marsh

Figure 2.26 Ecological features of the study area



Metres

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

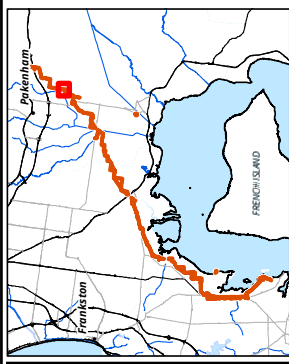


*Habitat zone

Identifiers labelled on the figure

Material: 28957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\389005\28957\Mapping\28957_12_EcologicalFeatures.mxd





Legend

Study area

Pipeline Works

Kilometre point

Proposed pipeline alignment

Open - Cut

Trenchless - HDD

Vegetation assessor

Biosis

Monarc

Scattered Tree

Large

Small

Patch Tree

Large

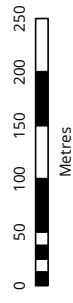
Ecological Vegetation Class (EVC)*

GipP0053 - Swamp Scrub

GipP0083 - Swampy Riparian

Woodland

Figure 2.27 Ecological features of the study area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



Matrix: 38957

Date: 22 May 2020

Checked by: CPM, Drawn by: LW, Last edited by: Wilson

Location: P:\38957\38957 Mapping\

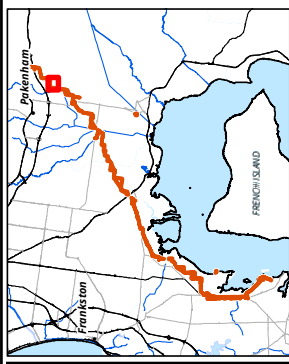
38957_2_EcologicalFeatures.mxd

*Habitat zone

Identifiers

labelled on

the figure



Legend

Study area

Pipeline Works

Kilometre point

Proposed pipeline alignment

Open - Cut

Trenchless - Bore

Vegetation assessor

Monarc

Scattered Tree

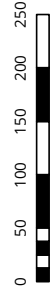
Large

Small

Ecological Vegetation Class (EVC)*

GipP0053 - Swamp Scrub

Figure 2.28 Ecological features of the study area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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*Habitat zone

Identifiers labelled on the figure

Matrix: 28957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\389005\28957\Mapping\28957_2_EcologicalFeatures.mxd



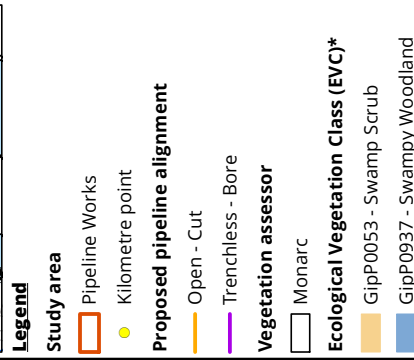
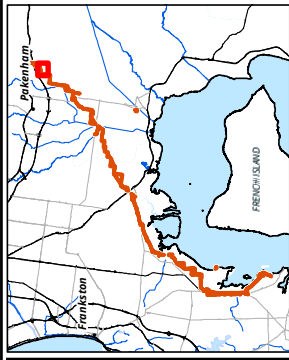
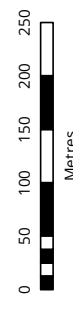


Figure 2.29 Ecological features of the study area



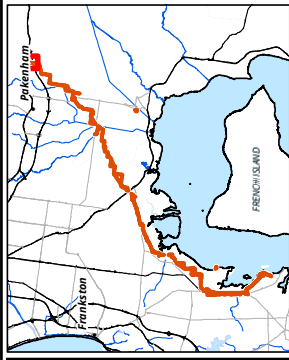
Scale: 1:5,000 @ A3
 Coordinate System: GDA 1994 MGA Zone 55

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Habitat zone
 identifiers
 labelled on
 the figure

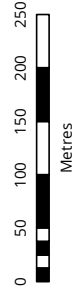
Matrix: 38957
 Date: 22 May 2020
 Checked by: CPM, Drawn by: LW, Last edited by: Wilson
 Location: P:\389005\38957\Mapings\38957_12_EcologicalFeatures.mxd





- Legend**
- Study area**
- Pipeline Works
 - Kilometre point
- Proposed pipeline alignment**
- Open - Cut
 - Trenchless - Bore
- Scattered Tree**
- Large
 - Small

Figure 2.30 Ecological features of the study area



***Habitat zone identifiers labelled on the figure**

Matrix: 28957
 Date: 22 May 2020
 Checked by: CPW, Drawn by: LW, Last edited by: Wilson
 Location: P:\28957\28957_Mapping\28957_12_EcologicalFeatures.mxd





Legend

Study area

■ Pipeline Works

● Kilometre point

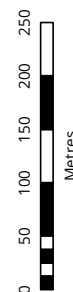
Proposed pipeline alignment

— Open - Cut

— Trenchless - Bore



Figure 2.31 Ecological features of the study area



Scale: 1:5,000 @ A3
 Coordinate System: GDA 1994 MGA Zone 55
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***Habitat zone identifiers labelled on the figure**

2. Scoping requirements

The EES scoping requirements for the Project were issued by the Victorian Minister for Planning in February 2019, and augment the key matters listed in the Minister's decision to require an EES.

The scoping requirements set out the specific matters to be investigated and documented in the EES in the context of the *Ministerial guidelines for assessment of environmental effects under the Environment Effects Act 1978* (DSE 2006).

The EES is an accredited assessment process for the purposes of the assessment of the Project under the EPBC Act, and the EES scoping requirements also include matters to be assessed under the EPBC Act.

2.1 Draft evaluation objectives

The following draft evaluation objectives are relevant to terrestrial and freshwater biodiversity, and identifies the desired outcomes in the context of potential Project effects.

The draft evaluation objectives, as set out in the final scoping requirements, provide a framework to guide integrated assessment of the environmental effects of the Project. These draft evaluation objectives are to be used in the context of the relevant legislative requirements set out in Section 3.0.

Draft evaluation objective for terrestrial and freshwater biodiversity

Biodiversity – To avoid, minimise or offset potential adverse effects on native flora and fauna and their habitats, especially listed threatened or migratory species and listed threatened communities.
Water and catchment values – To minimise adverse effects on water (including groundwater, waterway, wetland, estuarine, intertidal and marine) quality and movement particularly as they might affect the ecological character of the Western Port Ramsar site.

2.2 Assessment of specific environmental effects

The following extracts from the scoping requirements (Table 1) issued by the Minister for Planning, are relevant to the evaluation objectives listed above.

Table 1 Specific matters for terrestrial and freshwater biodiversity impact assessment (extracted from the EES scoping requirements)

Aspect	Scoping requirement	Report reference
Key issues	<ul style="list-style-type: none"> • Direct loss of native vegetation and any associated listed threatened flora and fauna species and communities known or likely to occur in or adjacent to the project works. • Direct loss of, or degradation to, habitat for flora and fauna species listed as threatened or migratory under the EPBC Act, Victorian <i>Flora and Fauna Guarantee Act 1988</i> (FFG Act) and/or DELWP advisory lists, including but not limited to the following species: <ul style="list-style-type: none"> Southern Brown Bandicoot Australian Grayling Dwarf Galaxias Growthling Grass Frog Australian Fairy Tern (Far) Eastern Curlew Curlew Sandpiper Sharp-tailed Sandpiper Red Knot Great Knot Greater Sand Plover Lesser Sand Plover Bar-tailed Godwit Bar-tailed Godwit (subspecies <i>baueri</i>) Northern Siberian Black-tailed Godwit* Red-necked Stint Double-banded Plover Short-tailed Shearwater Dense Leek-orchid • Indirect loss of vegetation or habitat quality, that may support any listed species or other protected fauna, resulting from hydrological or hydrogeological change, edge effects, habitat fragmentation, loss of connectivity, or other disturbance impacts arising from construction or operation, including noise, vibration and lights. 	Section 7.0 (Impact assessment)

Aspect	Scoping requirement	Report reference
	<ul style="list-style-type: none"> Potential for adverse effects on the ecological character and biodiversity values of the Western Port Ramsar site including, but not limited to, the species mentioned above and terrestrial and marine conservation reserves. Potential for indirect effects on biodiversity values including but not limited to those effects associated with changes in hydrology (including surface and groundwater changes), water quality (i.e. on water dependent ecosystems), contaminants and pollutants, environmental weeds, pathogens and pest animals including, but not limited to declared weeds, pathogens and pest animals under the Victorian <i>Catchment and Land Protection Act 1994</i> (CaLP Act). The availability of suitable offsets in accordance with Guidelines for the loss of native vegetation and habitat for threatened species, ecological communities and migratory species which are listed under the EPBC Act and/or the FFG Act. The potential for adverse effects on the functions, values and beneficial uses of groundwater due to the project, on groundwater dependent ecosystems (GDEs) and the ecological character of the Western Port Ramsar site due to changes in groundwater levels, behaviour or quality. 	
Priorities for charactering the existing environment	<ul style="list-style-type: none"> Characterise the distribution and quality of native vegetation and terrestrial and aquatic habitat and any wildlife movement in the area that could be impacted by the project or associated works. This must include the quality and type of habitat impacted and qualification of the total impact area and areas indirectly impacted from the proposed action and must be informed as appropriate by targeted surveys undertaken in accordance with appropriate Commonwealth or DELWP survey guidelines. Identify the existing or likely presence of any protected species, and especially species listed under the FFG Act and DELWP advisory lists, as well as environmental weeds, pathogens and pest animals. Characterise the listed threatened and migratory species, other protected species, ecological communities and potentially threatening processes that are likely to be present, in the Western Port Ramsar site or in other wetlands nearby. This characterisation is to be informed by the literature and suitable available data (especially, where relevant, data <5 years old) and supported by seasonal or targeted surveys where necessary. Details of the scope, timing and method for studies or surveys used to provide information on the ecological values at the site (and in other areas that may be impacted by the project) should 	Section 5.0 (Existing conditions)

Aspect	Scoping requirement	Report reference
	<p>be outlined. Records and other data from local sources should also be gathered and considered as appropriate.</p> <ul style="list-style-type: none"> As appropriate, identify the different uses which significant species may make of different habitat areas that could be affected by the project at different times or life-cycle stages. Identify and characterise any groundwater dependant ecosystems that may be affected by the project works. This characterisation is to be informed by data, literature and appropriate surveys. Identify flora and fauna that could be affected by the project's potential effects on air quality, noise or vibration, or could be disoriented or otherwise impacted by project lighting. Describe the biodiversity values that could be affected by the project, including: <ul style="list-style-type: none"> – native vegetation and any ecological communities listed under the EPBC Act or FFG Act; – presence of, or suitable habitats for, native flora and fauna species, especially those listed under the EPBC Act, FFG Act, and DELWP advisory lists; and – use of the site and its environs for movement by EPBC Act, FFG Act, and DELWP advisory list listed fauna species, including migratory species, and other protected species. Describe the existing threats present to biodiversity values, including: <ul style="list-style-type: none"> – direct removal of individuals or destruction of habitat; – disturbance or alteration of habitat conditions (e.g. habitat fragmentation, changes to water quantity or quality, fire hazards, etc.); – threats of mortality of listed threatened fauna; – presence of or risk of introduction of any declared weeds, pathogens and pest animals within and near the Project Area; and – initiating or exacerbating potentially threatening processes under the EPBC Act or FFG Act. 	
Design and mitigation measures	<ul style="list-style-type: none"> Identify potential and proposed design options and measures that could avoid, minimise, mitigate or manage significant direct and indirect effects on native vegetation and any listed ecological communities or flora and fauna species and their habitat including the ecological character of the Western Port Ramsar site and habitat values within or adjacent to the pipeline alignment 	<p>Section 6.0 (Risk assessment)</p> <p>Section 7.0 (Impact assessment)</p> <p>Section 8.0 (Mitigation measures)</p>

Aspect	Scoping requirement	Report reference
	<ul style="list-style-type: none"> Identify and evaluate aspects of project works and operations, and proposed design refinement options or measures, that could avoid or minimise significant effects on water, waterway or wetland environments. Best practice guidelines and standards must be considered when designing mitigations, including those referred to in Section 3.5 of the scoping requirements. 	
Assessment of likely effects	<ul style="list-style-type: none"> Assess likely direct and indirect effects of the project and alternatives on native vegetation, ecological communities and habitats for protected fauna and flora species, in particular any species listed under the EPBC Act, FFG Act or DELWP advisory lists. Assess likely direct and indirect effects of the project on the ecological character and habitat values of the Western Port Ramsar wetland site, including but not limited to effects of entrainment, potential introduction of exotic organisms, wastewater discharges, other waste streams, noise, vibration and light. Assess likely direct and indirect effects of the project and alternatives on protected fauna and their habitat, including threatened or migratory species listed under the EPBC Act, FFG Act or DELWP advisory lists, relative to existing hazards and risks and with regard to conservation or listing advices, action statements, recovery plans and threat abatement plans. Assess likely cumulative effects on biodiversity-related values that might result from the project in combination with other projects or actions taking place or proposed nearby. Identify and evaluate effects of the project and alternatives on groundwater, surface water, waterways and wetlands near the project works, including the likely extent, magnitude and duration (short and long term) of changes to water quality, water level, temperature or flow paths during construction and operation, considering appropriate climate change scenarios and possible cumulative effects resulting in combination with other existing or proposed projects of actions. 	Section 7.0 (Impact assessment)
Approach to management performance	<ul style="list-style-type: none"> Describe and evaluate proposed measures to manage the residual effects of the project on biodiversity values, including an outline of an offset strategy that sets out and includes evidence of the offsets that can be secured or are proposed to satisfy Commonwealth and Victorian offset policy or guideline requirements. Describe and evaluate the approach to monitoring and the proposed contingency measures to be implemented in the event of adverse residual effects on flora, fauna and ecological community values requiring further management. 	Section 8.0 (Mitigation measures)

Aspect	Scoping requirement	Report reference
	<ul style="list-style-type: none"> Describe and evaluate the approach to monitoring and the proposed ongoing management measures to be implemented to avoid adverse residual effects on the Western Port Ramsar site. Identify any further methods proposed to manage risks and effects on other biodiversity values and native vegetation, to form part of the Environmental Management Framework (refer to Section 5 of the scoping requirements). 	
<p>*The subspecies listed as 'Northern Siberian Black-tailed Godwit' in the scoping requirements is believed to be an error and is likely to be a reference to the Northern Siberian Bar-tailed Godwit (<i>Limosa lapponica menzbieri</i>). Bar-tailed Godwit (both subspecies <i>menzbieri</i> and <i>baueri</i>) are addressed in Appendix 2. No subspecies by the name 'Northern Siberian Black-tailed Godwit' is known. The Asian Black-tailed Godwit <i>Limosa limosa melanuroides</i> is the form of that species which migrates to Australia, however it is uncommon in southern Australia and Western Port. This species is therefore assessed as having a low likelihood of occurrence (refer to Section 4.1.2) and is not considered further.</p>		

In the context of this report, 'effects' includes all potential direct, indirect, on-site and off-site environmental impacts resulting from the Project.

The description and assessment of effects is not confined to the immediate area of the Project. It also considers the potential of the Project to impact on adjacent or other areas that could be affected, in the context of a systems-based approach.

The effects on Matters of National Environmental Significance (MNES) and an analysis of the acceptability of impacts on MNES are summarised in Section 7 and Appendix 7 of this report.

3. Legislation, policy and guidelines

Table 2 summarises the relevant legislation that applies to the Project in the context of this terrestrial and freshwater biodiversity impact assessment, as well as the implications and required approvals for the Project

Table 2 Key environmental legislation relating to the Project

Legislation/policy	Key policies/strategies	Implications for the Project
Commonwealth		
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	<p>The EPBC Act is a fundamental piece of Commonwealth legislation that provides a legal framework to protect and manage matters of national environmental significance (MNES) including World Heritage properties, National Heritage places, Ramsar wetlands, listed threatened species and ecological communities and listed migratory species.</p> <p>The EPBC Act states that if significant impacts on MNES are likely, then an action is known as a 'controlled action' and assessment and approval under the EPBC Act is required.</p>	<p>The Gas Import Jetty Works and Pipeline Works are each 'controlled actions' requiring assessment and approval under the EPBC Act, due to the following relevant controlling provisions:</p> <ul style="list-style-type: none"> wetlands of international importance (Sections 16 and 17B) listed threatened species and communities (Sections 18 and 18A) migratory species (Sections 20 and 20A) <p>Listed threatened species, migratory species and the Western Port Ramsar site are present or immediately adjacent to the Project Area. Approval under the EPBC Act is required, and decisions about the grant and conditions of any approval would be informed by assessment under the EES process through the bilateral agreement.</p>
State		
<i>Planning and Environment Act 1987</i>	<p>The Planning and Environment Act provides a legal framework for planning the use, development and protection of land in Victoria. The Planning and Environment Act provides for the preparation of planning schemes in each municipality consistent with the Victoria Planning Provisions (VPPs) and procedures by which planning schemes may be amended and planning permits obtained to govern land use and development.</p> <p>Guidelines for the Removal, Destruction or Lopping of Native Vegetation ('the Guidelines'; DELWP 2017a) is an incorporated document within the VPPs. It is referenced directly within this Act, within Clause 52.17 (native vegetation) of the local planning scheme.</p>	<p>The Project requires native vegetation removal which would ordinarily trigger the requirement for a planning permit and both general and species habitat unit offset prescriptions.</p> <p>However, in accordance with the <i>Pipelines Act 2005</i>, any works subject to a Pipeline Licence are exempt from approval under the Planning and Environment Act for use and development, including native vegetation removal. In this instance, the Pipeline Works located outside the declared Port of Hastings area are not subject to the requirements of the Planning and Environment Act due to the exemption in s85 of the Pipelines Act. Instead of a Planning Permit, the removal of native vegetation would be regulated by DELWP under the Pipelines Act through commitments made in an Environmental Management Plan (EMP). In granting the Pipeline Licence and approving the EMP, DELWP would give consideration to the Guidelines (DELWP 2017).</p> <p>Removal of native vegetation as a result of the Gas Import Jetty Works would require planning approval. A proposed Planning Scheme Amendment would apply a Specific Controls Overlay and an Incorporated Document to the</p>

Legislation/policy	Key policies/strategies	Implications for the Project
		Gas Import Jetty Works including the FSRU, and address any vegetation removal requirements for that area. Requirements for construction and/or post-construction monitoring such as monitoring of sediment levels, noise levels and dust levels, which may impact on terrestrial ecological values would be addressed in conditions and environmental management plans required by the Incorporated Document.
<i>Environment Effects Act 1978</i>	The Environment Effects Act provides a legal framework for the assessment and management of potential impacts to the environment as a result of development projects.	The Minister for Planning determined on 8 October 2018 that an EES was required for the Project due to the potential for significant environmental effects on FFG Act listed flora and fauna, impacts to the North Arm of the Western Port Ramsar site and impacts to waterways resulting from construction and/or operation of the Project.
<i>Flora and Fauna Guarantee Act 1988</i>	The FFG Act provides a framework for the protection of Victorian flora, fauna and associated habitats. The FFG Act provides a legal framework to promote conservation of Victoria's native flora and fauna and enable management of potentially threatening processes. Threatened species and communities of flora and fauna, as well as threatening processes, are listed under the FFG Act. Section 47 provides that a permit is required for the removal of any listed protected flora from public land.	A range of FFG Act listed species are present within the Project Area and within the pipeline alignment. Permits under the FFG Act would be required for several locations within the Project Area where removal of protected species is occurring on public land.
<i>Catchment and Land Protection Act 1994</i>	<p>The CaLP Act provides a framework for the regulation and control of pests, weeds and diseases within Victorian catchments. The CaLP Act is administered by the Department of Jobs, Precincts and Regions.</p> <p>Under the CaLP Act, landowners have a responsibility to avoid causing or contributing to land degradation, including taking all reasonable steps to conserve soil, protect water resources, eradicate regionally prohibited weeds, prevent the growth and spread of regionally controlled weeds and, where possible, eradicate established pest animals declared under the CaLP Act.</p> <p>The CaLP Act categorises weeds and their respective management requirements into:</p>	A range of CaLP Act listed weeds are present within the Project Area and would need to be managed, in conjunction with other weed species, during the construction period to restrict the spread of restricted weeds, and control the spread of regionally controlled weeds.

Legislation/policy	Key policies/strategies	Implications for the Project
	<ul style="list-style-type: none"> state prohibited weeds; regionally prohibited weeds; regionally controlled weeds; and restricted weeds. 	
<i>Water Act 1989</i>	The Water Act provides a legal framework for the management of Victoria's water resources.	The pipeline alignment crosses waterways that are protected by the Water Act. A permit may be required under the Water Act for crossings.
<i>Marine and Coastal Act 2018 (formerly Coastal Management Act 1995)</i>	The Marine and Coastal Act aims to protect Victoria's marine and coastal environment. The Act provides an integrated and coordinated approach to planning and managing the marine and coastal environment by enabling protection of the coastline and the ability to address the long-term challenges of climate change, population growth and ageing coastal structures. The Act supersedes the former Coastal Management Act.	Section 65 of the Act requires that a proponent must obtain consent to use or develop marine and coastal Crown land. The Pipeline Works and Gas Import Jetty Works would each require consent under this Act for component works undertaken on marine and coastal Crown land.
<i>Fisheries Act 1995</i>	The Fisheries Act provides a legislative framework for the protection, management and regulation of Victorian fisheries including aquatic habitats.	The Project Area provides habitat for some FFG Act listed fish species which are protected by this Act. A permit may be required.
<i>Environment Protection Act 1970</i>	The Environment Protection Act provides a legal framework for the systematic and strategic management of potential and realised environmental impacts. The Environment Protection Amendment Act 2018 is expected to take effect from 1 July 2020.	<p>The Project would require large-scale works which trigger controls and/or requirements for construction and/or operational monitoring, such as monitoring of sediment levels, noise levels and dust levels – all of which may impact on terrestrial ecological values. Existing EPA guidance has been considered in assessing impacts and preparing mitigation measures. The <i>Environment Protection Act 2017</i> (as amended by the <i>Environment Protection Amendment Act 2018</i>) will commence on 1 July 2020, and be supported by new regulations and guidance.</p> <p>The FSRU would require a works approval, which would transition into an application for a development licence under the new Environment Protection Act. An operating licence would be required from the EPA for the FSRU prior to commencing operations. Refer also to https://www.environment.vic.gov.au/__data/assets/pdf_file/0019/334450/Factsheet_Environment-Protection-Amendment-Act-2018.pdf</p>
<i>State Environment Protection Policy (Waters) 2018</i>	The Environment Protection Act underpins the SEPP (Waters) which provides a legal framework for the protection and management of Victoria's water environments,	The Project would impact on waterways, through direct trenching of Olivers Creek, Western Outfall Drain, Tooradin Inlet Drain and Hagelthornes Drain, along with several additional minor waterways. The Project would be required to ensure that impacts to surface water quality do not

Legislation/policy	Key policies/strategies	Implications for the Project
	including surface waters, estuarine and marine waters and groundwaters. The SEPP requires that aquatic ecosystem values be protected. Environmental quality objectives and indicators are defined to protect beneficial uses (i.e. the uses and values of the water environment) and an attainment program provides guidance on protection of the beneficial uses.	<p>result in changes that exceed background levels and/or the water quality objectives specified for the central Foothills and Coastal Plains segment, Western Port segment and Entrances and Nth Arm Western Port sub-segment.</p> <p>For the purposes of this assessment, the SEPP Waters has been considered in assessing the biodiversity impacts of the Project.</p>
<i>Pipelines Act 2005</i>	The Pipelines Act is the primary Act governing the construction and operation of pipelines in Victoria. The Pipelines Act covers 'high transmission' pipelines for the conveyance of gas, oil and other substances. DELWP and Energy Safe Victoria are responsible for administering the Act and the Pipelines Regulations 2017.	<p>The Project requires a pipeline licence under the Pipelines Act for the construction and operation of the Pipeline Works.</p> <p>Given the exemption in Section 85 of the Pipelines Act from planning requirements, the pipeline licence provides the mechanism for regulation of native vegetation removal and offset obligations through the imposition of conditions for the Pipeline Works.</p>

4. Methodology

A systematic risk-based approach has been applied to understand the existing environment, the potential impacts of the Project and how to avoid, minimise or manage the risk of impact.

The following sections outline the method that was used to determine the existing conditions within the Project study area and to assess impacts and risks to terrestrial and freshwater biodiversity associated with the Project.

4.1 Existing conditions assessment

To determine the baseline ecological values present within the Project study area, an existing conditions assessment was undertaken which incorporated a background review of relevant biodiversity databases and existing assessment reports, as well as site investigations for components of the study area not previously assessed. Further detail on the methods used to determine the baseline ecological values for the Project is provided below.

4.1.1 Review of existing information

For the purposes of this assessment, information and database records for flora and fauna have been drawn from a variety of pre-existing sources and from investigations undertaken specifically for the Project. Pre-existing records are included where they are documented in publications and reports that have been subject to, or available for peer review. Databases used are managed by government agencies or NGOs that have expert review processes in place. Multiple other sources providing background information about biodiversity and ecology of the area, and particularly about Western Port, that were used to inform this assessment are cited throughout and listed in Section 10 (References).

A number of ecological investigations have been undertaken to inform the Project, all of which were reviewed as part of the existing conditions assessment. These investigations are listed below.

- Field-based assessments to inform the Project undertaken by Biosis:
 - *Crib Point to Pakenham: Dwarf Galaxias targeted surveys* (Biosis 2019a).
 - *Crib Point Pakenham pipeline: Flora survey report for River Swamp Wallaby-grass* (Biosis 2019b).
 - *Crib Point Pakenham Pipeline: Flora survey report* (Biosis 2019c).
- Field-based assessments undertaken by other consultants to inform the Project:
 - *Flora and Fauna Assessment – Crib Point Pakenham Pipeline Project* (Monarc Environmental 2018a).
 - *Southern Brown Bandicoot Targeted Survey Report* (Monarc Environmental 2018b).
 - *Growling Grass Frog Targeted Survey Report* (Monarc Environmental 2018c).
 - *Aquatic Survey Report. Crib Point Pakenham Pipeline Project* (Monarc Environmental 2018d).
 - *Swamp Skink Targeted Survey Report* (Monarc Environmental 2018e).
 - *Southern Toadlet Targeted Survey Report* (Monarc Environmental 2018f).
 - *Groundwater Impact Assessment* (AECOM 2019a).

- *Noise and vibration impact assessment* (AECOM 2019b).
- *Flora and Fauna assessment*. AGL Gas Import Jetty Project (Jacobs 2018).

In order to provide additional context for the Project study area, information on ecological values from within 5 kilometres of the study area (the 'Project search area') was obtained from relevant biodiversity databases, many of which are maintained by the Victorian Government Department of Environment, Land, Water and Planning (DELWP) or the Australian Government Department of Agriculture, Water and the Environment (DAWE). Note, some databases have time lags between submission of records and their inclusion on searchable versions. This is usually due to time required for their internal expert scrutiny and subsequent acceptance of records. Records from the following databases were collated and/or reviewed:

- DELWP's Victorian Biodiversity Atlas (VBA).
- DAWE's Protected Matters Search Tool (PMST), for matters protected by the EPBC Act.
- DELWP's NatureKit vegetation mapping.
- Australian Government Bureau of Meteorology (BOM) Groundwater Dependent Ecosystems (GDE) Atlas.
- BirdLife Australia's Shorebirds 2020 data, obtained for the western shoreline areas of Western Port.
- BirdLife Australia's Birddata Atlas, for viewing threatened bird records located outside the 5 kilometre Project search area.

4.1.2 Determining likelihood of occurrence

Likelihood of occurrence indicates the potential for a species or ecological community to occur regularly within the Project study area. It is based on expert opinion, information in relevant biodiversity databases and reports, and an assessment of the habitats on site. Likelihood of occurrence is ranked as negligible, low, moderate, high or recorded, in accordance with the broad descriptions provided in Table 3. The specific rationale for the ranking assigned is also provided for each species in Appendix 1 (flora) and Appendix 2 (fauna). Those species for which there is little or no suitable habitat within the Project study area are assigned a likelihood of low or negligible and are not considered further. Species which have at least a moderate likelihood of occurrence are given further consideration in this report. A species is considered to be 'recorded' if it has been recorded during site investigations undertaken to inform the Project.

Table 3 Likelihood of occurrence

Likelihood	Description
Negligible	Species that do not fit any of the below criteria and would not be expected to occur within the study area under normal circumstances.
Low	Species that meet at least one or more of the following criteria: <ul style="list-style-type: none"> • Have not been previously recorded in the study area and surrounds and for which the study area is beyond the current distributional range • Rely on specific habitat types or resources that are not present in the study area • Rely on specific habitat types or resources that would not be impacted by the Project. • Are considered locally extinct by relevant authorities/experts • Perennial flora species that were specifically targeted by surveys and not recorded • Localised fauna species that have been specifically targeted by appropriate survey (i.e. surveys that meet published survey guidelines) and have not been recorded. Note that this would not be applied to highly mobile species where targeted surveys are generally less informative unless undertaken over long periods.

Likelihood	Description
Moderate	<p>Species that meet at least one or more of the following criteria:</p> <ul style="list-style-type: none"> • Are infrequently recorded in the study area and surrounds • Use habitat types or resources that are present in the study area, although generally in a poor or modified condition • Are unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically during variable seasons or migration • Are cryptically flowering flora species that were not seasonally targeted by surveys and that have not been recorded • Are cryptic fauna species that have not been seasonally targeted by surveys and have not been recorded • May periodically visit the site during seasonal movements or migration.
High	<p>Species that fit one or more of the following criteria:</p> <ul style="list-style-type: none"> • Are frequently recorded in the study area and surrounds • Use habitat types or resources that are present in the study area, and that are abundant and/or in good condition within the study area • Are known to, or considered likely to, maintain resident populations surrounding the study area • Are known or likely to regularly visit the site during regular seasonal movements or migration.
Recorded	Species recorded within the Project study area as a part of the site investigations undertaken to inform the Project.

4.1.3 Significance

This report encompasses the potential for the Project to influence all flora and vertebrate fauna of terrestrial and freshwater ecosystems and birds of the intertidal zone regardless of their conservation status. The significance of a species or ecological community is determined by its listing status under Commonwealth or State legislation / policy (Table 4). In accordance with the EES scoping requirements, species listed as threatened or migratory under the EPBC Act, FFG Act and/or a DELWP Advisory List (DSE 2009; DSE 2013; DEPI 2014) and flora species listed as rare on the DELWP advisory list for rare or threatened flora (DEPI 2014) are given particular consideration in this assessment. While not considered to be within a category of threat, rare flora species are considered as part of the native vegetation planning permit approval process and are included in this assessment for consistency. Species listed as near threatened, data deficient or poorly known are not considered to be threatened species, are not considered in Victoria's native vegetation removal policy, and are therefore not considered as part of the assessment under that policy. Rare or threatened flora species that occur as plantings outside their natural range have also not been included in this assessment.

Table 4 Criteria for determining significance of species and ecological communities

Significance	
National	<p>Listed as critically endangered, endangered or vulnerable under the EPBC Act</p> <p>Listed as a migratory species under the EPBC Act</p>
State	<p>Listed as threatened under the FFG Act</p> <p>Listed as rare or threatened (critically endangered, endangered, vulnerable or rare) in Victoria on a DELWP Advisory List (DSE 2009; DSE 2013; DEPI 2014)</p>

4.1.4 Site investigations

As previously mentioned, the existing conditions assessment is informed by a range of specific biodiversity studies that were undertaken by different consultants in 2018. Methods employed for those investigations are detailed in the reports referenced in Section 4.1.1. Additional studies to address particular aspects were undertaken by Biosis in 2018, 2019 and 2020 and the methods used are set out below.

As Biosis' methods involved reviewing other biodiversity studies, the methodologies of those assessments are outlined in Section 5.1 and 5.2 under *Previous assessments*. Biosis methods for assessment are outlined below.

4.1.4.1 Flora and vegetation

Native vegetation

Native vegetation is defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses' (Clause 72).

The Guidelines for the removal, destruction or lopping of native vegetation (the 'Guidelines') classify native vegetation into two categories (DELWP 2017a):

- A **patch** of native vegetation (measured in hectares) is either:
 - An area of native vegetation, with or without trees, where at least 25 per cent of the total perennial understorey cover is native.
 - An area with three or more native canopy trees where the drip line (i.e. the outermost boundary of a tree canopy) of each tree touches the drip line of at least one other tree, forming a continuous canopy.
 - Any mapped wetland included in the *Current wetlands map*, available in DELWP systems and tools.

Patch vegetation is classified into ecological vegetation classes (EVCs). An EVC contains one or more floristic (plant) communities, and represents a grouping of broadly similar environments. Definitions of EVCs and benchmarks (condition against which vegetation quality at the site can be compared) are determined by DELWP.

A discrete patch of native vegetation is referred to within this report as a habitat zone (HZ).

- A **scattered tree** is defined as a native canopy tree that does not form part of a patch of native vegetation.

A canopy tree is a mature tree that is greater than three metres in height and is normally found in the upper layer of a vegetation type. Ecological vegetation class descriptions provide a list of the typical canopy species. A scattered tree is defined as either small or large, and is determined using the large tree benchmark for the relevant EVC. The extent of a small scattered tree is the area of a circle with a 10 metres radius (i.e. 0.031 hectares), while the extent of a large scattered tree is a circle with a 15 metres radius (i.e. 0.070 hectares). A condition score is applied to each scattered tree based on information provided by DELWP's Native Vegetation Information Management (NVIM) tool.

A Vegetation Quality Assessment (VQA) was undertaken for all patches of native vegetation impacted by the Project works (not all by Biosis). This assessment is consistent with DELWP's habitat hectare method (DSE 2004) and the Guidelines (DELWP 2017a). For the purposes of this assessment the limit of the resolution for identification of a patch of native vegetation was taken to be 0.001 Habitat hectares (Hha). That is, if a discrete patch of native vegetation was present with sufficient cover but its condition and extent would not have resulted in the identification of at least 0.001 Habitat hectares, the patch of vegetation was not mapped or

included in the assessment. Vegetation Quality Assessment was not undertaken for areas where surface works are not proposed, such as areas avoided through the use of sub-surface bores or HDD.

Large trees

Large trees sizes according to diameter at breast height (DBH) are defined in the relevant bioregional EVC benchmarks. In some instances a tree is recorded within an EVC that does not support a large tree benchmark size. If these trees measure more than 125 centimetres circumference at breast height, then they are included as large trees for the purposes of calculating offsets. This occurred within the Project footprint in places containing Swamp Scrub, particularly north of Kings Creek near Hastings.

In some cases, where a tree within a patch has a tree protection zone impacted by more than 10%, the Native Vegetation Removal Report (NVRR) will list these as scattered trees. These are not true scattered trees by definition, however are treated the same for the offset purposes of the NVRR.

Targeted orchid survey

Biosis (2019c) found a concentration of significant orchids within the pipeline alignment at Crib Point, between kilometre points (KPs) 1.13 and 1.7 (Figure 7). Subsequently, targeted orchid survey was conducted on 6 and 31 October and 1 and 22 November 2019.

Species searched for were:

- Merran's Sun-orchid *Thelymitra X merraniae* (FFG Act listed, endangered in Victoria)
- Marsh Sun-orchid *Thelymitra longiloba* (endangered in Victoria on DELWP Advisory List)
- Pallid Sun-orchid *Thelymitra pallidiflora* (endangered in Victoria on DELWP Advisory List)
- Gaping Sun-orchid *Thelymitra reflexa* (endangered in Victoria on DELWP Advisory List)
- Crimson Sun-orchid *Thelymitra X macmillanii* (vulnerable in Victoria on DELWP Advisory List)

During each survey field personnel walked 5–10 metres apart depending on visibility of ground flora. Field assessments for threatened orchids were conducted according to the draft *Survey Guidelines for Australia's threatened orchids: Guidelines for detecting orchids listed as 'threatened' under the Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia 2013a).

Each orchid (or group of orchids depending on proximity/density) located was marked with a 23 centimetre plastic sand peg. Each peg was placed approximately 10 centimetres south of the orchid. Each orchid was given a number, written on the peg in permanent marker. Where a peg marked more than one orchid, the range was written onto the peg (e.g. 31–37). In slashed areas, each peg was pushed into the ground below the mower line, typically just above ground level. Plastic pegs were chosen as the survey area is regularly mown and the pegs would not damage the mower. They were also chosen because their yellow colour would make them easy to relocate.

4.1.4.2 Terrestrial fauna and waterbirds

The site investigations undertaken by Biosis also incorporated an assessment of fauna values, which were determined on the basis of the types and qualities of habitat(s) present. Particular attention was given to searching for significant fauna species and their habitats, particularly waders and waterbirds at the Gas Import Jetty Works study area, in order to complement existing information on species presence and habitat importance (refer to Sections 5.1.1 and 5.2.1 for details on the methods followed during previous assessments).

Important habitats in Australia for migratory shorebirds under the EPBC Act include those recognised as nationally or internationally important. As a Ramsar site, Western Port is an internationally recognised area of important habitat for migratory shorebirds. This is supported by numerous studies and survey records over many years (Loyn et al. 2001, Dann et al. 2003, Kellogg Brown & Root 2010, Hansen et al. 2011, Menkhorst et al. 2014, Hale 2016, Melbourne Water 2018). As the importance of shorebird habitat within Western Port has already been recognised, and there is suitable, credible data available, further surveys were not necessary to establish its importance. This is consistent with EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Commonwealth of Australia 2017). Targeted surveys were undertaken to ascertain the types of habitat present in close proximity to the Gas Import Jetty Works study, assess their suitability for shorebirds and to document waterbird presence there. Those survey were undertaken on the following dates:

- 15 and 21 March 2019
- 27 and 30 August 2019
- 13 and 30 January 2020
- 14 and 21 February 2020

Surveys in winter 2019 were undertaken to detect any resident waders and waterbirds present. Wader and waterbird surveys took place at high and low tide, with the aim of detecting any differences in bird distribution, habitat utilisation, numbers and species under those conditions. Surveys at high tide specifically checked for the presence of birds using any portions of the surveyed areas as a high tide roosting sites. The surveys were undertaken to provide additional information to the large number of existing records of waders and waterbirds from Western Port, with the intention of providing localised context relevant to the Gas Import Jetty Works footprint and immediate surrounds, and included a general assessment of habitat suitability and occupancy. The surveys were conducted on foot from the shore using binoculars and spotting scopes.

Targeted survey for Growling Grass Frog was undertaken at two farm dams on private property (KP 16.14 and KP 28.2), along with one naturally occurring wetland located on Council managed land at 10 Whitneys Road, Somerville, adjacent to KP 16.1. Surveys were undertaken at these waterbodies to determine presence of Growling Grass Frog, following pipeline alignment revisions that occurred subsequent to the initial Growling Grass Frog survey undertaken by Monarc Environmental in 2018 (refer to Section 5.2.1). Surveys were undertaken over two nights on 25 and 27 February 2020 in accordance with the EPBC Act survey guidelines for the species (Commonwealth of Australia 2009), however due to property access constraints the farm dam at KP 16.14 could only be surveyed from adjacent land utilising call playback and binocular searches of the waterbody.

All species nomenclature follows the Victorian Biodiversity Atlas (VBA).

4.1.4.3 Permits

Biosis undertook flora and fauna assessments under provisions of the following permits and approvals:

- Research Permit/Management Authorisation and Permit to Take/Keep Protected Flora & Protected Fish issued by DELWP under the Victorian *Wildlife Act 1975*, *Flora and Fauna Guarantee Act 1988* (FFG Act), *National Parks Act 1975* and *Crown Land (Reserves) Act 1978* (Permit Number 10008711).
- Permit to catch and release fish issued by the Victorian Fisheries Authority under the Victorian *Fisheries Act 1995* (Permit Number RP 1220, Personal File Number 13041).

- Approvals 30.17 and 19.18 issued by the Wildlife and Small Institutions Animal Ethics Committee of the Victorian Government Department of Economic Development, Jobs, Transport and Resources (DEDJTR).
- Scientific Procedures Fieldwork Licence issued by DEDJTR's Wildlife and Small Institutions Animal Ethics Committee (Licence Number 20020).

4.2 Risk assessment method

The EES scoping requirements for the Project require that a risk-based approach be adopted for assessment of the potential impacts of the Project. A risk assessment was carried out using an approach that is consistent with Australian/New Zealand Standard AS/NZS ISO 31000:2018 Risk Management Process.

The risk assessment process provides a method for:

- facilitating a consistent approach to risk assessment across the various specialist studies in the EES
- identifying key Project risks to inform where detailed investigations are required
- ensuring the level of investigation is proportionate to the relative environmental risk
- assessing the effectiveness of proposed mitigation measures and whether additional measures may be required.

Risk can be defined as a combination of:

- the magnitude of potential consequences of an event
- the likelihood of the event occurring.

The risk assessment process developed for the Project involved the assignment of consequence and likelihood ratings which were combined to give an overall risk level for each identified risk.

The initial findings of the impact assessment were used to identify and describe cause-and-effect pathways for the Project to determine links between Project activities and their subsequent environmental consequences (known as risk pathways). These risk pathways were identified considering the assets, values and uses requiring protection identified during the existing conditions assessment.

4.2.1 Assigning consequence of risks

In this risk assessment, the consequences of a risk occurring were assigned using a consequence guide. Specific consequence categories were developed considering existing conditions in the study area. The consequence rating criteria used in the risk assessment specifically for risks relating to terrestrial and freshwater biodiversity is shown in Table 5 to Table 11.

Table 5 Native vegetation: consequence rating criteria

Level	Qualitative description
Negligible	Insignificant loss (<0.1 ha) of an EVC with a Bioregional Conservation Status of endangered Temporary impact on native vegetation <0.5 ha Removal of 1–5 large trees
Minor	Minor loss (0.1–1 ha) of an EVC with a Bioregional Conservation Status of endangered Total native vegetation patch loss of <5 ha Removal of 6–50 large trees

Level	Qualitative description
Moderate	Moderate loss (1–5 ha) of an EVC with a Bioregional Conservation Status of endangered Total native vegetation patch loss of 5–15 ha Removal of 51–200 large trees
Major	Substantial loss (5–25 ha) of an EVC with a Bioregional Conservation Status of endangered Total native vegetation patch loss of 15–30 ha Removal of 201–400 large trees
Severe	Significant loss (>25 ha) of an EVC with a Bioregional Conservation Status of endangered Total native vegetation patch loss >30 ha Removal of 401 or more large trees

Table 6 Impact on threatened species and waders and waterbirds: consequence rating criteria

Level	Qualitative description
Negligible	Population change is not detectable outside natural variation
Minor	Detectable population change, but with no impact on population viability
Moderate	Detectable population change, with reduction in population viability that is significant at a local level
Major	Detectable population change, with reduction in population viability that is significant at a bioregion level
Severe	Detectable population change, with reduction in population viability that is significant at a State or National level

Table 7 Threatened ecological communities (EPBC and FFG Acts): consequence rating criteria

Level	Qualitative description
Negligible	Changes to threatened ecological communities not detectable outside natural variation
Minor	Loss to the area of threatened ecological community that is < 0.05 ha
Moderate	Loss to the area of threatened ecological community 0.05 – 0.5 ha
Major	Loss to the area of threatened ecological community of 0.5 – 1 ha
Severe	Loss to the area of threatened ecological community that is greater than 1 ha

Table 8 Threatening processes (i.e. weeds, pests, etc.): consequence rating criteria

Level	Qualitative description
Negligible	No exacerbation of a threatening process
Minor	Exacerbation of threatening process leading to impacts to associated ecological values within the Project study area
Moderate	Exacerbation of threatening process leading to impacts to associated ecological values within Local Government Area

Level	Qualitative description
Major	Exacerbation of threatening process leading to impacts to associated ecological values within the bioregion
Severe	Exacerbation of threatening process leading to impacts to associated ecological values at a State and/or National level

Table 9 Ecosystem function: consequence rating criteria

Level	Qualitative description
Negligible	Ecosystem change not detectable outside natural variation / occurrence
Minor	Measurable changes to the ecosystem components with a minor change in function (no loss of components or introduction of new species that affects ecosystem function)
Moderate	Measurable changes to the ecosystem components with a moderate change in function (some loss of components or introduction of new species that affects ecosystem function)
Major	Measurable changes to the ecosystem components with a major change in function
Severe	Long-term and possibly irreversible damage to one or more ecosystem function

Table 10 Western Port Ramsar site: consequence rating criteria

Level	Qualitative description
Negligible	No measurable change in ecological character. Limit of acceptable change met
Minor	Minor change in ecological character. Limit of acceptable change met
Moderate	Moderate change in ecological character. Limit of acceptable change not met for Critical components, processes and services (CPS)
Major	Major change in ecological character. Limit of acceptable change not met for Critical CPS
Severe	Extreme change in ecological character. Limit of acceptable change not met for Critical CPS

Table 11 Groundwater dependent ecosystems (GDE): consequence rating criteria

Level	Qualitative description
Negligible	No measurable change in condition and/or extent of surface expression GDE (wetland)
Minor	Loss of or impact on a GDE that is of significance within the Project study area
Moderate	Loss of or impact on a GDE that is of significance within the local government area
Major	Loss of or impact on a GDE that is of significance within the bioregion
Severe	Loss of or impact on a GDE that is of significance within the State and/or National context

4.2.2 Assigning likelihood of risks

A likelihood rating for each identified risk pathway was assigned using the guide in Table 12.

The likelihood criteria in the risk assessment range across a scale from 'almost certain' where 'the event is expected to occur in most circumstances or is planned to occur' to 'rare' where 'the event may occur only in exceptional circumstances.'

Table 12 Likelihood criteria

Level	Description
Rare	The event may occur only in exceptional circumstances
Unlikely	The event could occur but is not expected
Possible	The event could occur
Likely	The event will probably occur in most circumstances
Almost Certain	The event is expected to occur in most circumstances or is planned to occur

4.2.3 Risk assessment matrix and risk rating

Together the consequence and likelihood were combined to arrive at a risk rating, using the risk assessment matrix shown in Table 13. The risk register for terrestrial and freshwater biodiversity is presented in Section 6.

Table 13 Risk assessment matrix

		Consequence ratings				
		Negligible	Minor	Moderate	Major	Severe
Likelihood rating	Rare	Very Low	Very Low	Low	Medium	Medium
	Unlikely	Very Low	Low	Low	Medium	High
	Possible	Low	Low	Medium	High	High
	Likely	Low	Medium	Medium	High	Very High
	Almost Certain	Low	Medium	High	Very High	Very High

Further information about the risk assessment process and the risk register for the Project is detailed in EES Attachment III *Environmental risk report*.

4.2.4 Application of mitigation measures

An initial set of mitigation measures have been developed as part of this impact assessment. These mitigation measures are based on compliance with legislation and standard requirements that are typically incorporated into the delivery of infrastructure projects of similar type, scale and complexity.

As the Pipeline Works design, construction methodology and operation strategies were well progressed at the commencement of this impact assessment, mitigating measures that were already incorporated in the Pipeline Works design were included as initial mitigation measures.

Initial risk ratings were applied to the identified risk pathway assuming that these initial mitigation measures were in place.

Additional mitigation measures were developed where the initial risk ratings were categorised as medium or higher.

The initial and additional mitigation measures have been incorporated into the Project description and design (where relevant) by AGL and APA and included in the EMF to effectively manage the environmental performance of the Project during construction and operation. Refer to EES Chapter 25 *Environmental Management Framework* for further detail on how the mitigation measures are proposed to be implemented.

The risk and impact assessment process is iterative. Potential impacts were reassessed after the risk assessment and after mitigation measures were refined. The level of residual risk was reassessed using the same methodology to confirm the mitigation measure is effective in mitigating or managing potential impacts so the Project is able to satisfy the draft evaluation objectives set out in the EES scoping requirements.

4.3 Impact assessment method

This assessment outlines the potential impacts of the Project on terrestrial and freshwater biodiversity values identified during the existing conditions assessment, which incorporates the review and collation of a number of existing assessment reports, an assessment of the potential occurrence of rare or threatened species and the results of site investigations. The existing conditions assessment methodology is outlined in Section 4.1 and the results of site investigations are provided in Section 5.

The assessment of ecological impacts considers the risks identified during the risk assessment. The risk assessment methodology is provided in Section 4.2. In addition, the assessment of impacts to ecological values was guided by state and Commonwealth policy and legislation relating to impacts to native vegetation and threatened species and ecological communities.

Impacts to MNES protected under the EPBC Act are assessed against significant impact guidelines developed by the Commonwealth of Australia, to determine whether impacts are 'significant' as defined under the Act. The following EPBC Act policy documents were considered in the impact assessment for the Project:

- Matters of National Environmental Significance (MNES). Significant impact guidelines 1.1 (Commonwealth of Australia 2013b).
- Significant impact guidelines for the vulnerable Growling Grass Frog (Commonwealth of Australia 2009).
- Draft referral guidelines for the endangered Southern Brown Bandicoot (eastern) (Commonwealth of Australia 2011a).
- Referral guideline for management actions in Grey-headed and Spectacled Flying Fox camps (Commonwealth of Australia, 2015a).
- Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species, EPBC Act Policy Statement 3.21 (Commonwealth of Australia 2017).

Impacts on the Western Port Wetland of International Importance (Ramsar site) were also evaluated in reference to specific characters and limits of acceptable change for the site set out in the following publications:

- Western Port Ramsar Site Management Plan (Victorian Government Department of Environment, Land, Water and Planning 2017c).
- Western Port Ramsar Wetland Ecological Character Description, Report for Department of Sustainability, Environment, Water, Population and Communities, Kellogg Brown & Root Pty Ltd 2010.

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- Ecological Character Description Addendum - Western Port Ramsar Site, Victorian Government Department of Environment, Land, Water and Planning, Hale J 2016.

A Vegetation Quality Assessment (VQA) was undertaken for all patches of native vegetation in the Project Area. This approach used DELWP's VQA method that underpins the concept of Habitat Hectares (DSE 2004). Native vegetation was defined in accordance with The Guidelines (DELWP 2017a).

Habitat Hectares is Victoria's standard metric for quantifying native vegetation losses and gains. The method involves obtaining a habitat score out of 100, which is composed of a site condition score (score out of 75) combined with a landscape context score (score out of 25) to give a total habitat score (score out of 100). The score out of 100 is then multiplied by the area vegetation (habitat zone) to calculate the number of 'Habitat Hectares' in a patch of vegetation. Habitat Hectares is then used in the regulatory system to measure losses and gains in native vegetation for regulatory approvals and biodiversity offsets in Victoria. The habitat scoring method provides a useful surrogate for habitat quality as it considers important structural and functional elements such as density of large trees, understorey complexity, plant species richness, weediness, plant recruitment and coarse woody debris. It also considers the physical connectivity of native vegetation in the landscape (e.g. patch size, configuration and continuity).

The outcomes of other EES technical reports were used as inputs to determine impacts to Groundwater Dependent Ecosystems (GDEs) and the Western Port Ramsar site.

4.4 Assumptions and limitations

Assumptions and limitations relating to this terrestrial and freshwater biodiversity impact assessment are provided below, and referred to throughout the report where relevant. These factors do not present a significant limitation to the current assessment.

- A large portion of the existing conditions assessment is based on data gathered and reported by Monarc Environmental (see references). This included targeted surveys for threatened species, as well as mapping and scoring of native vegetation.
- Vegetation above proposed locations of HDD along the pipeline alignment has not been assessed unless otherwise stated.
- The current assessment does not include non-vascular flora (e.g. mosses and liverworts). These were not recorded apart from their cover, as part of the condition assessment for native vegetation.
- Ecological surveys and assessments provide a sampling of the flora and fauna at the time and do not provide a comprehensive list of all species that have the potential to utilise the site over time. Despite this, the current assessment of existing conditions is considered appropriate in determining the presence or likely presence of threatened species within the Project study area.
- Mapping was conducted using hand-held GPS units and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally +/- 5 metres) and dependent on the limitations of aerial photo resolution. Therefore, these should not be relied upon for detailed design purposes.
- Monarc Environmental (2018a) condition scores of native vegetation were at times extended into adjacent polygons that were recorded at a later date by Biosis. This was only done when the EVC was considered to be identical. If it was not appropriate to extend these condition scores and the EVC mapping into adjacent areas, the vegetation was reassessed by Biosis.

- EVCs were predominantly aligned with the findings from Monarc Environmental (2018a) or the pre-1750 modelled EVCs. In some instances contraindicative species were present in the habitat zones, or Monarc Environmental (2018a) findings were disputed and the previously ascribed EVCs were overwritten.
- Reference sites to assess flowering times for targeted flora surveys were used for River Swamp Wallaby-grass, Dense Leek-orchid and Merran's Sun-orchid. To ensure each targeted survey encapsulated an appropriate flowering period, surveys were timed to coincide with the beginning, middle and end species flowering periods.
- Some areas supported thick stands of Blackberry *Rubus anglocandicans* and other woody weeds, preventing access for flora surveys. Some additional species could occur in these areas.
- Review of nearby species records relies on the accuracy of each database. It is possible other records of flora and fauna are present within the Project study area that are not included in the databases assessed for this report.
- Some areas of the proposed pipeline alignment were heavily grazed at the time of assessment. This made identification of some species difficult, however general values and quality scores were still assessable.
- The calculated losses of native vegetation, scattered trees and canopy trees does not exactly match the Native Vegetation Removal Report. This is due to the calculation of overlap when multiple polygons overlap each other, i.e. two canopy trees have overlapping extent of removal.
- Biosis has relied on the accuracy of models and tests outlined in other EES technical reports (i.e. noise, groundwater, light) for assessing impacts on terrestrial and freshwater biodiversity.
- For the purposes of this assessment, information and database records for flora and fauna have been drawn from a variety of pre-existing third party sources and from investigations undertaken specifically for the Project. Pre-existing records are included where they are documented in publications and reports that have been subject to, or available for peer review. Biosis therefore relies on the accuracy of relevant third-party fauna databases, such as the VBA managed by DELWP, Shorebirds 2020 data and Birddata Atlas managed by BirdLife Australia and the PMST managed by DAWE. Some databases have time lags between submission of records and their inclusion on searchable versions. This is usually due to time required for their internal expert scrutiny and subsequent acceptance of records.

4.5 Stakeholder engagement

A program of stakeholder and community engagement was undertaken to assist with Project development as described in Chapter 26 *Stakeholder engagement*.

Stakeholder engagement undertaken as part of this terrestrial and freshwater biodiversity impact assessment occurred as a series of EES community events, as summarised in Table 14.

Table 14 Summary of EES community events undertaken on terrestrial and freshwater biodiversity matters

EES community event location	When	Key issues discussed	Engagement outcome
Crib Point	26 February 2019 27 August 2019	Bandicoot habitat fragmentation	Addressed mitigation measures and methodology for pipeline construction

EES community event location	When	Key issues discussed	Engagement outcome
Officer/Cardinia	27 February 2019 31 August 2019	Avifauna habitat removal	Outlined methodology for construction of the pipeline
Pearcedale	28 February 2019 28 August 2019	Impacts on native fauna, such as bird nests in woodland areas	Implement fauna spotter/catcher for pre-clearance works
Hastings	2 March 2019 24 August 2019	Impacts on large trees	Identified what constitutes a Large Tree within an EVC
Grantville	2 September 2019		

4.6 Independent peer review

An independent peer-review of this assessment has been undertaken by WSP Australia Pty Ltd.

4.7 Links to other EES technical reports

This terrestrial and freshwater biodiversity impact assessment should be read in conjunction with other relevant technical reports of the EES. Other potential impacts including those relating to groundwater, marine environment and noise have been considered in detail in other technical reports.

The outcomes of the following assessments were used to inform this assessment:

- EES Technical Report A *Marine biodiversity impact assessment*
- EES Technical Report C *Surface water impact assessment*
- EES Technical Report D *Groundwater impact assessment*
- EES Technical Report E *Contamination and acid sulphate soils impact assessment*
- EES Technical Report H *Noise and vibration impact assessment*
- EES Technical Report K *Safety, hazard and risk impact assessment*

5. Existing conditions

The existing conditions for each set of the Project Works are outlined in Section 5.1 (Gas Import Jetty Works) and Section 5.2 (Pipeline Works).

5.1 Gas Import Jetty Works

5.1.1 Previous assessments

Previous ecological assessments relevant to the Gas Import Jetty Works are listed below and a summary of each report is included. Full references are provided in Section 9. Table 15 provides a list of relevant ecology reports and publications relating to Western Port.

Jacobs 2018. AGL Gas Import Jetty Project. Flora and fauna assessment

This survey was conducted within the terrestrial areas of the existing Crib Point Jetty. Its purpose was to determine the terrestrial ecological values, assess these against relevant State and Commonwealth legislation and provide recommendations on avoiding and minimising potential impacts resulting from the Project.

The survey identified approximately 2 hectares of native vegetation comprising Heathy Woodland, Swamp Scrub and Coastal Dune Scrub EVCs. Some of this native vegetation, particularly south of the existing facility was considered suitable habitat for a range of flora, including Dense Leek-orchid. However, this area of native vegetation is not proposed to be impacted.

The report concluded that the proposed works were unlikely to constitute a significant impact for any MNES.

Monarc Environmental 2018. Flora and fauna assessment. Crib Point Pakenham Pipeline

This survey included most of the pipeline alignment with some exceptions, such as through Hastings and some smaller design alterations at various locations along the 57 kilometre length.

The surveys detected a range of ecological values protected under State and Commonwealth legislation or policy. These included a number of EPBC Act listed species of flora and fauna, and identified suitable habitat for a number of additional threatened species.

In total, 201 flora species, including 118 indigenous species, 13 non-indigenous natives and 70 introduced species were recorded. One individual Strzelecki Gum *Eucalyptus strzeleckii* was recorded within the Project Area near Langwarrin Creek. Three threatened flora species: Dense Leek-orchid, Swamp Fireweed and Swamp Everlasting were predicted to occur within suitable habitat in the pipeline alignment. These species were subject to targeted survey conducted by Biosis (2019) as outlined in Section 4.1.4.

The construction ROW was found to intersect 91 patches of native vegetation, of which 46 were impacted by the pipeline alignment, which has since been revised. The remaining 45 patches were to be avoided using HDD and other design modifications.

Biosis Research 2007. Flora and fauna assessment of proposed bitumen storage facility, Crib Point, Victoria.

Biosis undertook a flora and fauna assessment in 2006 to determine ecological values for the proposed bitumen storage facility at Crib Point. The assessment recommended targeted surveys for Southern Brown Bandicoot.

The assessment concluded that the majority of the site was highly degraded having been heavily modified by clearing and ground disturbance and unlikely to support habitat for Southern Brown Bandicoot.

Dann et al. (2003). Distribution and abundance of seabirds in Western Port, Victoria

Dann et al. (2003) documents a four-year investigation of seabirds within Western Port, excluding the Upper North Arm and Corinella segment. The surveys were boat-based and specifically excluded areas of less than 2 metres water-depth. The primary value of the study is its documentation of 25 species within Western Port, but it is not specific about areas utilised by the species recorded. It reports seasonal use by a number of species but highlights the degree of unpredictability of such use and variability in numbers of many species.

Table 15 Ecology related reports and publications relevant to Western Port

Title	Scope/Abstract	Geographic Coverage /Relevance	Taxa covered
Western Port Ramsar Site Management Plan DELWP (2017c)	<p>The primary purpose of the Western Port Ramsar Site Management Plan is to maintain ecological character and promote wise use of the site. Wise use is defined by the Ramsar Convention (2005) as: “the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development”. The Western Port Ramsar site supports a number of ecological, socio-economic and cultural values. The plan has adopted the principle that by maintaining (or improving) ecological character, the socio-economic and cultural values associated with the Ramsar Site will also be conserved, within the concept of wise use. Therefore, the primary objective of the Western Port Ramsar Site Management Plan is: “To maintain, and where necessary improve, the ecological character of the Western Port Ramsar site and promote wise and sustainable use.</p>	<p>Western Port Ramsar site and key areas around Western Port of priority locations for habitat loss / impacts</p>	<p>Waterbird guilds in Western Port, as well as migratory fish species and floristic communities (sea grasses, saltmarsh, mangroves)</p>
Understanding the Western Port Environment 2018 - A summary of research findings from the Western Port Environment Research Program 2011-2017 and priorities for future research. Melbourne Water (2018).	<p>Melbourne Water (2018) summarises the results of many interdisciplinary investigations that have taken place between 2011 and 2017. It highlights key links between different ecological elements and the importance of Western Port, outlining measures to protect and improve its health into the future. The broader ecosystem values of Western Port outside of the area relevant to the Project are assessed in the context of Western Port Ramsar Site values.</p>	<p>Western Port</p>	<p>Water birds and migratory birds within Western Port.</p>

Title	Scope/Abstract	Geographic Coverage /Relevance	Taxa covered
Western Port Welcomes Waterbirds: waterbird usage of Western Port. Hansen, B., Menkhorst, P. & Loyn, R. (2011).	<p>The project aimed at improving understanding of waterbird population dynamics and habitat use in Western Port. Primary focus was intertidal and coastal habitats within Western Port Ramsar site. Waterbird usage data spanning 37 years were collated. The dataset was analysed to identify trends in species abundance, important high-tide roosting sites and low-tide foraging areas. Movement patterns of two small shorebird species were also explored. Roosting sites were ranked by importance for waterbirds generally, and for shorebirds in particular, using a quantitative ranking system. Threats potentially impacting on important roosting and foraging sites were identified and management recommendations provided.</p>	Western Port. Survey methods primarily shore-based	Waterbirds, except pelagic seabirds
Waterbird surveys of the Port of Hastings and north-west Western Port. Menkhorst, P., Rogers, D. and Stamation, K. (2014) & associated data.	<p>Provides additional data to that of Hansen <i>et al.</i> (2011) for summer and autumn 2014 for sites in North Arm.</p>	North Arm sites	Waterbirds, except pelagic seabirds
Distribution and abundance of seabirds in Western Port, Victoria. Dann, P.; Arnould, J.P.Y., Jessop, R. & Healy, M. (2003).	<p>Boat-based survey of distribution, abundance and biomass of seabirds in Western Port between 1991 and 1994. Twenty five seabirds and nine waterbird species were recorded. Abundance and distribution of different species varied seasonally and annually and may be linked to available habitat within the bay.</p>	Western Port. Survey method boat-based, excluded areas of less than two metres water-depth.	Waterbirds, except taxa confined to areas of less than two metres water-depth
Rapid population decline in migratory shorebirds relying on Yellow Sea tidal mudflats as stopover sites. Studds, C. E. <i>et al.</i> (2017).	<p>Demonstrates northern hemisphere declines in migratory shorebird species that utilise Western Port.</p>	Provides context to values of sites in Australia to flyway populations	Migratory shorebirds
Important wader sites in the East Asian-Australasian Flyway: 1. Western Port, Victoria, Australia. Loyn, R.H., Dann, P. & McCulloch, E. (2001).	<p>Summarises values of Western Port to shorebirds of the East Asian–Australasian flyway.</p>	Western Port	Migratory shorebirds

Title	Scope/Abstract	Geographic Coverage /Relevance	Taxa covered
Flora and Fauna assessment of Port of Hastings Stage One Investigation area, Victoria. Biosis Research (2009).	Flora and fauna surveys of the study area, including some North Arm shorebird sites.	Some North Arm, Western Port, including Port of Hastings	Shorebirds
The influence of climate variability on numbers of three waterbird species in Western Port, Victoria, 1973-2002. Chambers, L.E. & Loyn, R.H. (2006).	Explores long-term waterbird counts from Western Port of Black Swan, White-faced Heron and Grey Teal and compared to climatic data at local and continental scales.	Western Port	Black Swan, White-faced Heron, Grey Teal
Migratory Shorebirds of the East Asian - Australasian Flyway: Population Estimates and Internationally Important Sites. Bamford, M.; Watkins, D.; Bancroft, W.; Tischler, G. & Wahl, J. (2008).	Summarises the various migratory wader groups, their populations and internationally significant sites for each species. It also breaks down the international sites found in each country.	East-Asian - Australasian Flyway	All migratory shorebird species
A framework for monitoring the status of populations: An example from wader populations in the East Asian-Australasian flyway. Amano, T.; Szekeley, T.; Koyama, K.; Amano, H. & Sutherland, W.J. (2010).	This study focuses on shorebird populations in the East Asian-Australasian flyway, and offers a three-step framework for monitoring the status of populations. The framework considers the entire flyway populations and is not applicable to individual sites. Population changes of waders are quantified by estimating population indices from nationwide survey data in Japan between 1975 and 2008. Second, species characteristics shared by declining waders are identified using a phylogenetic comparative method. Finally, based on the revealed characteristics of declining species, composite indices are created for monitoring changes in wader communities in the East Asian-Australasian flyway. The population indices revealed that 12 species out of 41, and 16 out of 42 have declined significantly during spring and autumn migration, respectively, in at least one of the past 10, 20 or 30 year-periods.	East Asian-Australasian flyway	Ruddy Turnstone, Dunlin, Bar-tailed Godwit, Whimbrel, Black-winged Stilt
Long-term trends of shorebird populations in eastern Australia and impacts of freshwater extraction. Nebel, S., Porter, J.L. &	Reports the results of a large-scale aerial shorebird survey, sampling about a third of the Australian continent over a period of 24 years (1983–2006). It found that migratory shorebirds have declined by 73%, while Australian resident shorebirds have declined by 81%. Loss of wetlands due to river regulation is a significant contributor to the drastic	Eastern Australia	Shorebirds

Title	Scope/Abstract	Geographic Coverage /Relevance	Taxa covered
Kingsford, R.T. (2008)	decline in shorebird numbers in Australia.		
Abundance, diet and feeding behaviour of the Whimbrel <i>Numenius phaeopus variegatus</i> in Rhyll Inlet, Victoria.	Reports the numbers, diet and behaviour of Whimbrels between 1977-1978 at Rhyll Inlet, approximately 12 km south-east of the Project study area. Maximum numbers for each year were 22 in Summer 1977 and 28 in Autumn 1978.	Western Port	Whimbrel
Dann, P. (1993).			

5.1.2 Flora

5.1.2.1 Recorded species

A total of 186 indigenous and 88 introduced flora species was recorded within the Project Area by Biosis and Monarc Environmental (2018) (Appendix 1). The number of flora species recorded specifically from within the Gas Import Jetty Works study area was not noted, as previous assessments considered the Project Area as a whole. Despite this, flora species present within the Gas Import Jetty Works study area are largely associated with coastal and near-coastal habitats.

Appendix 1 (Table A1.1) contains a list of all flora species recorded within the Project study area, as well as during additional assessments within Hastings Bight and along the foreshore at Woolleys Beach and Jack's Beach.

5.1.2.2 Ecological vegetation classes

Two EVCs are present within the Gas Import Jetty Works study area (Table 16).

Table 16 Details of EVCs recorded within the Gas Import Jetty Works study area

EVC	Bioregional conservation status	Extent
Heathy Woodland (EVC 48)	Least concern	1,573 hectares
Swamp Scrub (EVC 53)	Endangered	0.030 hectares

Heathy Woodland

This EVC was recorded by both Monarc Environmental (2018) and Biosis as part of the Project assessments. The extent of this EVC can be seen in Figure 2, and extends adjacent to The Esplanade.

The habitat zone that runs adjacent to The Esplanade is of moderate diversity with a relatively intact canopy that is patchy in places. There are a number of introduced weeds present within the habitat zone, which increase along the road verge. There are a number of large trees supporting hollows, and organic litter is predominantly native although in places there are infestations of invasive weeds, particularly Bluebell Creeper *Billardiera heterophylla*.

A small habitat zone of Heathy Woodland exists on the western side of The Esplanade. This small area has a number of planted shrubs within it, however does also support a high cover of native grasses in the understorey.

Swamp Scrub

Recorded by Monarc Environmental (2018), this EVC is only a small area in the north-eastern corner of the Gas Import Jetty Works study area. It is of low quality and does not contain any emergent eucalypts. This area supports a low diversity of native flora and a moderate cover of weeds.

Swamp Scrub is listed as Endangered within the Gippsland Plain Bioregion.

5.1.2.3 Trees

The Gas Import Jetty Works impact area supports two large patch trees and no scattered trees. Large trees may comprise trees within patches of native vegetation, or scattered trees. Scattered trees considered lost (>10% encroachment into the tree protection zone) within the Project impact area are listed in Appendix 4.

5.1.2.4 Condition of native vegetation

Native vegetation within the Gas Import Jetty Works study area is significantly degraded, mostly comprising regrowth from removal decades ago and is heavily modified. There is an abundance of Australian native planted shrubs and trees, including Sallow Wattle *Acacia longiflora* and Sweet-scented Hakea *Hakea drupacea*, and invasive weeds are also abundant in this area. The Esplanade roadside components of the habitat zones are highly modified, however weeds reduce in abundance deeper into the roadside habitat zones.

Relatively intact native vegetation runs along The Esplanade south from Crib Point supporting a moderate diversity of understorey species and a mostly intact canopy.

5.1.2.5 Noxious weeds

Noxious weeds are introduced plants listed under the CaLP Act and classified by region in accordance with the level of action required to control or prevent their spread. There are three categories of noxious weeds; regionally prohibited, regionally controlled, and regionally restricted. Land owners have legal responsibilities to take action on noxious weeds, depending on their classification in the region.

Five noxious weeds were identified within the Gas Import Jetty Works study area, which is part of the Port Phillip and Western Port region (Table 17).

Table 17 Noxious weeds recorded within the Gas Import Jetty Works study area

Classification	Species	Legal responsibility (CaLP Act)
Restricted	<ul style="list-style-type: none">Bridal Creeper <i>Asparagus asparagoides</i>Soursob <i>Oxalis pes-caprae</i>	Land owners have a responsibility to take all reasonable steps to prevent the growth and spread of these weeds on their land.
Regionally Controlled	<ul style="list-style-type: none">Spear Thistle <i>Cirsium vulgare</i>Flax-leaf Broom <i>Genista linifolia</i>Blackberry <i>Rubus anglocandicans</i>	Trade in these weeds and their propagules, either as plants, seeds or contaminants in other materials is prohibited.

These weeds are sporadic within the Gas Import Jetty Works study area, and predominantly occur alongside The Esplanade road verge.

5.1.3 Fauna

5.1.3.1 Fauna species

Eight vertebrate fauna species were observed within the Gas Import Jetty Works study area during field surveys undertaken by Biosis. These were all birds utilising habitats associated with the Crib Point Jetty and were observed flying over, perching on or roosting on the existing jetty infrastructure. These species included: Pacific Gull *Larus pacificus*, Welcome Swallow *Petrochelidon neoxena*, Little Black Cormorant *Phalacrocorax sulcirostris*, Pied Cormorant *Phalacrocorax varius*, Little Pied Cormorant *Microcarbo melanoleucos*, Australian Pelican *Pelecanus conspicillatus*, Crested Tern *Thalasseus bergii* and Silver Gull *Chroicocephalus novaehollandiae*. There are additional records of an Australian Fur Seal *Arctocephalus pusillus doriferus* using the jetty infrastructure as a haul-out site (CEE 2020), and near-threatened Black-faced Cormorants *Phalacrocorax fuscescens* perching on the pier (J. Krohn pers. comm. 2020).

Wader and waterbird surveys undertaken by Biosis in March 2019 and August 2019 recorded several waders and waterbirds foraging at high tide and low tide shoreline areas within Hasting's Bight. These include: Black Swan *Cygnus atratus*, Chestnut Teal *Anas castanea*, White-faced Heron *Egretta novaehollandiae*, Little Egret *Egretta garzetta*, Eastern Great Egret *Ardea modesta*, Australian White Ibis *Threskiornis molucca*, Royal Spoonbill *Platalea regia*, Masked Lapwing *Vanellus miles* and Caspian Tern *Hydroprogne capsia*. The surveys were undertaken with a view to better understand the usage of Western Port by certain birds outside of the main season for migratory birds (November – February). This indicates that some bird species that were present at important roost sites and foraging areas were not present at the Crib Point Foreshore during this survey, but this is not necessarily a determinative indication that these species could not, or would not, use Crib Point Foreshore.

Wader and waterbird surveys undertaken in January and February 2020 were timed to coincide with the annual presence of migratory shorebirds in southern Australia. Of the four surveys undertaken at high tide, only one survey detected one resident species (Pied Oystercatcher *Haematopus longirostris*) utilising habitat on Woolleys Beach to the immediate north the Gas Import Jetty Works study area. During the four low tide surveys undertaken, two migratory shorebird species were recorded. One Eastern Curlew *Numenius madagascariensis* was observed foraging in Hastings Bight, approximately 2.5 kilometres north of the Crib Point Jetty. This species, which is listed as critically endangered and migratory under the EPBC Act, threatened under the FFG Act and vulnerable under the DELWP Advisory List, has previously been recorded in this area, according to database records (DELWP, 2017b). Five Red-necked Stints *Calidris ruficollis* (migratory under the EPBC Act) were observed foraging at low tide on Woolleys Beach immediately north of the Gas Import Jetty Works study area. Resident Masked Lapwings were recorded during all four low tide surveys, while Pied Oystercatchers were recorded on one low tide survey. Overall, the survey results were largely consistent with existing information about wader and waterbird use in the vicinity of the Gas Import Jetty Works study area.

Significant fauna species are discussed further in Section 5.1.4.

5.1.3.2 Fauna habitat

Terrestrial fauna habitat within the Gas Import Jetty Works study area includes areas of native vegetation around the proposed Crib Point Receiving Facility, as well as along The Esplanade road reserve.

Terrestrial fauna habitats associated with native vegetation are discussed in more detail in Section 5.2.

Adjacent to the Gas Import Jetty Works study area, at Woolleys Beach, are coastal mud-flats that support foraging habitat for waders and waterbirds, and the existing jetty itself provides roosting habitat for some species of waterbirds.

Habitats for fauna within Western Port are discussed further in Section 5.1.6.1.

5.1.3.3 Invasive animals

No invasive animals were recorded within the Gas Import Jetty Works study area but it is likely some, including foxes and rabbits, utilise this area.

5.1.4 Significant species

The background review of relevant databases, reports and the PMST produced a list of significant species recorded or predicted to occur within 5 kilometres of the Project study area (Project search area), which is provided in Appendix 1 (flora) and Appendix 2 (fauna). An assessment of the likelihood of these species to occur in the Gas Import Jetty Works study area is included in those appendices. Of the significant and/or migratory species recorded or predicted to occur within the Project search area, 42 are considered to have a moderate or higher likelihood of occurrence within the Gas Import Jetty Works study area (including in the immediately adjacent Woolleys Beach area), comprising:

- Nine EPBC Act listed threatened species
- 13 FFG Act listed threatened species
- 30 DELWP Advisory Listed rare or threatened species
- 25 EPBC Act listed migratory species.

Species may fall into more than one category of legislative listing, therefore the combined sum of the above numbers totals more than 42.

A summary of the species recorded or likely to occur within the Gas Import Jetty Works study area along with an indication of the habitat or site features relevant to the species is provided in Table 18. Species that were initially considered to have a moderate or higher likelihood of occurrence, but have since been discounted as a consequence of the results of targeted survey, have not been included. Rationale for the likelihood assessments are provided in Appendix 1 and Appendix 2.

Table 18 Significant species recorded or likely to occur within the Gas Import Jetty Works study area (including Woolleys Beach).

Common name	Conservation status			Areas of importance within the Gas Import Jetty Works study area (including Woolleys Beach)
	EPBC	DELWP	FFG	
EPBC Act listed threatened species				
Fairy Tern	VU	e	L	Western Port and Crib Point jetty
Lesser Sand Plover	EN, Mi	e		Western Port shoreline and intertidal zone
Greater Sand Plover	VU, Mi	e		Western Port shoreline and intertidal zone
Eastern Curlew	CR, Mi	v	L	Western Port shoreline and intertidal zone
Bar-tailed Godwit	VU, Mi			Western Port shoreline and intertidal zone
Curlew Sandpiper	CR, Mi	e		Western Port shoreline and intertidal zone
Red Knot	EN, Mi	e		Western Port shoreline and intertidal zone
Great Knot	CR, Mi	e	L	Western Port shoreline and intertidal zone
White-throated Needletail	VU, Mi	v	L	Aerial species that will occur over most habitat types
FFG Act listed threatened species				
Merran’s Sun-orchid		e	L	Potential habitat south of Crib Point Jetty, adjacent to Woolleys Beach Reserve

Common name	Conservation status			Areas of importance within the Gas Import Jetty Works study area (including Woolleys Beach)
	EPBC	DELWP	FFG	
Little Egret		e	L	Western Port shoreline and intertidal zone
Intermediate Egret		e	L	Western Port shoreline and intertidal zone
Eastern Great Egret		v	L	Western Port shoreline and intertidal zone
White-bellied Sea-Eagle		v	L	Potential to utilise the entire Project study area as part of this species broad home range
Powerful Owl		v	L	All wooded habitat (native and non-native)
Caspian Tern	Mi	nt	L	Western Port and Crib Point Jetty area
Little Tern	Mi	v	L	Western Port and Crib Point Jetty area
Grey-tailed Tattler	Mi	e	L	Western Port shoreline and intertidal zone
Chestnut-rumped Heathwren		v	L	All heathy and wooded habitat (native and non-native)
DELWP Advisory listed rare or threatened species				
Marsh Sun-orchid		e	I	Potential habitat south of Crib Point Jetty. adjacent to Woolleys Beach Reserve
Pallid Sun-orchid		e	I	Potential habitat south of Crib Point Jetty. adjacent to Woolleys Beach Reserve
Gaping Sun-orchid		e		Potential habitat south of Crib Point Jetty, adjacent to Woolleys Beach Reserve
Crested Sun-orchid		r		Potential habitat south of Crib Point Jetty. adjacent to Woolleys Beach Reserve
Crimson Sun-orchid		v		Potential habitat south of Crib Point Jetty. adjacent to Woolleys Beach Reserve
Green Leek-orchid		v	I	Native vegetation south of Crib Point Jetty
Hardhead		v		Western Port
Musk Duck		v		Western Port
Ruddy Turnstone		v		Western Port shoreline and intertidal zone
Whimbrel	Mi	v		Western Port shoreline and intertidal zone
Common Sandpiper	Mi	v		Western Port shoreline and intertidal zone
Common Greenshank	Mi	v		Western Port shoreline and intertidal zone
Marsh Sandpiper	Mi	v		Western Port shoreline and intertidal zone
EPBC Act listed migratory species				
Pectoral Sandpiper	Mi	nt		Western Port shoreline and intertidal zone
Broad-billed Sandpiper	Mi			Western Port shoreline and intertidal zone
Fork-tailed Swift	Mi			Aerial species that will occur over most habitat types
Arctic Jaeger	Mi			Western Port
Crested Tern	Mi			Western Port and Crib Point Jetty
Double-banded Plover	Mi			Western Port shoreline and intertidal zone
Red-necked Stint	Mi			Western Port shoreline and intertidal zone
Sharp-tailed Sandpiper	Mi			Western Port shoreline and intertidal zone
Rufous Fantail	Mi			May utilise woodlands in Gas Import Jetty Works study area during migration
Satin Flycatcher	Mi			May utilise woodlands in Gas Import Jetty Works study area during migration

Notes to table: CR – Critically Endangered, EN/e – Endangered, VU/v – Vulnerable, r – rare, nt – near threatened, L – listed under FFG Act, I – ineligible for listing under FFG Act, Mi – migratory species listed under EPBC Act.

Southern Brown Bandicoot

The Southern Brown Bandicoot is not considered likely to occur in the Gas Import Jetty Works study area. That assessment is based on the following information. The vegetation within the Gas Import Jetty Works study area was assessed for suitability as habitat for Southern Brown Bandicoot in particular. Previous targeted surveys by Biosis in 2006 (Biosis Research 2007), as well as Paul Kelly & Associates (PKA) in 2016 (PKA 2016), did not record Southern Brown Bandicoot at Crib Point. Targeted surveys undertaken by Monarc Environmental (2018b) for the Pipeline Works study area did not record the species at any survey locations between Crib Point and Manks Road (KP 33.5), and further discussion regarding the likelihood of occurrence along this section is provided in Section 5.2.4. While there are historical records within the local area, due to previous land-use disturbances and the general population decline within the Port Phillip and Western Port region (Ecology Australia 2017), it is considered unlikely they now occur within the Crib Point area, including the Gas Import Jetty Works study area. It is possible that Southern Brown Bandicoot still persist further north from Crib Point along the coastal reserve towards Hastings where extensive low-lying areas of vegetation occur, as a record exists in the VBA from 2010. Coates et al. (2008) also concludes that Southern Brown Bandicoot have now disappeared from most of the Mornington Peninsula, with populations in the Pines Flora and Fauna Reserve and Langwarrin Flora and Fauna Reserve likely to now be locally extinct.

5.1.5 Significant ecological communities

5.1.5.1 EPBC Act listed ecological communities

The background review identified the following significant ecological communities as having potential to occur within the Gas Import Jetty Works study area:

- Natural Damp Grassland of the Victorian Coastal Plains (Critically Endangered under EPBC Act)
- Subtropical and Temperate Coastal Saltmarsh (Vulnerable under EPBC Act).

Native vegetation was assessed to determine whether it corresponded to any of these significant ecological communities by assessing the vegetation against relevant condition thresholds and community descriptions published by the Commonwealth of Australia.

No EPBC Act listed ecological communities were recorded within the Gas Import Jetty Works study area.

5.1.5.2 FFG Act listed ecological communities

The background review identified one FFG Act listed community, the Plains Grassland (South Gippsland) Community, as known or likely to occur within the Gas Import Jetty Works study area.

The Plains Grassland (South Gippsland) Community varies in structure from closed tussock grassland to open woodland that includes a very sparsely-treed shrubby zones associated with drainage lines.

None of the vegetation within the Gas Import Jetty Project study area is considered to align with the description of this Community.

5.1.6 Western Port Ramsar site

This section describes the existing conditions within Western Port Ramsar site, as it is important to understand the context of Western Port as a whole before considering conditions adjacent to the Gas Import Jetty Works study area. Consequently, this section contains qualitative considerations that may also apply to sections of the Pipeline Works, which are not duplicated in the Pipeline Works section.

Western Port occupies approximately 59,950 hectares comprised of shallow intertidal areas, dissected by deeper channels and a narrow strip of adjacent coastal land in some areas. It was designated as a wetland of

international importance and given special recognition as *Waterfowl Habitat* under the Ramsar Convention (Kellogg, Brown & Root, 2010). Under the summary of critical components for the site in 1982, it is listed as containing 7,200 hectares of seagrass, 31,000 hectares of saltmarsh vegetation and 13,700 hectares of mangrove vegetation. However, Boon et al. (2015) consider these values for saltmarsh and mangroves to be impossibly high.

The Western Port Ramsar site encompasses the majority of Western Port, excluding the land areas of French Island and Phillip Island. The southern boundary of the Ramsar Site extends from the Phillip Island bridge around the north coast of the island to the eastern end of Silverleaves Estate (near Cowes) and then in a straight line westwards to Point Leo on the western shore of Western Port.

Waterbirds are identified by the Western Port Ecological Character Description (ECD) as a critical component of the Ramsar Site (Kellogg Brown & Root 2010). Three of the five criteria required to satisfy the listing of Western Port as a Ramsar Site in 1982 directly relate to waterbirds within the site.

In 2010, Western Port was also listed as an Important Bird Area (BirdLife International) on the basis that it regularly supports more than 1% of the global population of Eastern Curlew, Red-necked Stint and Australian Pied Oystercatcher, plus declining numbers of two threatened species, Fairy Tern and Orange-bellied Parrot.

Many wader and waterbird species that use Western Port are protected under international agreements for the protection of migratory birds to which Australia is a signatory (CAMBA, JAMBA, ROKAMBA and the Convention on Migratory Species (or 'Bonn Convention')).

Amendments to the Ecological Character Description (Kellogg, Brown and Root 2010) were provided by Hale (2016) to take into account new information known for the Western Port Ramsar site. Hale (2016) concluded that the Western Port Ramsar site supports four wetland types that cover different areas:

- Marine subtidal aquatic beds (underwater vegetation) (15,000 hectares)
- Intertidal mud, sand or salt flats (27,000 hectares)
- Intertidal marshes (1,144 hectares)
- Intertidal forested wetlands (1,700 hectares).

Over 35 waterbird species listed under international migratory agreements (species listed under JAMBA, CAMBA and ROKAMBA) have been recorded within the Ramsar Site (Hale 2016). This number includes species that, in Australia, are residents (e.g. Eastern Great Egret) and vagrant seabirds for which the site does not provide significant habitat (e.g. Artic Jaeger). Table 19 lists the 28 species that are routinely migratory and are not vagrants to Australia. There are 12 species of international migratory shorebirds that are regularly supported (in two thirds of seasons) by the Western Port Ramsar site (shown in bold in Table 19).

The Ramsar listing Criterion 2 states that: *A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.* Hale (2016) concludes that the Western Port Ramsar site regularly supports one wetland-dependent ecological community and seven fauna species listed under the EPBC Act, as listed below:

- Coastal saltmarsh – Vulnerable ecological community
- Australian Fairy Tern *Sternula nereis* – Vulnerable fauna species
- Bar-tailed Godwit *Limosa lapponica baueri* - Vulnerable fauna species
- Curlew Sandpiper *Calidris ferruginea* – Critically endangered fauna species
- Eastern Curlew *Numenius madagascariensis* – Critically endangered fauna species

- Lesser Sand Plover *Charadrius mongolus* – Vulnerable fauna species
- Red Knot *Calidris canutus* - Endangered fauna species
- Australian Grayling *Prototroctes maraena* – Vulnerable fauna species.

Table 19 Palaeartic migratory waders recorded in Western Port and their frequency of occurrence (percentage). Species that are regularly supported (in two thirds of seasons) by Western Port shown in bold (Table reproduced from Hale 2016.)

Species name	Scientific name	Frequency of occurrence*
Bar-tailed Godwit	<i>Limosa lapponica</i>	100
Black-tailed Godwit	<i>Limosa limosa</i>	3
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	3
Common Greenshank	<i>Tringa nebularia</i>	100
Common Sandpiper	<i>Actitis hypoleucos</i>	18
Curlew Sandpiper	<i>Calidris ferruginea</i>	100
Eastern Curlew	<i>Numenius madagascariensis</i>	100
Great Knot	<i>Calidris tenuirostris</i>	18
Greater Sand Plover	<i>Charadrius leschenaultii</i>	26
Grey Plover	<i>Pluvialis squatarola</i>	12
Grey-tailed Tattler	<i>Tringa brevipes</i>	85
Latham's Snipe	<i>Gallinago hardwickii</i>	3
Lesser Sand Plover	<i>Charadrius mongolus</i>	68
Marsh Sandpiper	<i>Tringa stagnatilis</i>	9
Oriental Pratincole	<i>Glareola maldivarum</i>	-
Pacific Golden Plover	<i>Pluvialis fulva</i>	94
Pectoral Sandpiper	<i>Calidris melanotos</i>	-
Red Knot	<i>Calidris canutus</i>	85
Red-necked Stint	<i>Calidris ruficollis</i>	100
Common Ringed Plover	<i>Charadrius hiaticula</i>	-
Ruff	<i>Philomachus pugnax</i>	3
Ruddy Turnstone	<i>Arenaria interpres</i>	94
Sanderling	<i>Calidris alba</i>	-
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	94
Terek Sandpiper	<i>Xenus cinereus</i>	59
Wandering Tattler	<i>Tringa incana</i>	3
Whimbrel	<i>Numenius phaeopus</i>	100
Wood Sandpiper	<i>Tringa glareola</i>	3

*Frequency of occurrence is the percentage of all surveys in which a species was recorded.

Hale (2016) confirms that Western Port regularly supports greater than 20,000 waterbirds in 80 per cent of years based on annual maximum counts. Although there was a decline in total waterbird abundance from the mid-2000s, the Western Port Ramsar site continued to meet this criterion at the time of Hale's publication in 2016 (Figure 3).

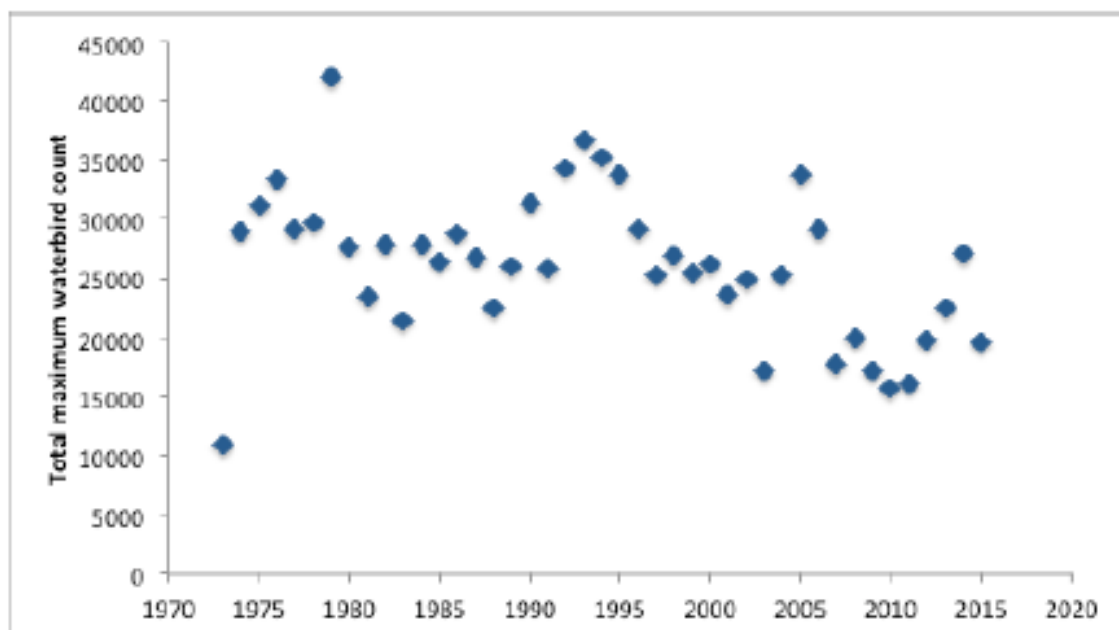


Figure 3 Total annual maximum waterbird count (data represents the sum of maximum counts for all waterbird species in a calendar year, calculated from count data provided by BirdLife Australia and Richard Loyn). Reproduced from Hale (2016).

The most important values of Western Port for birds are in the extensive shoreline, shallow and intertidal environments it provides. Loyn et al. (2001) summarize these values as follows:

[Western Port] contains 27,000 hectares of intertidal mudflat and is an important habitat for migratory waders, being ranked third in the State and among the top twenty in Australia in terms of wader numbers (Lane 1987, Dann 1994) and the number of species meeting criteria for international importance (maximum counts >1% of estimated flyway populations) (Watkins 1993).

Hale (2016) identifies six species of waterbirds for which Western Port regularly supports greater than 1% of the global population. These species, listed below, are comprised of three spring-summer visiting shorebirds, an oystercatcher, a tern and a gull.

- Australian Fairy Tern *Sternula nereis nereis*
- Australian Pied Oystercatcher *Haematopus longirostris*
- Curlew Sandpiper *Calidris ferruginea*
- Eastern Curlew *Numenius madagascariensis*
- Pacific Gull *Larus pacificus*
- Red-necked stint *Calidris ruficollis*.

5.1.6.1 Habitats of Western Port

Melbourne Water (2018) identify the following major habitats that make up Western Port:

The water column is inhabited by multiple organisms, including phytoplankton, zooplankton, jellyfish and a range of larger vertebrate species.

Mud includes soft sediments as the prevailing habitat in Western Port, covering about two thirds of the bay. This area has increased following the loss of seagrass beds. These intertidal flats are important foraging grounds for shorebirds.

Seagrasses are aquatic flowering plants that provide a role as ecosystem engineers, as they are involved with the movement of sediments, nutrient and energy transfer and the provision of habitat for animals. It is seen as intricately linked with protecting the health of Western Port. It is present in two genera, *Zostera* and *Amphibolis*. There has been extensive losses of these seagrasses in areas where water quality is poor, particularly in the eastern section of the bay. Sedimentation is identified as a major threat to seagrass communities in Western Port. The extent of marine subtidal aquatic beds (underwater vegetation, principally seagrass) totals 15,000 hectares (Hale 2016).

Mangroves persist in large numbers throughout much of the shoreline of Western Port. Historical comparisons have shown some loss of mangroves and changes in their overall distribution. As outlined within Boon et al. (2011), mangroves have encroached on saltmarsh communities within Western Port at some locations (Rogers et al. 2005). Boon et al. (2011) map the total extent of Mangrove Shrubland within Western Port at 1823 hectares, while Melbourne Water (2011) estimates this extent as 1,800 hectares.

Saltmarshes occur around much of the coast of Western Port, generally between the mangrove fringe on the seaward side, and terrestrial vegetation such as Estuarine Scrub. This vegetation type is vulnerable to sea level rise and other consequences of climate change, especially rising air and water temperatures.

Boon et al. (2011) describe several coastal saltmarsh and other coastal wetland EVCs within Western Port. The following coastal saltmarsh EVCs comprise 2,266 hectares:

- Wet Saltmarsh Herbland
- Wet Saltmarsh Shrubland
- Coastal Tussock Saltmarsh
- Coastal Dry Saltmarsh
- Coastal Aggregate Saltmarsh.

Western Port also supports 108 hectares of Estuarine Wetland (Boon et al. 2015).

Rocky reefs occupy a very small part of Western Port, mainly Crawfish Rock, a small reef near San Remo and intertidal reefs along the south-western coast.

5.1.6.2 Marine conservation reserves

Western Port contains three marine national parks that contain internationally significant roosting sites and feeding areas for migratory waders and waterbirds, including:

- French Island Marine National Park (2,800 hectares)
- Yaringa Marine National Park (980 hectares)
- Churchill Island Marine National Park (670 hectares).

Yaringa National Park contains extensive areas of mangroves, intertidal mudflats and saltmarsh areas, particularly within Watson Inlet and Quail Island.

French Island Marine National Park and French Island National Park together contain a variety of marine and coastal habitats, including seagrass beds, channels, mangroves, mudflats and beaches. This park contains one of the most extensive areas of saltmarsh and mangrove communities in Victoria.

Churchill Island Marine National Park protects seagrasses, mangroves, mudflats and sandy beaches and contains a raised beach.

5.1.6.3 Fauna of Western Port

Waders and waterbirds

The significance of Western Port to waders and waterbirds is well documented, and is briefly summarised in this section. No species of bird is wholly reliant on, or restricted to, Western Port and various environmental factors – many of which are external to Western Port – affect the abundance and spatial and temporal use of the bay by almost all wader and waterbird species, hereafter collectively referred to as waterbirds.

A relatively small number of the species that use Western Port are sedentary. One example is the Hooded Plover *Thinornis rubricollis*. Of the species known to nest in Western Port, the majority do so on French Island and other small islands where foxes are not present (Hansen et al. 2011).

The majority of waterbirds that use Western Port are nomadic or migratory. Nomadic species in Australasia have substantial capacity to make large-scale movements to take advantage of suitable resources as and where they are available. This is an adaptation to unpredictable rainfall and drought and consequent wetting and drying of wetlands across the continent

A large portion of the birds using Western Port are migratory. Migrants make regular annual movements, often along defined flyways, between areas where they breed and areas they use during the non-breeding portion of the year. Many have very specific annual routines and their migrations are highly predictable. The majority of shorebirds using Western Port breed in high latitudes of the northern hemisphere and are known as Holarctic species. These migrants are routinely present in southern Australia during the austral spring-summer. Some non-breeding individuals may remain here for our winter but the majority depart and the bulk of their populations are absent during the austral winter. The Double-banded Plover *Charadrius bicinctus* breeds in New Zealand and is present in southern Australia during winter. Many pelagic birds including petrels, giant-petrels, shearwaters, albatrosses and some terns breed on islands of the Southern Ocean and are present in southern Australian waters only during the austral winter. Short-tailed Shearwaters *Ardenna tenuirostris* breed in colonies in southern Australia coastal locations, including at Phillip Island and French Island, and migrate annually to the northern Pacific Ocean.

Western Port provides habitat for Little Penguin *Eudyptula minor*. A large and significant breeding colony is located at Phillip Island, and small numbers have been recorded breeding within Western Port at Barralier Island (Melbourne Water 2011). Little Penguins that breed on Phillip Island are less likely to use Western Port for foraging compared with those that breed in the small colony at Barralier Island, which undertake most of their foraging within Western Port (Dann et al. 2001; Melbourne Water 2011).

The following factors are some of the natural and anthropogenic influences that may affect the seasonal, annual and long-term variability in waterbird usage of Western Port as a whole. Some of them will also affect internal distribution and usage within Western Port. These effects are widely discussed in the literature.

- Continental and regional drought and rainfall events.
- Natural environmental variables affecting breeding success at distant breeding sites.
- Climate change.
- Freshwater flow regulation and water extraction.
- Variable abundance of prey species within and outside Western Port.

- Loss of key wetland sites due to human developments, such as major wetland reclamation in north Asia.
- Commercial and recreational fishery impacts on waterbird prey species and by-catch of pelagic birds.
- Recreational use of coastal locations by people and companion animals.
- Industrial development, shipping and associated disturbances (e.g. noise and light).

A total of 115 waterbird species considered critical to the character of the Ramsar site have been recorded within Western Port Ramsar site, with total numbers of waders and other non-pelagic waterbirds exceeding 20,000 in 80 per cent of years surveyed (Western port Bird Survey 1973 – 2015, as reviewed in Hale 2016).

Western Port is one of very few Australian sites where waterbirds groups have been counted systematically for over 35 years (Melbourne Water 2011) and, as such, population trends are relatively well understood. Of a total of 39 waterbird species (excluding seabirds) documented for Western Port, the population trend for 22 species declined between 1973-2015 while it remained stable overall for 15 species (despite fluctuations and some changes in distribution) and increased for two species (Pied Oystercatcher and Red-necked Avocet, Loyn et al. in Melbourne Water 2018).

The declines were mainly in populations of trans-equatorial migratory shorebirds. These declines may be due to habitat loss on migratory flyways in north Asia, particularly the Yellow Sea (Studds et al 2017). Fish-eating terns, cormorants and pelicans have decreased in Western Port, and Little Pied Cormorant declined in the late 1970s in association with seagrass dieback. Crested Tern decreased in the 1980s and 1990s. Fairy Tern and Little Tern also declined around the same time (Loyn et al. in Melbourne Water 2018).

Distribution of some species within the confines of Western Port has been shown to have altered over time. Several species of waterbirds declined in the central-east part of the bay along with major loss of seagrass. However, this area is now consistently used by four formerly rare species; Red-necked Avocet, Banded Stilt, Whiskered Tern and Gull-billed Tern, which suggests they have suitably adapted to new habitats involving open mudflats and shallow waters without seagrass (Loyn et al. in Melbourne Water 2018).

Important habitat for migratory and resident shorebirds in Western Port comprises 27,000 hectares of intertidal mudflats, used for foraging, and adjacent higher areas used for roosting (Melbourne Water 2011). Shorebird roosting sites are distributed around the shorelines of Western Port. Many of the roosts act in tandem and most are associated with extensive and adjacent intertidal feeding areas. The roosts are usually undisturbed sites with clear views of approaching terrestrial and aerial predators, and close to intertidal feeding areas with long tidal exposure times (Melbourne Water 2011).

Hansen et al. (2011) document various sites within Western Port that were the focus of shorebird and waterbird monitoring undertaken every year for 37 years. They also document locations of high-tide roosts, and areas of primary and secondary foraging habitats. These are identified and detailed in Hansen et al. (2011) and summarised in their figures reproduced here as Figure 4 and Figure 5. High-tide roosts were monitored because they are known to support substantial congregations of birds at various times. All but one of these sites (Hanns Inlet) are high-tide locations where shorebirds and other waterbirds congregate to roost whilst their foraging habitat on the intertidal mudflats is submerged. Distances from the closest point of these key locations to the Gas Import Jetty Works study area are provided in Table 21.



Figure 4 Distribution of waterbird monitoring sites within Western Port and their relative 'importance', based upon rankings of total abundance and number of species. (Reproduced from Hansen *et al.* 2011).

In Figure 4, green circles show the three highest-ranked locations of key habitat (Hansen *et al.* 2011), red circles show the eight lowest-ranked sites, and the yellow circles are sites intermediate in importance. The different circle sizes have no meaning other than grouping site(s) in the approximate geographic area within which they occur (B. Hansen pers. comm.) Blue shading indicates the Western Port Ramsar Site. Individual monitoring sites are shown as small blue circles. The black star indicates the location of Crib Point Jetty.

There are no high tide roost sites known to occur between Hastings and Sandy Point (Figure 5). No waders or waterbirds were observed roosting at Woolleys Beach to the north and south of the Crib Point jetty, during surveys undertaken by Biosis in March 2019 (Section 4.1.4.2). Only one species (Pied Oystercatcher) was recorded during high tide surveys undertaken in January and February 2020. Mangroves occur along the coastal zone to the north and south of the jetty and these areas may provide roosting and foraging sites for species such as cormorants, egrets, ibis, herons and spoonbills. Woolleys Beach is easily accessed by the public and subject to human visitation at times, including with companion dogs, and is unlikely to provide beach roosting habitat.

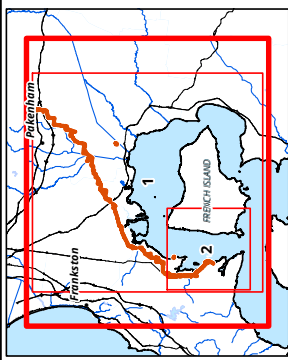
A program of waterbird surveys has been undertaken over many years by Birdlife Australia. Their surveys have been focused on identified locations of importance to waterbirds, primarily these are roost sites. Table 20 identifies the region and location of Birdlife Australia surveys over the 37 years of their monitoring and the distances from the proposed FSRU location.

Table 20 Straight-line distances from the proposed FSRU at the Crib Point Jetty to locations of waterbird roost sites and primary foraging habitat (distance is given to closest point of roost site where a locality has both roost and foraging habitat)

Name/Location	Direction from FSRU & location	Roost site	Primary foraging area	Distance to the proposed FSRU location
Crib Point (nearest extension of primary foraging habitat)	NE, Mainland		✓	0.6 km
Hanns Inlet / Stoney Point	SW, Mainland		✓	2.2 km
Hastings Bight (offshore from Warringine Park)	NW, Mainland		✓	3.3 km
Long Island Spit	N, Mainland	✓	✓	3.8 km
Fairhaven	E, French Is.	✓	✓	4.0 km
Sandy Point (former survey site)	S, Mainland	✓		5.9 km
Tortoise Head	SE, French Is.	✓	✓	7.1 km
North-west French Island	NE, French Is.	✓	✓	8.8 km
Barralliar Island & nearby reefs	NE, French Is.	✓	✓	10.8 km
Reef Island & nearby parts of Bass Bay	SE, Mainland	✓	✓	20.3 km
Yallock Creek	NE, Mainland	✓	✓	24.3 km
Stockyard Point	E, Mainland	✓	✓	25.2 km
North Pioneer Bay	E, Mainland	✓	✓	26.9 km
Central Pioneer Bay	E, Mainland	✓	✓	28.0 km

Roost sites and primary and secondary foraging habitat are depicted in (Hansen et al 2011) and shown here in Figure 5. It is important to note that areas of habitat shown are directly as mapped in the source document. In some cases they are not precise and in the immediate area of Crib Point, secondary foraging habitat for waterbirds is mapped as extending inland to encompass the land area of the Crib Point Receiving Facility and land to its north and south. In reality, foraging habitat for waterbirds will not extend landward from the beach or high tide line.

Recent data obtained as part of the Shorebirds 2020 program operated by Birdlife Australia does not contain any records of rare species from Woolleys Beach and Jack's Beach (in this regard, rare refers to those species listed in Table 19 that are not commonly encountered). All records around the Gas Import Jetty Works study area are of relatively common species.



Legend

Study area

Pipeline Works

Gas Import Jetty Works

Important waterbird habitat

(from Figure 16 of Hansen et al. 2011)

Primary foraging habitat

Secondary foraging habitat

Roosting sites

Figure 5.1 Overview of important waterbird habitat within Western Port

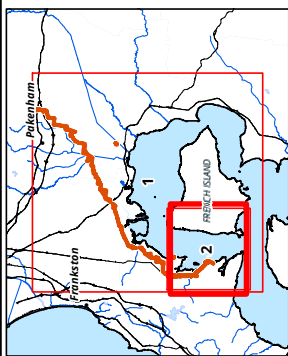


Scale: 1:160,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



Number: 38957
Date: 22 May 2020
Checked by: CPM, Drawn by: LW, Last edited by: Wilson
Location: P:\38957\38957 Mapping\18957_15_WaterbirdHabitat.mxd



- Legend**
- Study area**
- Pipeline Works
 - Gas Import Jetty Works
- Important waterbird habitat**
- (from Figure 16 of Hansen et al. 2011)
- Primary foraging habitat
 - Secondary foraging habitat
 - Roosting sites

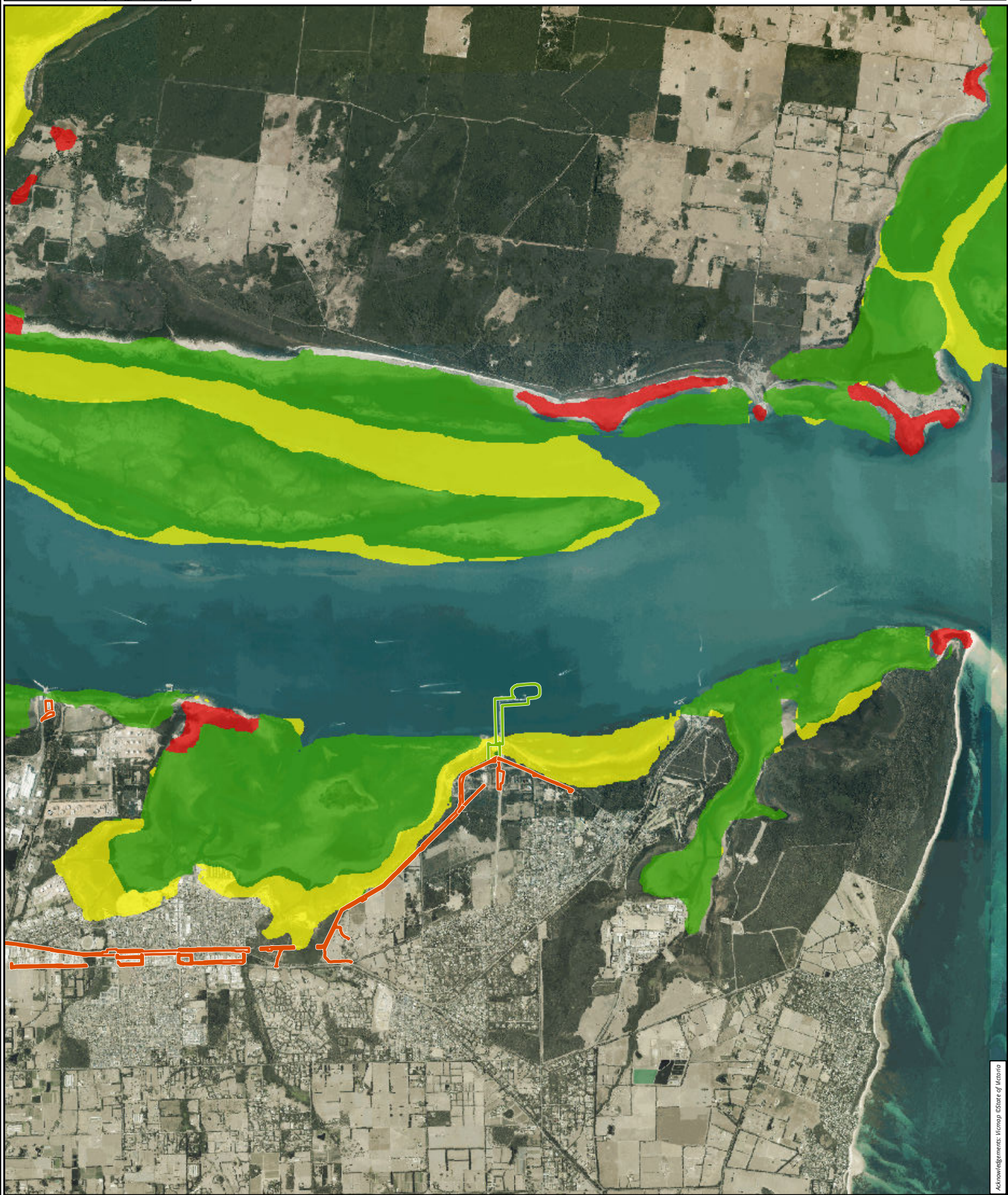


Figure 5.2 Important waterbird habitat within Western Port

0 0.5 1 1.5 2 2.5
Kilometers

Scale: 1:50,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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Seabirds

Seabirds are those that spend significant time foraging at sea, and include species that dive and others that take prey at the surface. For diving birds the important feeding areas of Western Port include the subtidal areas in the western, northern and eastern arms with particular concentrations in the western arm (Dann et al. 2003) and the confluence of the three arms, located off the coast of Tortoise Head, French Island (Dann et al. 2001). Species that take prey on the surface of the water, like albatrosses, surface-plunging species (terns), shallow-plunging species (gannets) and pursuit-plunging species (shearwaters) are found more commonly in the deeper western arm of Western Port (Melbourne Water 2011). These observations are consistent with the species recorded roosting on the Crib Point Jetty, such as terns and cormorants (shallow plunging), that would have easy access to the western arm of Western Port from Crib Point Jetty.

5.1.6.4 Western Port environment adjacent to the Gas Import Jetty Works study area at Crib Point Jetty

The location proposed for the FSRU is on Crib Point Jetty within the deep-water channel approximately 500 metres offshore from the intertidal zone. Crib Point Jetty is located on a short portion of coast where the shoreline is particularly close to permanent deep water and the intertidal zone is narrow by comparison with much broader intertidal zones elsewhere within much of Western Port. Habitats associated with the marine environment of Western Port are described by CEE (2020).

The shoreline to the north of Crib Point Jetty contains scattered occurrences of Grey Mangrove, while further north along Woolleys Beach and closer to Jack's Beach there are pockets of Mangrove Shrubland EVC. The NVIM system models the area at Crib Point as having Coastal Saltmarsh or Mangrove EVCs, but field investigations by Biosis did not identify those EVCs in the area.

Surveys by Biosis within Western Port along the Crib Point Jetty in March 2019 did not record any migratory species. Results from wader and waterbird surveys undertaken in the areas immediately adjacent to the Crib Point Jetty are provided at Section 5.1.3.1. Data collected as part of the Shorebirds 2020 program containing migratory bird records were obtained from Birdlife Australia in June 2019. Neither of these sources of data indicate that migratory birds nor any listed species of other waterbirds make significant usage of habitats within the intertidal zone extending to approximately one kilometre to the north and south of Crib Point Jetty.

Habitat values for waterbirds within Western Port are mapped by Hansen et al. (2011, refer also to Figure 5). To the south of the jetty secondary foraging habitat extends for approximately 2 kilometres and the closest primary foraging habitat extends south of Stony Point. To the north of the jetty secondary foraging habitat extends in a band approximately 250 metres wide, seaward from the high tide line. Primary foraging habitat occurs in a zone to the north and seaward of the secondary habitat, commencing approximately 250 to 300 metres north of the nearest part of the jetty and a similar distance to the north-east of the Crib Point Receiving Facility. The proposed FSRU berth located on the existing jetty is approximately 600 metres from the closest mapped primary foraging habitat. The closest identified waterbird roost locations to Crib Point Jetty are at Long Island Spit in the north of Hastings Bight and between Fairhaven and Tankerton Pier on French Island. These sites are approximately 3.8 and 4 kilometres, respectively, from Crib Point Jetty.

5.2 Pipeline Works

5.2.1 Previous assessments

Previous ecological assessments relevant to the proposed Pipeline Works are listed below along with a summary of the methodology and results for each report. Full references are available in Section 10.

A map outlining survey locations by Monarc Environmental (mentioned in this section) is provided in Figure 6.

Biosis 2019d. Crib Point to Pakenham pipeline: Water quality and Dwarf Galaxias targeted surveys

Targeted survey for Dwarf Galaxias *Galaxiella pusilla* was conducted at 10 locations from 22 to 24 January 2019, and from 13 to 15 February 2019 within areas of suitable habitat, including:

- Warringine Creek (KP 4.85)
- Watson Creek (KP 18.9)
- Pearcedale South Creek (KP 19.2)
- Langwarrin Creek (KP 21)
- Lachies Marsh (KP 21.1)
- Rutherford Creek (KP 29.57)
- Western Outfall Drain (KP 31.54)
- Cardinia Creek (KP 40.1)
- Hagelthornes Drain (KP 45.25; dry during assessments)
- Pakenham Creek (KP 49.22).

Surveys were conducted using bait traps, which were left overnight for no longer than 12 hours.

No Dwarf Galaxias were recorded within any of the survey locations. Common Galaxias *Galaxias maculata*, a closely related native species was found at five of the locations, and the introduced *Gambusia holbrooki* was recorded at most locations.

Presence of Dwarf Galaxias can be unpredictable, even within apparently suitable habitat, therefore in order to adopt a conservative approach, for the purposes of this report it is assumed likely that Dwarf Galaxias utilise the surveyed habitats, despite no observations being recorded.

In-situ water samples were taken from each survey location. Sampling was undertaken using a Horiba U-52 water quality meter and the following parameters were recorded:

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

All water quality measurements were taken in accordance with the EPA publication *IWRG701: Sampling and analysis of waters, wastewaters, soils and wastes* (EPA 2009). Survey was undertaken in accordance with EPBC Act survey guidelines for Australia's threatened fish (Commonwealth of Australia 2011b)

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

Biosis 2019b. Crib Point to Pakenham pipeline: Flora survey report for River Swamp Wallaby-grass.

Targeted surveys were conducted on 14 December 2018, 15 January 2019 and 12 February 2019 across areas determined to have a moderate or higher likelihood of supporting River Swamp Wallaby-grass. One of the locations is known to support the species and the site was surveyed to determine the total number of individuals. River Swamp Wallaby-grass was not recorded at other locations within the study area.

A total of 95 plants were recorded within Swamp Scrub (EVC 53) adjacent to Mckirdys Road, Tyabb at KP 13.6.

Biosis 2019c. Crib Point to Pakenham pipeline: Flora survey report.

Flora surveys completed by Monarc Environmental (2018) identified a high or moderate likelihood of the following threatened flora species being present within the Pipeline Works study area:

- Dense Leek-orchid *Prasophyllum spicatum* (EPBC Act vulnerable)
- Swamp Fireweed *Senecio psilocarpus* (EPBC Act vulnerable)
- Swamp Everlasting *Xerochrysum palustre* (EPBC vulnerable, FFG Act listed)
- Merran's Sun-orchid *Thelymitra X merraniae* (FFG Act listed, endangered in Victoria).

Monarc Environmental (2018) were unable to find these species in the study area as the survey time was not within the flowering period for any of these species. Based on recommendations by Monarc Environmental Biosis undertook targeted flora surveys undertaken at the following locations and kilometre points (KPs):

- KP 1–2 within the former BP terminal (Crib Point)
- KP 33.4–33.5: near Muddy Gates Lane and Manks Road and the former South Gippsland Railway Line
- KP 2.9 to 5.0 within the proposed pipeline alignment within Warringine Park.

Surveys were undertaken on 12 October 2018, 22 October 2018, 1 November 2018, 14 December 2018 and 15 January 2019 in order to maximise the likelihood of locating flowering plants. Each survey involved at least two observers experienced in field identification of the target species. Species name and GPS location were recorded for each targeted species encountered, and photos were taken of the general area. There are database records of all species within the Project search area, including records immediately adjacent to the Pipeline Works study area.

Field assessments for threatened orchids were conducted according to the draft *Survey Guidelines for Australia's threatened orchids: Guidelines for detecting orchids listed as 'threatened' under the Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia 2013b).

Merran's Sun-orchid was recorded within the Pipeline Works study area adjacent to Woolleys Road, Crib Point. None of the other target species were recorded during targeted surveys. Further detailed survey of sun-orchids at Crib Point was subsequently undertaken (refer to sections 4.1.4.1 and 5.2.4)

Monarc Environmental 2018a. Flora and Fauna Assessment. Crib Point to Pakenham Pipeline

This assessment included most of the pipeline alignment with some exceptions, notably south of Crib Point, through Hastings and a small number of minor design alterations along the length of the Project.

The assessments involved the review of background information and public databases, including Victoria's Planning Schemes Online, the VBA, the GDE Atlas, and the PMST. The report compiles the results of targeted surveys for Southern Brown Bandicoot, Growling Grass Frog, Southern Toadlet, Swamp Skink and the aquatic surveys (all listed further below).

The surveys detected a range of ecological values protected under State and Commonwealth legislation or policy. These included a number of EPBC Act listed flora and fauna, and identified suitable habitat for a number of additional threatened species.

In total, 201 flora species, including 118 indigenous species, 13 non-indigenous natives and 70 introduced species were recorded. One individual tree identified as a Strzelecki Gum *Eucalyptus strzeleckii* was recorded within the Project Area near Langwarrin Creek. Three threatened species of flora; Dense Leek-orchid, Swamp Fireweed and Swamp Everlasting were predicted to occur within suitable habitat in the pipeline alignment. These species were the subject of the targeted surveys conducted by Biosis (2019); as outlined above.

The construction ROW was found to intersect 91 patches of vegetation, of which 46 were impacted by the pipeline alignment, which has since been revised. The remaining 45 patches were to be avoided using HDD and other design modifications.

One EPBC Act listed community, *Subtropical and Temperate Coastal Saltmarsh*, was recorded in one location (habitat zone 1) near South Boundary Road East, Pearcedale (KP 20.2).

The report identified that most of the Pipeline Works study area contained low habitat value for native fauna. However, a range of habitat features for Southern Brown Bandicoot, Growling Grass Frog, Dwarf Galaxias and Australian Grayling were present within the Pipeline Works study area.

Habitat for Southern Brown Bandicoot includes linear patches of vegetation along paddock edges and roadsides north of Watson Creek at eight general (10 specific) locations, including specific KP's 34.6, 35.4, 37.1, 40, 40.4, 40.8, 41.3, 41.6, 43, and 46.3. Southern Brown Bandicoot was assumed to be present at a further eight locations based on proximity to known populations or records from the targeted surveys, including KP's 33.4, 33.4 (road reserve), 33.5, 37.5, 46.25, 46.5, 48.4 & 48.4 (road reserve). Figure 16 displays Southern Brown Bandicoot habitat within the impact area.

Growling Grass Frog habitat was determined to be present within Cardinia Creek at the end of Bloomfield Lane (KP 40.1) and assumed present in Cardinia Creek to the south of Ballarto Road, where an adjacent access track is proposed to be used during the construction phase.

Dwarf Galaxias was noted to have habitat at Warringine Creek, Watson Creek, Pearcedale South Creek, Langwarrin Creek, Lachies Marsh, Craigs Lane Drain, Western Outfall Drain, Cardinia Creek, Toomuc Creek, Deep Creek and Pakenham Creek.

Australian Grayling habitat was not noted following surveys at the above locations.

Eight threatened fauna species were recorded within the Pipeline Works study area, these were: Growling Grass Frog, Southern Brown Bandicoot, Southern Toadlet *Pseudophryne semimarmorata*, Australasian Shoveler *Anas rhynchos*, Glossy Grass Skink *Pseudemoia rawlinsoni*, Hardhead *Aythya australis*, Lewin's Rail *Lewinia pectoralis pectoralis* and Eastern Great Egret.

The report concluded that the Pipeline Works were not likely to constitute a significant impact for any EPBC Act listed species once mitigation measures are implemented.

Monarc Environmental 2018b. Southern Brown Bandicoot Targeted Survey Report. Gas Import Jetty Facility and Crib Point to Pakenham Gas Pipeline

This study was undertaken between March 2018 and August 2018 and involved 134 camera survey weeks across 35 sites within or adjacent to the pipeline alignment.

Southern Brown Bandicoot are known from areas that traverse and are adjacent to the pipeline alignment. The majority of the pipeline falls within the Southern Brown Bandicoot Management Area as defined in the Sub-Regional Species Strategy (DEPI 2014). Surveys for the Southern Brown Bandicoot were conducted in accordance with the Australian Government *Survey guidelines for Australia's threatened mammals* (Commonwealth of Australia 2011c). Surveys consisted of:

- Daytime searches for potentially suitable habitat, such as areas with a dense understorey and thick ground-cover.
- Daytime searches for signs of activity, including tracks, scats, nests and diggings.
- Baited camera traps.

Southern Brown Bandicoot were recorded, or assumed to be present, at 16 of the 35 areas containing suitable habitat. This included eight positive recordings, with the remaining eight locations as assumed presence due to recent records.

All positive sightings were recorded between KP 34.6 (Manks Road, Tooradin) and KP 46.3 (Hagelthornes Drain, Cardinia), however the locations with assumed presence extend either side of these locations based on recent records within proximity to these locations.

Monarc Environmental 2018c. Growling Grass Frog Targeted Survey Report. Gas Import Jetty Facility and Crib Point to Pakenham Gas Pipeline

Growling Grass Frog surveys were undertaken during March 2018 in accordance with EPBC Act survey guidelines for the species (Commonwealth of Australia 2009). Surveys were undertaken at seven sites over four nights during suitable conditions. Water quality was also recorded at each site, and deemed to be suitable to support Growling Grass Frog. A further five sites were identified for targeted survey, however field-assessments determined that the locations did not support suitable habitat.

The surveys used a combination of standard methods such as:

- Active searching with spotlights in appropriate habitat.
- Call recording and call playback (using the advertising call of the male).
- Searching banks and emergent vegetation.

Growling Grass Frog was recorded at Cardinia Creek at the end of Bloomfield Lane (KP 40.1; refer to Figure 7). The species is also assumed to be present in Cardinia Creek approximately 900 metres to the north-west, where an existing access track runs adjacent to the waterway which is proposed to be used during the construction phase of the Pipeline Works.

Since these surveys were undertaken, Pipeline alignment revisions resulted in two additional farm dams being included in the Pipeline Works impact area that had not been surveyed by Monarc Environmental in 2018. Biosis therefore undertook targeted survey at these locations in February 2020, including a naturally occurring wetland on Council-managed land adjacent to the Pipeline Works impact area. Further information on these surveys is provided in Section 4.1.4.2 (*Methodology*) and 5.2.3.1 (*Results*).

Monarc Environmental 2018d. Aquatic Survey Report. Gas Import Jetty Facility and Crib Point to Pakenham Gas Pipeline

This study was undertaken at 16 waterbodies, including Warringine Creek, Watson Creek, Pearcedale South Creek, Langwarrin Creek, Lachies Marsh, a farm dam and connected drainage channel at KP 21.5, Vowell Drive (two locations), Craigs Lane, Rutherford Creek, Western Outfall Drain, Cardinia Creek (two locations), Toomuc Creek, Deep Creek, Pakenham Creek. The aim was to determine if any fish or other aquatic species listed under the EPBC Act or FFG Act were present in the waterbodies.

Eight two-day/one-night surveys were conducted on 16-17 April 2018, 14-15 May 2018, 25-26 June 2018 and 26-27 July 2018. The surveys used a combination of visual observation, hand-held dip-netting, bait traps, fyke netting and electrofishing as well as in-situ water quality sampling.

Three species: Dwarf Galaxias, Australian Grayling and Flatback Mangrove Goby *Mugilogobius platynotus* were identified as having a high likelihood of occurring within the Pipeline Works study area.

None of these species were detected during the field surveys for this assessment. Aquatic survey locations are provided in Figure 10.

Monarc Environmental 2018e. Swamp Skink Targeted Survey Report. Gas Import Jetty Facility and Crib Point to Pakenham Gas Pipeline

This study was undertaken between February 2018 and mid-March 2018. It included Elliot Traps set over a period of six days, as well as camera traps operating for 21 days.

Records from a VBA search undertaken by Monarc Environmental indicate that Swamp Skink *Lissolepis coventryi* is known to occur within 300 metres of the pipeline alignment, and that 69 additional sightings occurred within 5 kilometres of the pipeline alignment, predominantly at Watson Creek and Warringine Park (KP 2.9 to 5.0).

A desktop review was undertaken to determine likely presence and habitat along the alignment, the results of which were used to identify three sites for targeted survey; two within Warringine Park (KP 4.1 & KP 4.88) and one at South Boundary Road East, Pearcedale (KP 20.3). While suitable habitat was also identified within Watson Creek, this area was not surveyed due to impacts being avoided at this location through the use of HDD between KP 18.76 and KP 19.37.

Targeted surveys for Swamp Skink were conducted in accordance with recommendations contained within the *Biodiversity Precinct Structure Planning Kit* (DSE 2010) using:

- Infra-red cameras.
- Motion sensing cameras.
- Elliott Traps.

No Swamp Skinks were recorded at any of the survey sites during the targeted surveys.

Monarc Environmental 2018f. Southern Toadlet Targeted Survey Report. Gas Import Jetty Facility and Crib Point to Pakenham Gas Pipeline

This survey was undertaken at eight locations on 23 and 24 May 2018 during nocturnal hours (Figure 6). The surveys combined listening, call playback and active searching with spotlights.

Southern Toadlet surveys were undertaken in accordance with the methodology prescribed in the *Biodiversity Precinct Structure Planning Kit* (DSE 2010). Survey techniques included:

- Listening for calls.

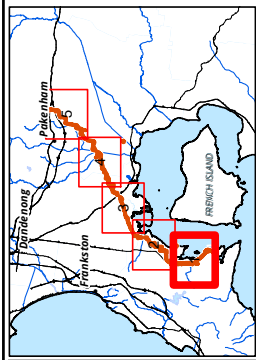
-
- Call-playback (using the advertising calls of male Southern Toadlet).
 - Active searching.
 - Spotlighting.

Southern Toadlet was recorded at one location adjacent to KP 2.2 on the western side of a pond bank to the west of the Pipeline Works study area (refer to Figure 7). A number of other amphibians were recorded, including Common Froglet *Crinia signifera* which was recorded at all eight survey locations.

Biosis Research 2007. Targeted Southern Brown Bandicoot *Isoodon obesulus obesulus* survey at the proposed bitumen storage plant, Crib Point, Victoria.

Targeted surveys were conducted for this species at a site adjacent to Woolleys Beach reserve in the vegetation immediately north of the Gas Import Jetty Works study area. No bandicoots were recorded, however it was concluded that the northern boundary of the site and adjacent foreshore reserve to the north and south supported suitable habitat. This assessment also concluded that the existing disturbed environment with the Gas Import Jetty Works study area, does not provide current habitat for Southern Brown Bandicoot, and development of this area would not constitute a significant impact.

It was considered that movement of Southern Brown Bandicoot through the site is already impeded by the existing modified conditions, and that it is unlikely to persist in this area.



Legend

- Kilometre point
- Study area
- Pipeline Works
- Gas Import Jetty Works
- Monarc's targeted survey locations**
- Aquatic fauna
- Southern Brown Bandicoot
- Southern Toadlet
- Ramsar site**
- Western Port

Figure 6.1 Targeted survey locations used by Monarc locations used by Monarc Environmental (previous assessments)

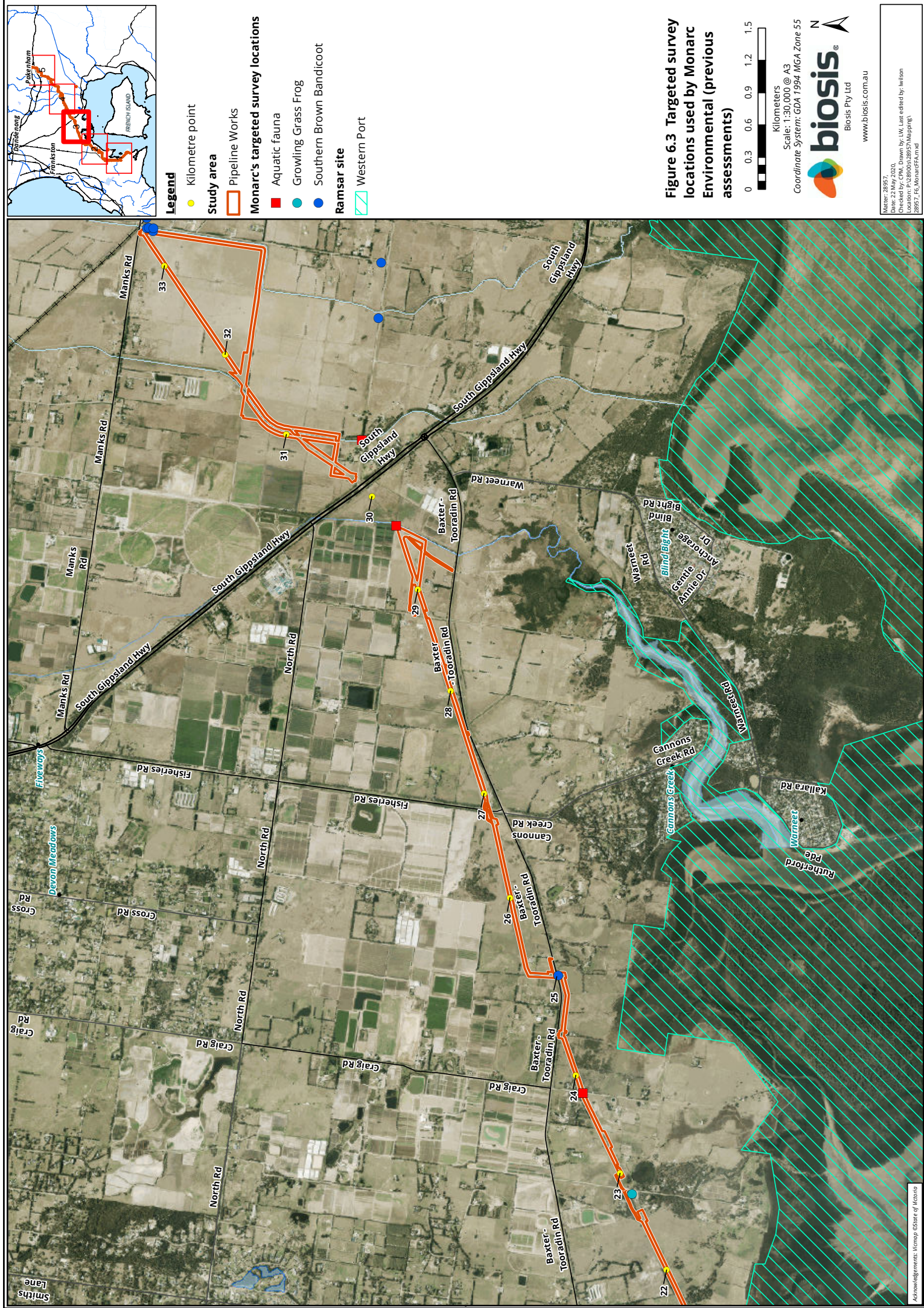


Kilometers
Scale: 1:30,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



Matrix: 38957
Date: 22 May 2020
Checked by: CPM, Drawn by: LW, Last edited by: Wilson
Location: P:\389005\38957\Mapping\38957_15_MonarcPlan.mxd





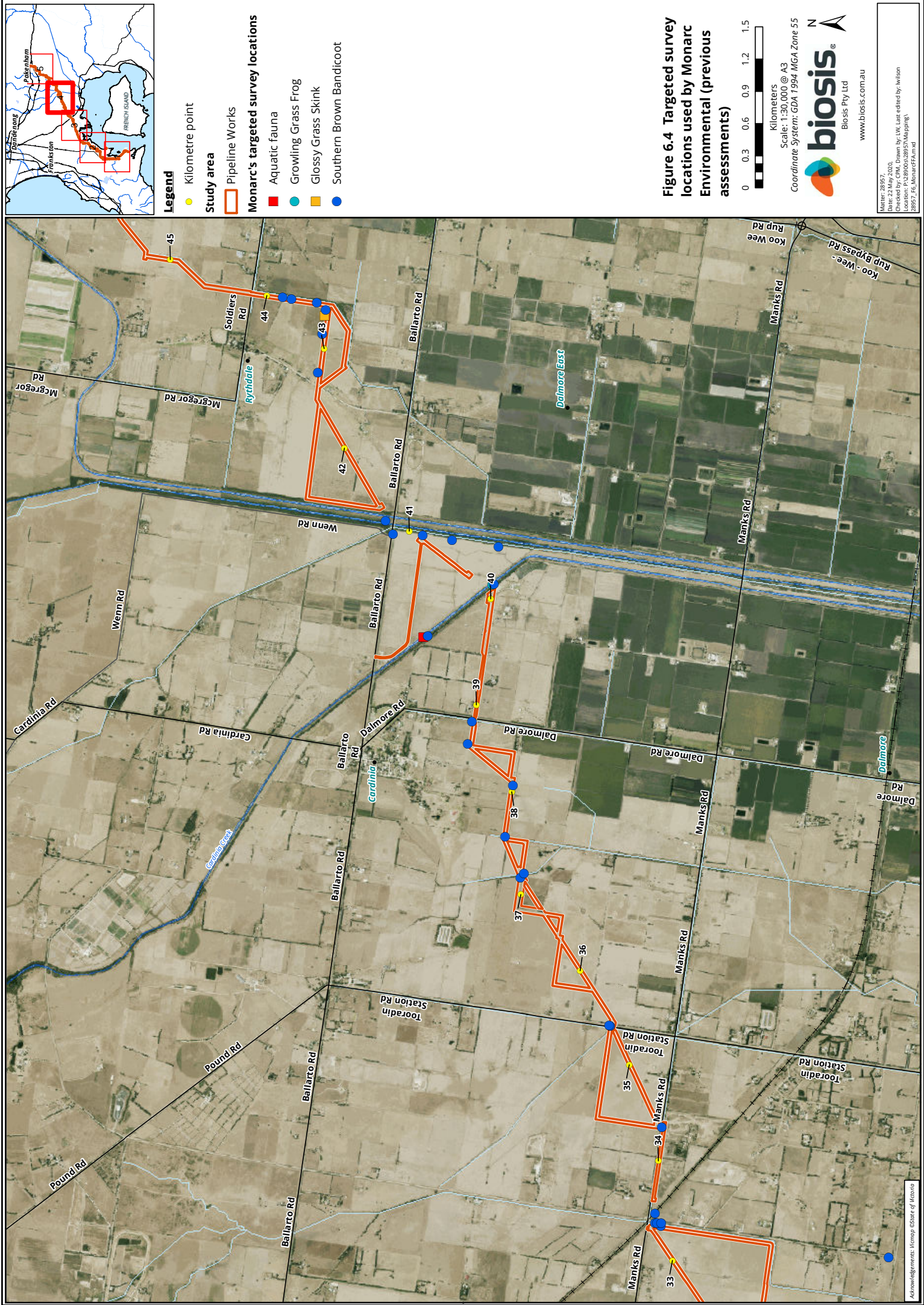


Figure 6.4 Targeted survey locations used by Monarc Environmental (previous assessments)

0 0.3 0.6 0.9 1.2 1.5
Kilometers
Scale: 1:30,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

biosis
Biosis Pty Ltd
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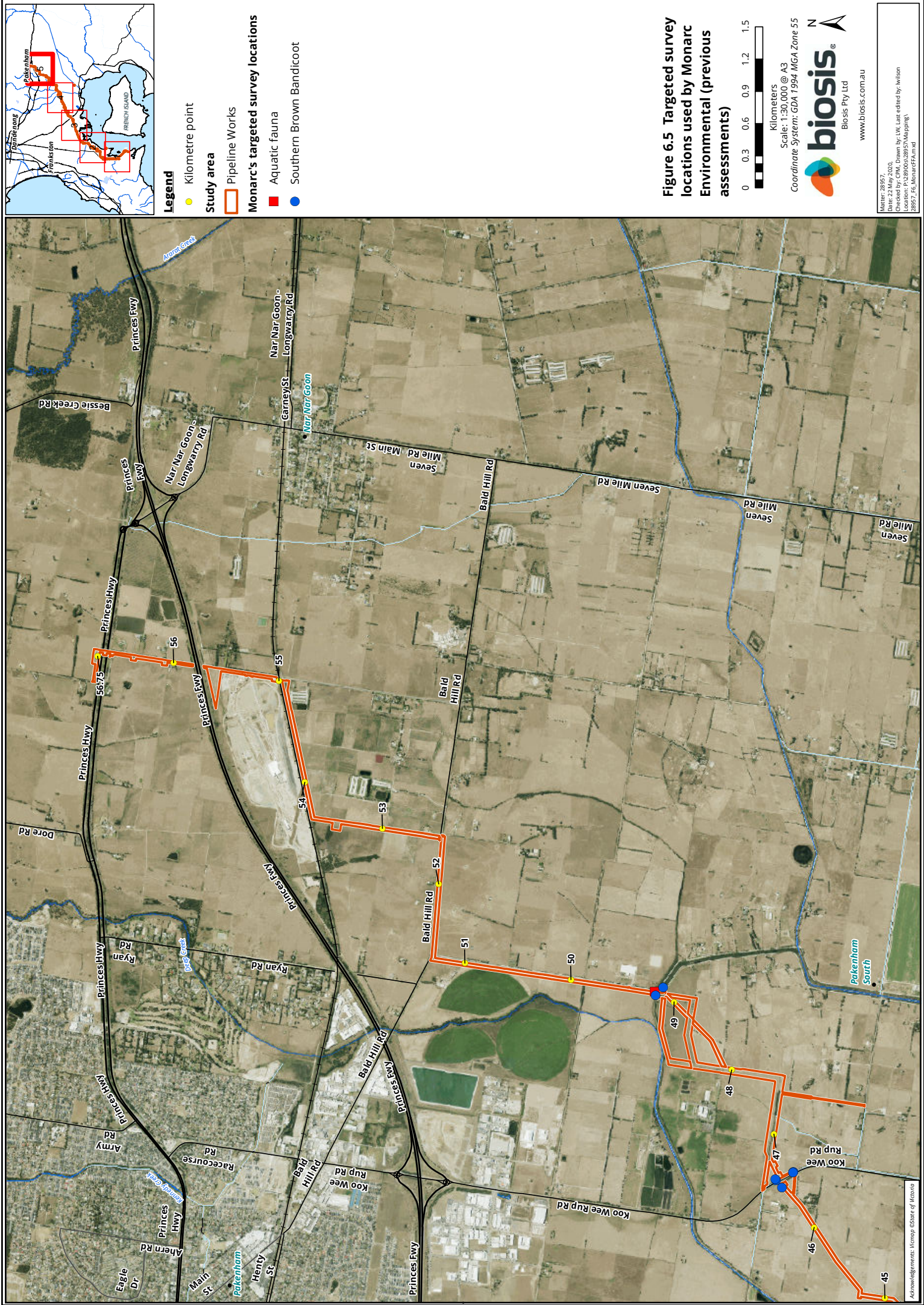


Figure 6.5 Targeted survey locations used by Monarc Environmental (previous assessments)

Kilometers
Scale: 1:30,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55
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5.2.2 Flora

5.2.2.1 Recorded species

A total of 186 indigenous and 88 introduced flora species was recorded within the Project Area by Biosis and Monarc Environmental (2018a) (Appendix 1). The number of species recorded specifically from within the Pipeline Works study area was not noted, as these previous assessments considered the Project Area as a whole. The Pipeline Works impact area contains a variety of habitat types and supports the majority of flora species recorded by these assessments, particularly those associated with cleared agricultural land, aquatic systems, riparian vegetation and the EVCs not within the Gas Import Jetty Works study area, such as Damp Sands Herb-rich Woodland and Coastal Saltmarsh.

5.2.2.2 Ecological vegetation classes (EVCs)

Eleven EVCs were recorded within patches in the Pipeline Works impact area, comprising a combined extent of 12,300 hectares. The remainder of the Pipeline Works impact area does not support any EVCs. In addition, a total of 48 large patch trees, 29 large scattered trees and 50 small scattered trees are recorded within the Pipeline Works impact area. EVC locations are mapped in Figure 2 and Figure 9 and briefly described below. EVCs are also described in Monarc Environmental (2018a).

Aquatic Herbland (EVC 653)

One habitat zone (HZ42) of Aquatic Herbland occurs within the Pipeline Works study area at KP 16.2 in a farm dam. This is the only occurrence in the Project study area.

The vegetation is a herbland dominated by Water-ribbons *Cycnogeton* sp. in an area that receives fresh groundwater.

Aquatic Herbland is not assigned a Bioregional Conservation Status within the Gippsland Plain bioregion by DELWP. While natural occurrences would be considered Endangered, examples including those in created wetlands, such as farm dams at HZ42, are considered Least Concern here.

Coastal Saltmarsh (EVC 009)

One habitat zone (HZ1) of Coastal Saltmarsh occurs within the Pipeline Works study area at KP 20.2, the only occurrence in the Project study area.

The vegetation is a succulent herbland dominated by Beaded Glasswort *Sarcocornia quinqueflora* in an area that receives saline groundwater.

Coastal Saltmarsh is categorised as Least Concern within the Gippsland Plain bioregion. It corresponds to the EPBC Act listed subtropical and temperate coastal saltmarsh ecological community, which is listed as vulnerable.

Damp Heathy Woodland (EVC 793)

Two habitat zones of Damp Heathy Woodland are present within the Pipeline Works study area, both at Crib Point between KP 0.4 and KP 1.8 (Figure 2).

The largest habitat zone (HZ8), between KP 1.13 and KP 1.8, consists of a mosaic of typical and atypical vegetation type as a result of past management practices within the ESSO pipeline alignment. If left, with time it would develop back into Damp Heathy Woodland across the entire extent of this area. However, currently some areas are slashed regularly to ensure trees do not persist.

This slashed pipeline easement is the only habitat for Merran's Sun-orchid, Pallid Sun-orchid and Gaping Sun-orchid within the study area. Eleven species of sun-orchid are recorded along the pipeline easement.

A number of native species are present including Yellow Hakea *Hakea nodosa*, Burgan Kunzea *leptospermoides*, Sword Sedge *Lepidosperma* spp., Prickly Tea-tree *Leptospermum continentale* and Kangaroo Grass *Themeda triandra*. A range of introduced species include Blackberry, Bluebell Creeper *Billardiera heterophylla*, Black Nightshade *Solanum nigrum*, Radiata Pine *Pinus radiata* and Pampas Grass *Cortaderia selloana*.

Damp Heathy Woodland is categorised as Vulnerable within the Gippsland Plain bioregion.

Damp Sands Herb-rich Woodland (EVC 003)

One habitat zone of Damp Sands Herb-rich Woodland is present within the Pipeline Works study area in Tyabb at KP 9.5 (Figure 2).

This habitat zone (HZ2) does not fit the EVC benchmark description as it is a heavily modified derived grassland form. The EVC was assigned due to the underlying pre-1750 EVC mapping based on models by DSE (2004), coupled with the presence of Rough-barked Manna Gum *Eucalyptus viminalis* subsp. *pyroriana* in the nearby landscape. This area only supports wallaby grasses *Rytidosperma* spp., with a range of introduced flora, including Flatweed *Hypochaeris radicata* and Brown-top Bent *Agrostis capillaris*.

Damp Sands Herb-rich Woodland is categorised as Vulnerable within the Gippsland Plain bioregion.

Estuarine Scrub (EVC 953)

One habitat zone (KOJH28) of Estuarine Scrub is present within Pipeline Works study area at KP 20.1, near South Boundary Road East, Pearcedale (Figure 2).

This habitat zone was recorded by Monarc Environmental (2018) as Swamp Scrub, however due to the presence of Swamp Paperbark with an understorey of Rounded Noon-flower *Disphyma crassifolium*, Beaded Glasswort *Sarcocornia quinqueflora* and Trailing Hemichroa *Hemichroa pentandra* it is correctly classified as Estuarine Scrub.

Estuarine Scrub is not assigned a Bioregional Conservation Status within the Gippsland Plain bioregion by DELWP. This EVC is considered to be Vulnerable here.

Grassy Woodland (EVC 175)

Twenty-three habitat zones of Grassy Woodland are present within the Pipeline Works study area.

Grassy Woodland within the proposed pipeline alignment is of varying quality, with the most notable differences between patches being the difference in canopy cover and numbers of large trees. Generally the understories are of low to moderate quality and weed cover is high. Common native species include Swamp Gum, Narrow-leaf Peppermint *Eucalyptus radiata* and Weeping Grass *Microlaena stipoides*. Weeds include Capeweed *Arctotheca calendula*, Panic Veldt-grass *Ehrharta erecta* and Sheep Sorrell *Acetosella vulgaris*.

The largest habitat zones are around Hastings, starting at Warringine Park at KP 4.9, extending sporadically all of the way to KP 8.3. One other patch occurs in Somerville at KP 17.2 (Figure 2).

Grassy Woodland is categorised as Endangered within the Gippsland Plain bioregion.

Heathy Woodland (EVC 048)

Fifteen habitat zones of Heathy Woodland were recorded within the Pipeline Works study area.

These habitat zones are of extremely varied quality, ranging from areas of mainly understorey species, to areas containing high cover of large trees and understorey. However, while some areas support a reasonable diversity of native grasses and herbs, such as Flat Pea *Platylobium* spp., Horny-cone Bush *Isopogon ceratophyllus* and Black-anther Flax-lily *Dianella revoluta*, the patches are generally low in diversity of species. The largest habitat zones are found at Crib Point around KP 0 (including south along The Esplanade), KP 2.2, and in Tyabb from KP 13.7 to KP 14.4, while smaller ones are interspersed throughout the Pipeline Works study area.

Heathy Woodland is categorised as Least Concern within the Gippsland Plain bioregion.

Swampy Riparian Woodland (EVC 083)

Swampy Riparian Woodland was recorded within the Pipeline Works study area in a large number of small habitat zones.

One large patch is identified within Warringine Park (KP 4.6 – KP 4.9), along Warringine Creek. This patch has emergent Swamp Gum *E. ovata* with an understorey of Swamp Paperbark and Prickly Tea-tree. A range of graminoids is present, including Kangaroo Grass *Themeda triandra* and Wattle Mat-rush *Lomandra filiformis*. Medium shrubs were prevalent due to a recent burn, resulting in rejuvenating shrubs. Other patches include KP 7.3 behind Hastings at the termination point of the HDD north of Hodgins Road, which is highly modified with a high cover of Swamp Paperbark, as well as near KP 8.7, KP 9, KP 14.2, KP 22.7, KP 49.45, and in a few locations north of KP 49.9. These additional patches are all very small isolated pockets with low species diversity and moderate or high weed cover.

Swampy Riparian Woodland is categorised as Endangered within the Gippsland Plain bioregion.

Swamp Scrub (EVC 053)

Recorded by both Monarc Environmental (2018a) and Biosis, this EVC varies greatly in quality and local extent, with the smallest patches only barely of sufficient size to map. This EVC occasionally supports emergent eucalypts, however it generally comprises Swamp Paperbark over a low diversity ground-layer.

Several patches of Swamp Scrub was recorded within the Pipeline Works study area. In one patch (JHCC59), 95 River Swamp Wallaby-grass plants were recorded, suggesting that this area has been less heavily modified. However, most areas supported a relatively high weed cover, including Sweet Pittosporum *Pittosporum undulatum*, Blackberry *Rubus anglocandicans* and Bridal Creeper *Asparagus asparagoides*.

A large number of habitat zones have arisen from the altered topography (i.e. raised railway tracks or roads and drains) leading to some areas becoming sufficiently wet to regrow Swamp Paperbark. The EVC is extensively represented within Warringine Park (KOJH9, KOJH 13) where it extends over the large majority of the Pipeline Works study area between KP 3.2 and KP 4.8. It also occurs behind Hastings between KP 7.4 and KP 7.5 as well as in small isolated pockets in other locations (Figure 2).

These patches generally support a relatively wet understorey, including a range of mosses, lichens and liverworts, however one patch (JHCC59) contains a much drier ground layer with minimal mosses, lichens and liverworts and a high cover of bare ground, interspersed with grasses and herbs.

Swamp Scrub is categorised as Endangered within the Gippsland Plain bioregion.

Swampy Woodland (EVC 937)

This EVC occurs in scattered locations on sites with relatively poor drainage away from riparian zones. It typically consists of Swamp Gum over a flood-tolerant understorey including Swamp Paperbark. Due to a

history of disturbance, mainly in the form of past and/or present stock grazing, no relatively intact examples were found although large canopy trees are sometimes present.

Swampy Woodland is categorised as Endangered within the Gippsland Plain bioregion.

Tall Marsh (EVC 821)

Six habitat zones of Tall Marsh are present within the Pipeline Works study area. The EVC is typically characterised by presence of Cumbungi *Typha* spp. and/or Common Reed *Phragmites australis*, along with a range of other herbs and graminoids. Within the pipeline alignment it is typically lacking in diversity. This is largely due to the colonisation of this vegetation type in areas of altered topography that now collect and store water, such as the bottom of embankments established for the rail corridor or road drains.

This EVC occurs mainly around Hastings, at KP 6.9 and KP 8.5 within or nearby the rail corridor (Figure 2). At KP 6.9, a low-moderate diversity of species was recorded, however in all other zones species diversity is restricted to a few species, including Cumbungi, Common Reed or Slender Knotweed *Persicaria decipiens*. In these locations the habitat zone is almost exclusively composed of Cumbungi, with no native herbs and moderate weed cover. Tall Marsh (as Reed Swamp EVC 300) is categorised as Endangered within the Gippsland Plain bioregion.

5.2.2.3 Trees

The Pipeline Works impact area supports 48 large patch trees, 29 large scattered trees and 50 small scattered trees (Appendix 4).

Large tree sizes are outlined on the benchmark for the EVC in which they are growing. In some instances a tree is recorded within an EVC that does not support a large tree benchmark. If these trees measure more than 40 cm DBH they are included as large trees for the purposes of calculating offsets. Many of these trees are smaller (>40 cm) emergent trees in EVCs that do not have a large tree benchmark, and therefore in some cases are not large enough to support the ecological features typical of large trees, i.e. hollows and bark furrows, but are considered large trees regardless as over time they would provide habitat value. Large trees may comprise trees within patches of native vegetation, or scattered trees.

In some cases, where a tree within a patch has a tree protection zone impacted by more than 10%, the Native Vegetation Removal Report (NVR) will list these as scattered trees. These are not true scattered trees by definition, however are treated the same for the offset purposes of the NVR. Table 21 summarises trees by EVC within the Pipeline Works impact area.

Table 21 Trees by EVC within the Pipeline Works impact area.

EVC	Bioregional conservation status	Patch trees (large trees only)	Scattered trees
Aquatic Herbland (EVC 653)	Least concern	0	0
Coastal Saltmarsh (EVC 009)	Least concern	0	0
Damp Heathy Woodland (EVC 793)	Vulnerable	4 large	0
Damp Sands Herb-rich Woodland (EVC 003)	Vulnerable	0	2 large, 6 small
Estuarine Scrub (EVC 953)	Vulnerable	0	0
Grassy Woodland (EVC 175)	Endangered	6 large	7 large, 7 small

EVC	Bioregional conservation status	Patch trees (large trees only)	Scattered trees
Heathy Woodland (EVC 048)	Least concern	30 large	16 large, 9 small
Swampy Riparian Woodland (EVC 083)	Endangered	8 large	0
Swamp Scrub (EVC 053)	Endangered	0	3 large, 22 small
Swampy Woodland (EVC 937)	Endangered	0	1 large, 6 small
Tall Marsh (EVC 821)	Endangered	0	0

5.2.2.4 Condition of native vegetation

The vegetation along the length of the proposed pipeline alignment, while varying greatly, is generally of low quality. North of South Boundary Road East, Pearcedale (KP 20), the Pipeline Works study area is extensively modified due to the historical clearing of land for agriculture. As a result of this, most habitat zones support low quality vegetation that has recolonised peripheral areas such as along fence and drainage lines. South of this location at KP 20, while still highly modified with large areas of agricultural land and the township of Hastings, there are remnants of native vegetation that support a moderate diversity of native flora and relatively high numbers of large trees, including from Crib Point to Warragine, through the rail corridor in Hastings, in Tyabb and a few smaller but still intact populations, such as at KP 18.5, south of Watson Creek.

As the proposed pipeline alignment closely follows existing pipelines easements, much of it has also been previously cleared or at least impacted by the construction of the ROW associated with existing pipelines.

The majority of habitat zones support moderate to high levels of weeds, especially Blackberry and agricultural pasture grasses. Localised clearing, track development and weed invasion have significantly altered most of these environments.

The highest condition score recorded for a patch of native vegetation was 69/100 (Heathy Woodland; HZ JHCC57), while the lowest score for a patch of native vegetation was also Heathy Woodland; HZ11, with a score of 38/100. These scores incorporate canopy cover, canopy health, large tree scores, recruitment ability, lifeform presence, organic matter, logs, patch size as well as other nearby modification.

The majority of habitat zones support low quality native vegetation, for reasons which include:

- Lack of large trees
- High levels of weed cover due to small size of habitat zone
- Altered hydrological regimes resulting in high weed cover and low species richness
- Grazing/browsing by livestock
- Previous extensive land clearing and drainage of the native vegetation and wetlands resulting in low quality regeneration of native vegetation.

5.2.2.5 Non-native vegetation

The vast majority of the Pipeline Works study area supports non-native vegetation on land predominantly used for agriculture. In some cases, these areas may support sporadic occurrences of native vegetation, however they are generally not of sufficient size to form a patch of native vegetation in accordance with the perennial native cover or tree thresholds in the Guidelines (DELWP 2017a).

5.2.2.6 Noxious weeds

Noxious weeds are introduced plants which are listed under the CaLP Act and classified by region in accordance with the level of action required to control or prevent their spread. There are four categories of noxious weed; state prohibited, regionally prohibited, regionally controlled and restricted. Land owners have legal responsibilities to take action on noxious weeds, depending on their classification in the region.

A total of 15 noxious weeds were identified within the Pipeline Works study area, which is part of the Port Phillip and Western Port region (Table 22).

Table 22 Noxious weeds recorded within the Pipeline Works study area during field assessments

Classification	Species	Legal responsibility (CaLP Act)
State Prohibited	None	Agriculture Victoria is responsible for these species on all land in Victoria.
Regionally Prohibited	None	Land owners, including public authorities responsible for crown land management, must take all reasonable steps to eradicate regionally prohibited weeds on their land.
Regionally Controlled	<ul style="list-style-type: none"> Boneseed <i>Chrysanthemoides monilifera</i> Spear Thistle <i>Cirsium vulgare</i> Hawthorn <i>Crataegus monogyna</i> Flax-leaf Broom <i>Genista linifolia</i> Montpellier Broom <i>Genista monspessulana</i> African Box-thorn <i>Lycium ferocissimum</i> Sweet Briar <i>Rosa rubiginosa</i> Blackberry <i>Rubus anglocandicans</i> Gorse <i>Ulex europaeus</i> Bulbil Watsonia <i>Watsonia meriana</i> var. <i>bulbillifera</i> Bathurst Burr <i>Xanthium spinosum</i>. 	Land owners have a responsibility to take all reasonable steps to prevent the growth and spread of these weeds on their land.
Restricted	<ul style="list-style-type: none"> Angled Onion <i>Allium triquetrum</i> Bridal Creeper <i>Asparagus asparagoides</i> Soursob <i>Oxalis pes-caprae</i> Willow <i>Salix</i> spp. 	Trade in these weeds and their propagules, either as plants, seeds or contaminants in other materials is prohibited.

Many of these species, including Blackberry, are prolific and are widespread through the Pipeline Works study area, including in agricultural pastures and within dense areas of native vegetation. Other species, such as Bathurst Burr are restricted to open areas of agricultural grasslands typically in the northern section of the Pipeline Works study area.

5.2.3 Fauna

5.2.3.1 Fauna species

Monarc Environmental (2018a) recorded a total of 143 fauna species from within the Pipeline Works study area during field surveys, including 22 introduced species (Monarc Environmental 2018, Appendix E). These records are summarised by fauna groups in Table 23. Biosis recorded one additional native bird species as an

incidental record within the Pipeline Works study area: Latham's Snipe *Gallinago hardwickii*, which is listed as migratory under provisions of the EPBC Act and as near threatened in Victoria. This species was recorded by Biosis south of Kings Creek in Hastings (KP 6.8; Figure 7). Biosis also recorded one additional frog species not previously recorded by Monarc Environmental: Peron's Tree Frog *Litoria peronii*, which was recorded at the wetland at 10 Whitneys Road, Somerville, adjacent to the Pipeline Works impact area at KP 16.1. A full list of fauna species recorded within the Project study area by Monarc Environmental (2018a) and Biosis is provided in Appendix 2.

Table 23 Summary of fauna records from within the Pipeline Works study area (Monarc Environmental 2018, Appendix E)

Species group	Native species	Introduced species	Total
Aquatic invertebrates	2	0	2
Amphibians	8	0	8
Birds	90	8	98
Fish	7	4	11
Mammals	9	10	19
Reptiles	5	0	5
Total	121	22	143

The Victorian Biodiversity Atlas (VBA) contains records of 406 vertebrate fauna species from within 5 kilometres of the proposed pipeline alignment.

Significant fauna species are discussed in Section 5.2.4.

5.2.3.2 Fauna habitat

Fauna habitat within the Pipeline Works study area generally corresponds with vegetation documented as EVCs, however the waterways and cleared agricultural lands and thickets of introduced vegetation also provide habitat of value for fauna, including for some significant species such as Southern Brown Bandicoot. Generally habitat values for fauna are assessed with regard to habitat features, including: open water, swampy vegetation, hollow bearing trees, dense understorey cover, bark furrows, log crevices and leaf litter.

Within the Pipeline Works study area, these can be broadly placed into three categories:

- Native vegetation (patches of native vegetation and scattered trees).
- Cleared pastoral land (including areas of heavy weed infestation).
- Freshwater habitat, including creeks, drainage lines, wetlands and dams.

Native vegetation and cleared pastoral lands are scattered along the length of the proposed pipeline alignment. A number of fauna species are associated with native vegetation and cleared pastoral land. A number of notable freshwater habitats are present within the Pipeline Works study area. These includes constructed farm dams, constructed drains in the former Koo Wee Rup Swamp area and named creeks.

Habitats for key EPBC Act listed fauna along, or adjacent to the Pipeline Works study area include:

Southern Brown Bandicoot – Southern Brown Bandicoots prefer habitat that provides a dense cover between 0.2 -1 metre high, regardless of whether the vegetation is native or introduced. Suitable habitat for

this species is extensive between the South Gippsland Highway (KP 30) and the EOLSS. Southern Brown Bandicoots utilise long linear habitats within the Pipeline Works study area for foraging, shelter and movement/dispersal.

Growling Grass Frog – Habitat for Growling Grass Frog can include farm dams and slow moving waterways with some level of emergent vegetation. Adjacent terrestrial areas providing shelter in the form of rocks, logs, cracking soil and dense ground vegetation, all of which may be used for overwintering.

Australian Grayling – Australian Grayling prefers larger waterways with a high level of natural characteristics. This species is limited within the Pipeline Works study area to Cardinia Creek and Lower Gum Scrub Creek.

Dwarf Galaxias – Dwarf Galaxias can persist in most aquatic habitats and will even persist in seasonally dry drains where wet refuges permit. The species will persist in larger drains within the Pipeline Works study area if given the opportunity, however, at many locations it is outcompeted by the invasive Gambusia.

Table 24 outlines waterways or waterbodies that are assessed to contain suitable habitat for the Dwarf Galaxias, Australian Grayling or Growling Grass Frog.

Table 24 Important waterways or waterbodies within the Pipeline Works study area (bold indicates those which are planned to be avoided either with trenchless HDD or refinement of alignment)

Waterway/waterbody	Location	Suitable species habitat
Warringine Creek	KP 4.85	Dwarf Galaxias
Watson Creek	KP 18.9	Dwarf Galaxias
Pearcedale South Creek	KP 19.2	Dwarf Galaxias
Langwarrin Creek	KP 21	Dwarf Galaxias
Lachies Marsh	KP 21.1	Dwarf Galaxias
Farm dam	KP 21.5	Dwarf Galaxias, Growling Grass Frog
Craigs Lane Drain	KP 23.83	Dwarf Galaxias
Western Outfall Drain	KP 31.54	Dwarf Galaxias, Growling Grass Frog
Tooradin Inlet Drain	KP 37.2	Dwarf Galaxias
Cardinia Creek	KP 40.1	Dwarf Galaxias, Australian Grayling, Growling Grass Frog
Lower Gum Scrub Creek	KP 41	Dwarf Galaxias, Australian Grayling, Growling Grass Frog
Toomuc Creek	KP 41.07	Dwarf Galaxias, Australian Grayling, Growling Grass Frog
Deep Creek	KP 41.2	Dwarf Galaxias, Australian Grayling, Growling Grass Frog
Hagelthornes Drain	KP 45.25	Dwarf Galaxias
Pakenham Creek	KP 49.22	Dwarf Galaxias

Habitat in a landscape context

Habitats south of Watson Creek (KP 19), while heavily fragmented, have a high degree of connectivity to larger patches of native vegetation. Many of these patches are interconnected with one or more areas of vegetation, including a larger area of intact native vegetation hugging the coastline. Moving progressively north through the Pipeline Works study area beyond Watson Creek (KP 19), vegetated habitats are much more fragmented, and if connected, occur as thin linear strips of vegetation along paddock edges or within road reserves and along drains. Due to the highly fragmented nature of the northern portion of the study area (between Watson Creek and the EOLSS), habitat connectivity is significantly reduced and reliant upon scattered trees, areas of native vegetation, thick low-lying introduced vegetation and drains within paddocks.

5.2.3.3 Invasive animals

Invasive animals are introduced animals which are listed under the CaLP Act, and are widespread and beyond eradication from the whole of Victoria. Land owners have a legal responsibility to control these species under the CaLP Act.

Five invasive animals were recorded during field assessments within the Pipeline Works study area:

- Red Fox *Vulpes vulpes*
- European Rabbit *Oryctolagus cuniculus*
- European Hare *Lepus europeaus*
- Cat *Felis catus*
- Goat *Capra hircus*.

5.2.4 Significant species

The background review of relevant databases, reports and the PMST produced a list of significant species recorded or predicted to occur within 5 kilometres of the broader Project study area, which is provided in Appendix 1 (flora) and Appendix 2 (fauna). An assessment of the likelihood of these species occurring in the Pipeline Works study area is included in those appendices.

Of the significant species recorded or predicted to occur within the Pipeline Works study area, 36 are considered to have a moderate or higher likelihood of occurrence within the Pipeline Works study area, including:

- Eight EPBC Act listed threatened species
- 19 FFG Act listed threatened species
- 30 DELWP Advisory listed rare or threatened species
- Five EPBC Act listed migratory species.

Some species are included in more than one category of legislative listing, and the combined sum of species in these lists is 36.

A summary of these species is provided in Table 25, along with a description of the habitat or site features relevant each. Species name in bold denotes those recorded within study area. Places where species were recorded are in bold. The location of significant species recorded during field assessments is shown in Figure 7.

Table 25 Significant species recorded or with a moderate or higher likelihood of occurrence within the Pipeline Works study area

Species	Conservation status			Areas where species were recorded or are likely to occur within the Pipeline Works study area
	EPBC	DELWP	FFG	
EPBC Act listed threatened species				
River Swamp Wallaby-grass	VU		I	KP 13.6 (Tyabb, Figure 7)
Swift Parrot	CR	e	L	Planted and remnant eucalypts over the entire Project study area. While it is not expected to make great use of the study area, it likely flies through and may stop-over within areas of winter flowering eucalypts during migration.
Southern Brown Bandicoot	EN	nt	L	Heathland, woodland, dense introduced vegetation and Swamp Scrub between KP 33.5 and the EOLSS. In this area, most roads and creeks crossed by the Pipeline Works that contain dense weedy vegetation contain suitable habitat. Records for Southern Brown Bandicoot are provided in Figure 15, suitable habitat is also shown in Figure 16.
Grey-headed Flying-fox	VU	v	L	Planted and remnant flowering eucalypts. A camp was first recorded in 2014 at HMAS Cerberus, approximately 3 km south-west of the Project study area, and has been noted there in most years since. This species is therefore likely to utilise trees in the Project study area for foraging, but is unlikely to roost in them.
Growling Grass Frog	VU	e	L	Farm dam at KP 21.5, Western Outfall Drain, Cardinia Creek and Lower Gum Scrub Creek.
Australian Grayling	VU	v	L	Cardinia Creek and Lower Gum Scrub Creek.
Dwarf Galaxias	VU	e	L	Several waterways and farm dams (refer to Table 25).
White-throated Needletail	VU, Mi	v	L	Aerial species that may occur over all habitat types
FFG Act listed threatened species				
Merran's Sun-orchid		e	L	Low-lying slashed habitat within the pipeline easement at Crib Point, between KP 1.13 and KP 1.7 .
Lewin's Rail		v	L	Warringine Park (KP 3.95) , a low lying cleared area at KP 7.3 and a vegetated farm dam near KP 21.5, KP 28.2.
Baillon's Crake		v	L	Farm dams at KP 21.1, KP 21.5, KP 28.2, within Warringine Park and east of KP 7.3 in low-lying wet area.
Little Egret		e	L	Farm dams at KP 21.1, KP 21.5, KP 28.2, all farm paddocks subject to seasonal inundation.
Intermediate Egret		e	L	Farm dams at KP 21.1, KP 21.5, KP 28.2, all farm paddocks subject to seasonal inundation.
Eastern Great Egret		v	L	Farm dams at KP 21.1 , KP 21.5, KP 28.2, all farm paddocks subject to seasonal inundation.
Australian Little Bittern		e	L	Warringine Park, a low lying cleared area 100 m east of KP 7.3 and a vegetated farm dam near KP 21.5, KP 28.2.
Blue-billed Duck		e	L	Wetlands, including farm dam at KP 28.2, and Lachies Marsh

Species	Conservation status			Areas where species were recorded or are likely to occur within the Pipeline Works study area
	EPBC	DELWP	FFG	
(KP 21.1)				
White-bellied Sea-Eagle		v	L	Coastal areas and wetlands
Powerful Owl		v	L	Woodland habitat, with one record adjacent to KP 18.15.
Chestnut-rumped Heathwren		v	L	Woodland habitat present in coastal zone
Swamp Skink		v	L	Vegetated areas associated with wetlands, estuaries and Western Port, such as saltmarsh, sedgeland and swamp scrub including within Warrigine Park, Watson Creek, KP 13.3-KP 14.3 in low-lying areas, and near KP 20.2, KP 21, and KP 22.74.
DELWP Advisory listed rare or threatened species				
Austral Crane's-bill		v		Grassy Woodland EVC (refer to Figure 2).
Creeping Rush		r		Saline habitat at KP 20.3
Marsh Sun-orchid		e	I	Low-lying areas between KP 1.13 and KP 1.7.
Pallid Sun-orchid		e	I	Low-lying areas between KP 1.13 and KP 1.7.
Gaping Sun-orchid		e		Low-lying areas between KP 1.13 and KP 1.7.
Crimson Sun-orchid		v		Low-lying areas between KP 1.13 and KP 1.7.
Crested Sun-orchid		r		Low-lying areas between KP 1.13 and KP 1.7.
Australasian Shoveler		v		Vegetated freshwater wetlands at KP 21.1, KP 21.5, KP 28.2
Hardhead		v		Vegetated freshwater wetlands at KP 21.1, KP 21.5, KP 28.2
Musk Duck		v		Vegetated freshwater wetlands at KP 21.1, KP 21.5, KP 28.2
Glossy Grass Skink		v		Damp low-lying components of Damp Heathy Woodland and Heathy Woodland between Crib Point and Hastings North.
Southern Toadlet		v		Moist soaks and depressions in a variety of habitats from Crib Point to Hastings North
EPBC Act listed migratory species				
Latham's Snipe	Mi	nt		King's Creek and vegetated freshwater wetlands at KP 21.1, KP 21.5, KP 28.2
Fork-tailed Swift	Mi			Aerial species that will occur over most habitat types
Rufous Fantail	Mi			Forested and woodland areas, but will also occur in open and coastal environments during migration.
Satin Flycatcher	Mi			

Notes to table: CR – Critically Endangered, EN/e – Endangered, VU/v – Vulnerable, r – rare, nt – near threatened, L – listed under FFG Act, I – ineligible for listing under FFG Act, Mi – migratory species listed under EPBC Act.

Further detail on EPBC Act and FFG Act listed species are provided below.

Targeted orchid survey

Three target orchid species were found at Crib Point (KP 1–1.8), with all individuals in flower (Figure 7):

- Merran's Sun-orchid: 53 plants in 2018, 338 plants in 2019. As plants flowering in 2018 may not have flowered in 2019 the observed population range is 338 to 338+53 = 338–391 plants.
- Pallid Sun-orchid: 2 plants
- Gaping Sun-orchid: 8 plants

These orchids were all within the slashed easement for existing pipelines parallel to Woolleys Road. It was noted that native vegetation on the south-western side of the easement, which does not currently contain pipelines but would have formed part of the disturbed area during pipeline construction, is in considerably better condition than the north-eastern side, and has considerably more of these orchids. The side where pipeline trenches are located has not recovered from disturbance during past trench construction and pipeline installation to the same extent as the south-western side of the easement, having lower species diversity, more weeds and more bare areas, though some orchids were still present above the pipelines.

All plants were demarcated using marker pegs as described in Section 4.1.4.1.

River Swamp Wallaby-grass was observed within the Pipeline Works study area near KP 13.63, outside of the construction footprint (avoided by HDD). It is a rhizomatous and stoloniferous aquatic or semi-aquatic perennial; culms decumbent (at least when growing in water), sometimes only the inflorescence emergent, to 80 centimetres high overall. The leaves glabrous or scabrous, with a flat blade to 25 centimetres long and 2–5 millimetres wide (Walsh 2004). River Swamp Wallaby-grass is predominantly found in swampy areas, mainly along the Murray River between Wodonga and Echuca, however, scattered records exist in a number of areas in Southern Victoria, where fragmentation is likely due to historical drainage of wetlands (Walsh, N. 1994). Targeted searches did not make any other observations of this species and it is considered to have a low likelihood of occurrence elsewhere in the Pipeline Works study area.

Growling Grass Frog was recorded in Cardina Creek at the end of Bloomfield Lane (KP 40 – 40.3) by Monarc Environmental during targeted surveys undertaken in 2018. Habitat for Growling Grass Frog can include farm dams and slow moving waterways with some level of emergent vegetation. Adjacent terrestrial areas providing shelter in the form of rocks, logs, cracking soil and dense ground vegetation, all of which may be used for overwintering. The species is known to occur in the local area and has been recorded a total of 185 times within 5 kilometres of the Pipeline Works study area. Targeted surveys undertaken by Biosis in February 2020 did not record the species at two additional farm dams (KP 16.14 and KP 28.2) which are considered unlikely to support the species, nor at Council-managed wetland at 10 Whitneys Road Somerville (adjacent to KP 16.1). Suitable wetland habitat for the species is identified in Table 24 and Table 25.

Australian Grayling has not been recorded within the Pipeline Works study area, nor on the Mornington Peninsula at all. The species inhabits fresh and brackish rivers and streams with a cool, clear, moderate flow. Larvae are likely to utilise estuarine waters for foraging, therefore the species moves through the lower sections of waterways it inhabits. The species was not recorded during targeted surveys, however it is assumed to be present within suitable aquatic habitat (refer to Table 25). There are reliable records within Lower Gum Scrub Creek where it crosses under the Princes Freeway, as well as within Cardinia Creek as mentioned above. This species distribution is generally diminishing with a correlation to decreasing availability of quality habitat in which it can persist. However, since the installation of a fish ladder on the Yarra River at Dights Falls, the species has been recorded upstream, representing an increase in current known distribution (DELWP 2017b).

Dwarf Galaxias has not been recorded within the Pipeline Works study area, however there are many records in river systems and drains around Western Port and south-east Melbourne. Given the species preference for still water, often less than 30 centimetres deep with abundant aquatic vegetation, there is potential for it to occur in a range of habitats available within the Pipeline Works study area (refer to Table 25). As this species responds to flooding, it does not necessarily require abundant aquatic vegetation, and can persist within the ground if there are suitable areas of damp refuge. As a consequence it may persist in a waterway despite not being recorded during targeted surveys.

Swift Parrot has no records within the Pipeline Works study area. There are, however, four records for the species within 5 kilometres of the Pipeline Works study area, recorded in 1980 less than 900 metres from the Pipeline Works study area. The species can utilise a range of habitats, including forests, woodlands and well-

treed urban areas, but prefers those supporting nectar-producing tree species and those that support lerp. This species is unlikely to make use of the Pipeline Works study area other than occasionally flying through on migration passage between Tasmania and areas of the eastern mainland.

Southern Brown Bandicoot is known to occur within the northern part of the Pipeline Works study area (between Manks Road at KP 33.5 and the EOLSS at KP 56.75, with 91 database records within 5 kilometres of the Project Area, and the species recorded or assumed to be present at 16 locations along the pipeline alignment (Monarc Environmental 2018b). Within this fragmented landscape, Southern Brown Bandicoots are known to utilise linear habitat corridors consisting of low-lying dense vegetative cover. These are most often found within road and rail reserves, along paddock boundaries and within or alongside drainage systems and waterways. While the species is typically confined to densely covered areas during daylight hours, they will venture into open areas, including agricultural pasture areas after dark. Older records for this species also exist for areas south of KP 33.5 adjacent to the Pipeline Works study area, particularly around Hastings and Jack's Beach. Historically, Southern Brown Bandicoots have been documented in other areas of the Mornington Peninsula, however the species has not been detected south of Langwarrin since 2010, with the exception of Quail Island (Ecology Australia 2013; DELWP, 2017b). As a result of the generally accepted absence of this species on the Mornington Peninsula (Coates et al. 2008; Ecology Australia 2013), lack of recent records in the area (DELWP, 2017b) and the results of targeted surveys undertaken by Monarc Environmental in 2018, it is considered unlikely that this species persists south of Watson Creek (KP 19). Figure 15 refers to the locations of Southern Brown Bandicoot habitat.

Grey-headed Flying-fox occurs through-out much of Victoria and is a wide-ranging species with the ability to cover distances of 100-200 kilometres on a night on migration flights. They feed on nectar and pollen of Myrtaceae and Proteaceae plants, as well as fruit from both introduced and native trees. A large, permanent and nationally important Flying-fox camp is located at Yarra Bend in Kew, Melbourne, approximately 50 kilometres north-west of the Pipeline Works study area at its closest point. A permanent camp is also located in Doveton, approximately 27 kilometres to the north-west (CSIRO 2014). A small camp of between 500 and 2499 individuals was recorded at nearby Department of Defence property HMAS Cerberus in 2014 (Ecology Australia 2016; CSIRO 2014), which is located approximately 3 kilometres south-west of the southern end of the Pipeline Works study area. Advice from Department of Defence (pers. comm. May 2020) is that a camp has been present there between January and April of each year since 2014, except in 2020. A number of additional database records exist for this species in close proximity. Plants within the Myrtaceae family, including *Eucalyptus* and *Melaleuca* are widespread across the study area, found in almost every patch of vegetation, be they introduced or otherwise. The species is therefore likely to utilise food resources within the Pipeline Works study area occasionally, however these would not constitute an important food resource for the species and the species is not expected to make significant use of this habitat.

Swamp Skink has been recorded in several locations within 100 metres of the Pipeline Works study area, most notably around Hastings including Warringine Park and Kings Creek. A single record from 2006 also exists at Crib Point, approximately 100 metres south of the Crib Point Jetty, and from 2000 near KP 14 (approximately 3.75 kilometres east of Tyabb). The distribution of this species is fairly wide, and generally covers the entire study area. A total of 31 observations have been recorded on the VBA within 5 kilometres of the Pipeline Works study area, with the latest in 2010. However, the species preferred habitat includes densely vegetated swamps and associated watercourses, and coastal saltmarshes around Western Port. This species was not recorded during targeted surveys, however it is assumed to be present within the Pipeline Works study area within low lying areas of Warringine Park, Kings Creek and Watson Creek, all of which are being avoided by the use of HDD, and between KP 13.3 – KP 14.3 in low lying areas, as well as near KP 20.2, KP 21, and KP 22.74.

Merran's Sun-orchid is known only from four or five locations in Victoria, with a large population of 338–391 recorded between KP 1.13 and KP 1.7 within the existing pipeline easement. This population was known to

DELWP prior to the construction of Woolleys Road, the construction of which has fragmented the population in two. Habitat for the species generally includes depressions or low-lying areas around swamps, heathlands, woodlands and open forests where its parent plants are thought to occur. However, its life cycle and origin are not well understood and there is uncertainty about whether it is a hybrid or a full species. This species has been able to persist within the pipeline easement due to the current management regime and partial recovery of the area following clearance of the easement. However, relatively few occur on the alignment above formerly disturbed pipeline trenches. Historically, it was known further south at Stony Point, however that population is now extinct due to decline in habitat quality and a lack of effective management. At Crib Point beside Woolleys Road, regular slashing without soil disturbance emulates fire and keeps the vegetation open and the light-demanding orchid population viable and healthy.

Lewin's Rail has been recorded at Warringine Park at KP 3.95 (Monarc Environmental 2018a). It may also occur within a low lying cleared area at KP 7.3 and a vegetated farm dam near KP 21.5, KP 28.2. Lewin's Rail inhabits natural and artificial habitats, including saline and freshwater wetlands, farm dams, riverine forest, saltmarshes, streams, ditches and tidal creeks. The species is widespread but cryptic. There are 16 records of Lewin's Rail within 5 kilometres of the Pipeline Works study area, mostly from around the fringes of Western Port Bay. The species is known to occur near the Pipeline Works study area, and is likely to occur in suitable habitat within this area.

Baillon's Crane has been recorded six times within the Pipeline Works study area, with the closest records to the pipeline alignment near Balnarring and Pakenham. The species utilises well-vegetated permanent and temporary fresh and brackish wetlands, artificial habitats and inundated depressions. The species is most likely to occur in farm dams at KP 21.1, KP 21.5, KP 28.2, within Warringine Park and east of KP 7.3 in low-lying wet areas.

Little Egret has been recorded 11 times within 5 kilometres of the Pipeline Works study area, including a record from Stony Point in 1974. The Little Egret nests in trees and utilises a range of slow-moving or standing waterways including billabongs, swamps, floodplain pools, mudflats, mangroves and irrigation channels. The species may use farm dams at KP 21.1, KP 21.5, KP 28.2 and inundated paddocks.

Intermediate Egret has not been recorded within the Pipeline Works study area. This species has been recorded eight times within 5 kilometres of the Pipeline Works study area with the most recent records being from Long Island Point in 1981. The Intermediate Egret inhabits densely-vegetated freshwater wetlands including lakes, swamps and billabongs, and breeds in trees standing in water. It may occur in farm dams at KP 21.1, KP 21.5, KP 28.2 and inundated paddocks.

Eastern Great Egret is common within 5 kilometres of the Pipeline Works study area and has been recorded more than 300 times within this broader area. Eastern Great Egret was also recorded from within the Pipeline Works study area by Monarc Environmental (2018a). The species has been regularly observed at Stony Point and Crib Point. An additional three records exist from near Crib Point between 1975 and 2012. The Eastern Great Egret is a wetland specialist, which inhabits terrestrial and estuarine habitats. The species prefers permanent waterbodies on floodplains, well-vegetated swamps, shallow water of permanent waterbodies, particularly when flowing, but it may also occur in inundated grassland and pasture and use a range of artificial waterbodies such as dams and sewage farms. Within the Pipeline Works study area, it has been recorded from the farm dam near KP 21.1 and it may also use farm dams at KP 21.5, KP 28.2 and inundated paddocks.

Australian Little Bittern has not been recorded within the Pipeline Works study area, however there are several recent records within 5 kilometres of the proposed Pipelines Works study area including three sightings in 2006 near Pakenham. The Australian Little Bittern inhabits freshwater swamps, lakes and rivers with dense reed beds, saltmarsh and coastal lagoons and prefers wetlands with dense emergent vegetation. The Australian Little Bittern may occur at Warringine Park.

Blue-billed Duck has been recorded within 5 kilometres of the Pipeline Works study area, including Devilbend Reservoir in 2015 and Somers Treatment Plant in 2006. The Blue-billed Duck prefers deep, large permanent wetlands with stable conditions and abundant aquatic vegetation, and breeds in deep fresh water swamps and lakes with dense vegetation of rushes, sedges, lignum and also in Melaleuca swamps. It can also be found on artificial waterbodies. The species may utilise wetland habitats, including a farm dam at KP 28.2, and Lachies Marsh (KP 21.1), within the Pipeline Works study area.

White-bellied Sea-Eagle has been previously recorded within 5 kilometres of the Pipeline Works study area, including within 500 metres south of Baxter-Tooradin Road in 1998. A pair has also bred historically at Devilbend Reservoir (J. Krohn pers. comm. 2020). The species may fly over the Pipeline Works study area occasionally. The most recent record from the Pipeline Works study area is from 2017, with the majority of records being from the coastal edges of French Island. The species inhabits coastal areas such as beaches and estuaries, inland wetlands and major inland streams where it hunts over terrestrial habitats and nests in trees, cliffs and escarpments on the coast, offshore islands and next to large waterbodies.

Powerful Owl has been recorded adjacent to the Pipeline Works study area in 2013 and an additional eight times within 5 kilometres. Other records include Warringine Parklands in 2012. The Powerful Owl prefers eucalypt forests and woodlands, but will also utilise well-treed urban areas. The species uses large, old, trees with large hollows for nesting. They hunt and forage in forests, woodland and open habitats and can move over large areas within a home range. The Powerful Owl is most likely to occur within woodland habitat and near KP 18.5 within the Pipeline Works study area.

Chestnut-rumped Heathwren has not been recorded within the Pipeline Works study area. However, there are a small number of recent records within 5 kilometres of the Pipeline Works study area, including one from 2008 at Lumeah Road, near the North Western Port Nature Conservation Reserve in Somerville. The Chestnut-rumped Heathwren prefers heath, forest and woodland habitat with a dense, shrubby understorey.

5.2.4.1 Other significant species

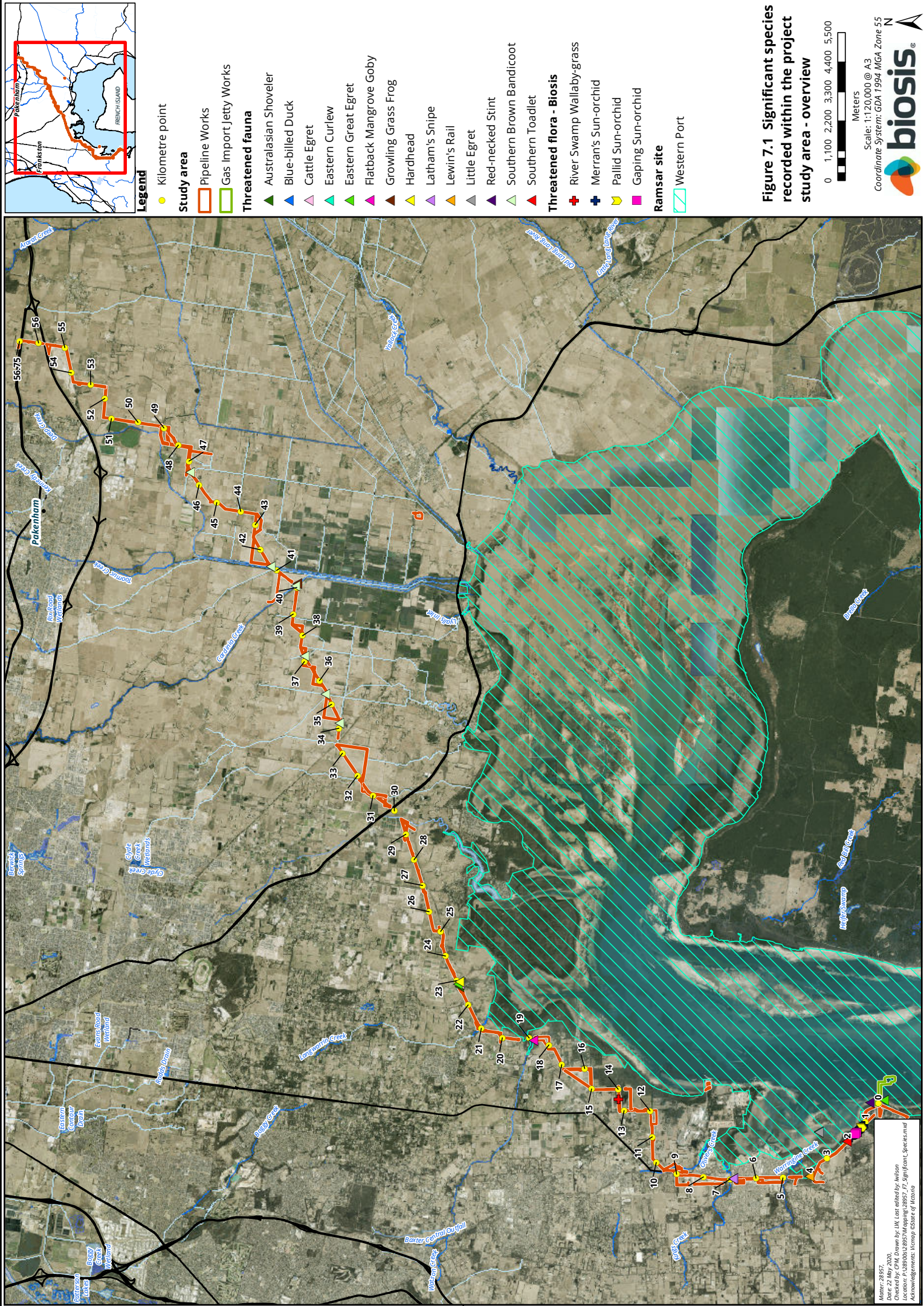
Strzelecki Gum was initially recorded within the proposed pipeline alignment near KP 20.8 in 2018 by Monarc Environmental (2018a). This species is a tree to 40 metres tall; bark smooth, whitish with red-brown mottling, usually with a short stocking of loose, semi-persistent rough bark. Juvenile leaves petiolate, soon alternate, lanceolate to ovate or elliptic, subcrenulate, eight centimetres long, four centimetres wide (Brooker & Slee 1996). The presence of this species at this location is considered unlikely due to the known distribution of the extant population. This species is largely restricted to the western section of the Strzelecki Range, from Neerim South in the north, south to Foster, and with a few isolated records from the Otway ranges. It favours ridges, slopes and streambanks and deep fertile soils (Brooker & Slee 1996). To confirm the identification of this tree, a follow-up assessment was undertaken by Dr Matt Dell on 25 September 2019. This assessment concluded that the tree more closely fits Mountain Swamp-gum *Eucalyptus camphora* subsp. *humeana*, and is unlikely to be Strzelecki Gum (DellBotany 2019).

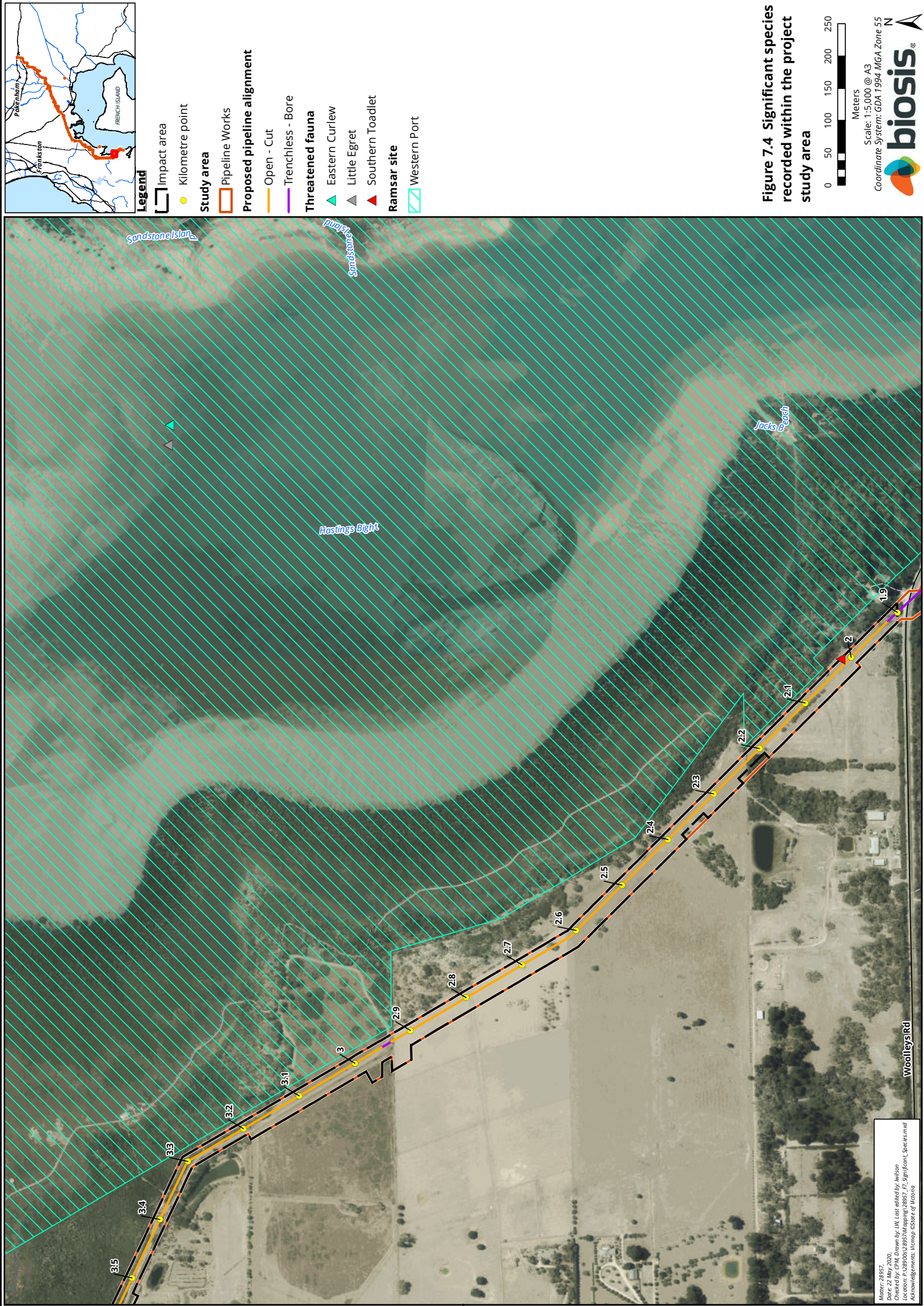
Orange-bellied Parrot. There are no records for the Orange-bellied Parrot within the Pipeline Works study area, however there are two records for the species within 5 kilometres of the Pipeline Works study area from 1987. In late April 2020, 27 Orange-bellied Parrots were released to the wild after being bred in captivity as part of the species recovery program. A small number of these were released at a private property in Pearcedale near North Western Port Coastal Reserve (Minister for Environment and Climate Change Media Release 28 April 2020). The species can utilise a range of habitats, but prefers coastal salt marshes and saline scrubs with halophytic species. This species was once more common within areas of Coastal Saltmarsh along the Victorian coastline, particularly around Western Port, however a decline in the species in more recent decades has resulted in a population of less than 60 remaining in the wild. This species now likely to be an irregular visitor to Western Port, with no records for the past 20 years (Hale 2016). The species is now subject

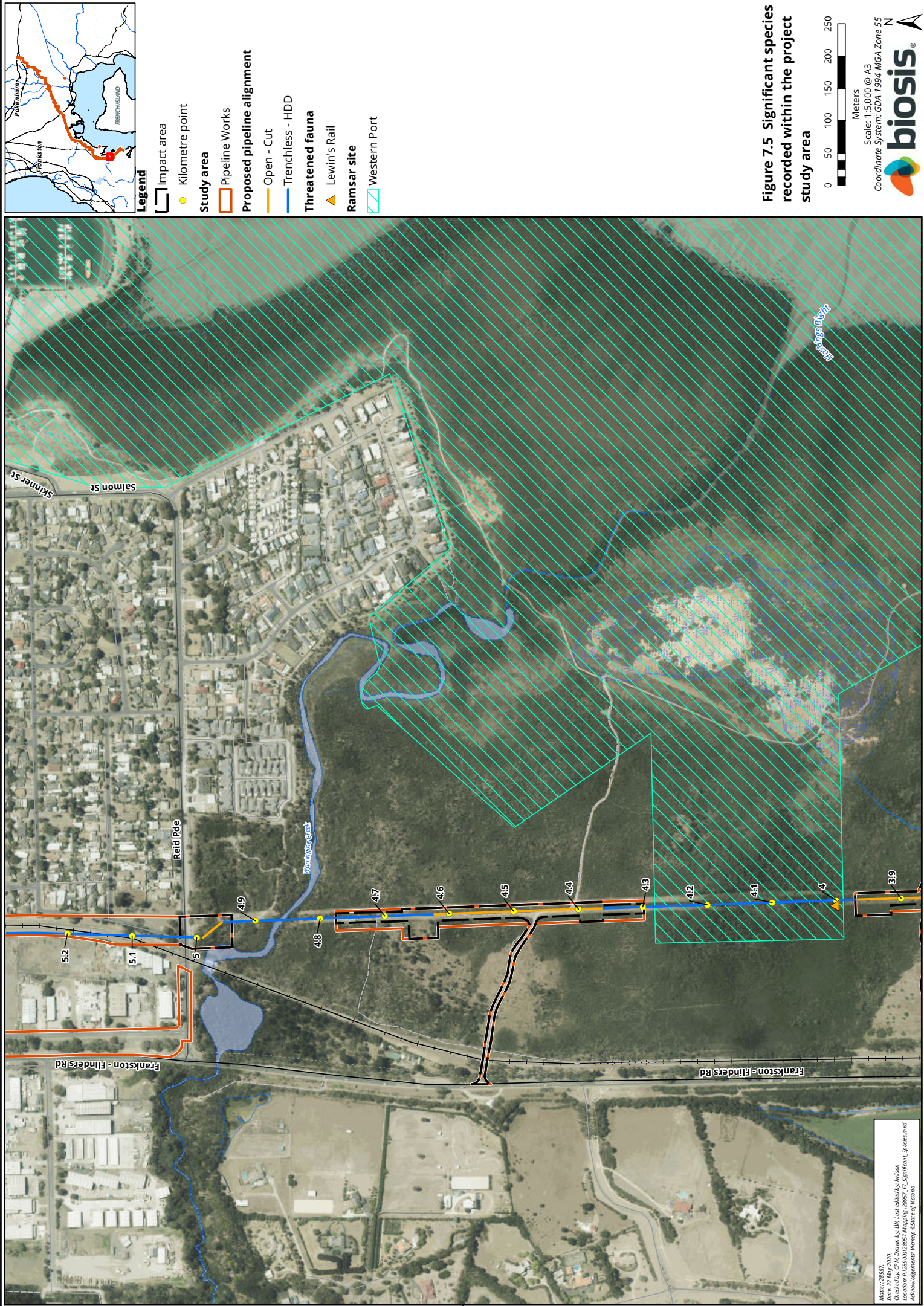
to an intensive recovery program and if it is ultimately successful the Western Port region may once again become important to the species.

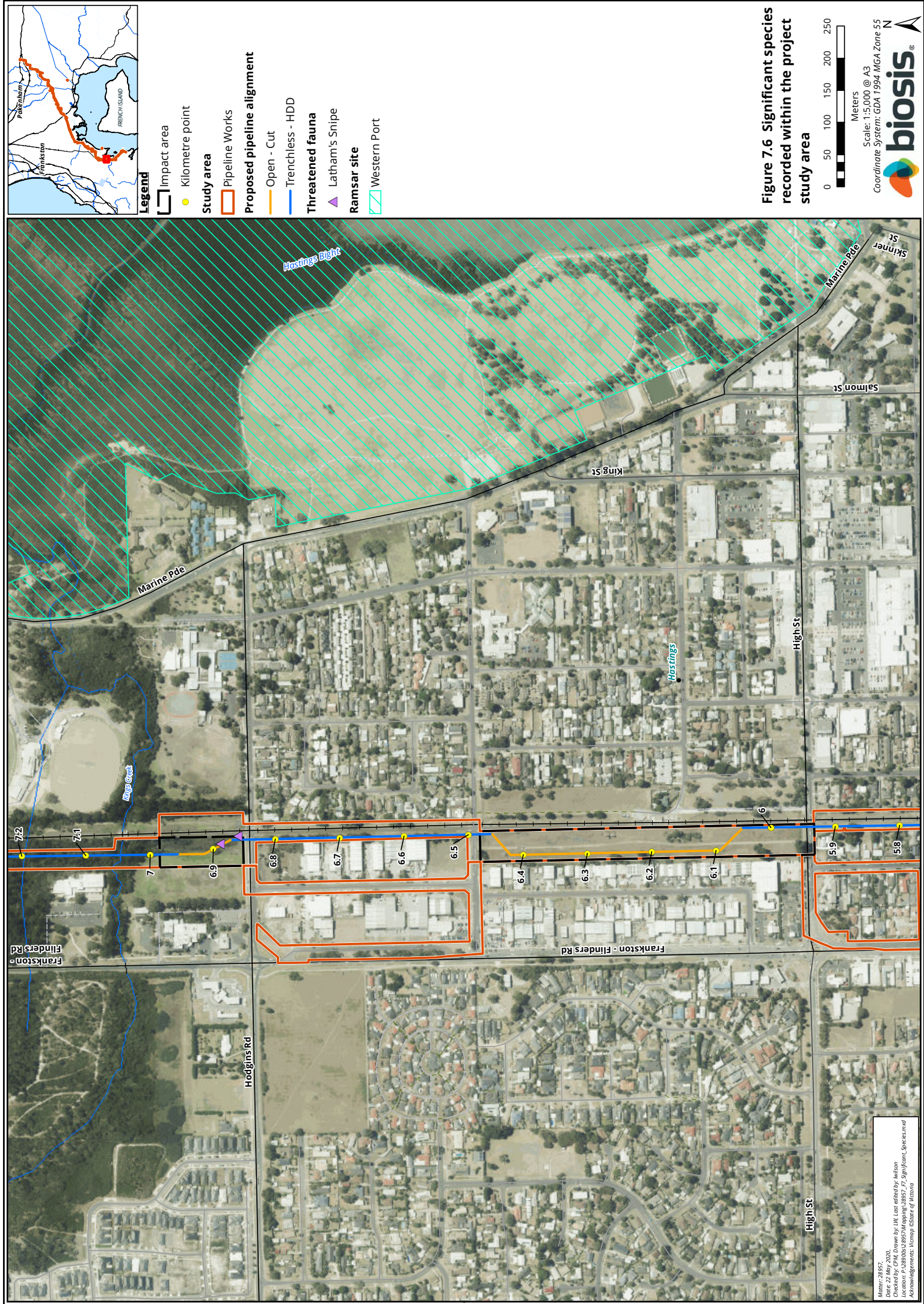
Flatback Mangrove Goby was recorded within Watson Creek, which aligns with its preferred habitat of saline creeks and estuaries, including coastal seawater. The Pipeline Works study area does not cover Watson Creek, as it is being avoided with HDD, therefore this species was not recorded within the Pipeline Works study area, nor does it have any other suitable habitat within this area.

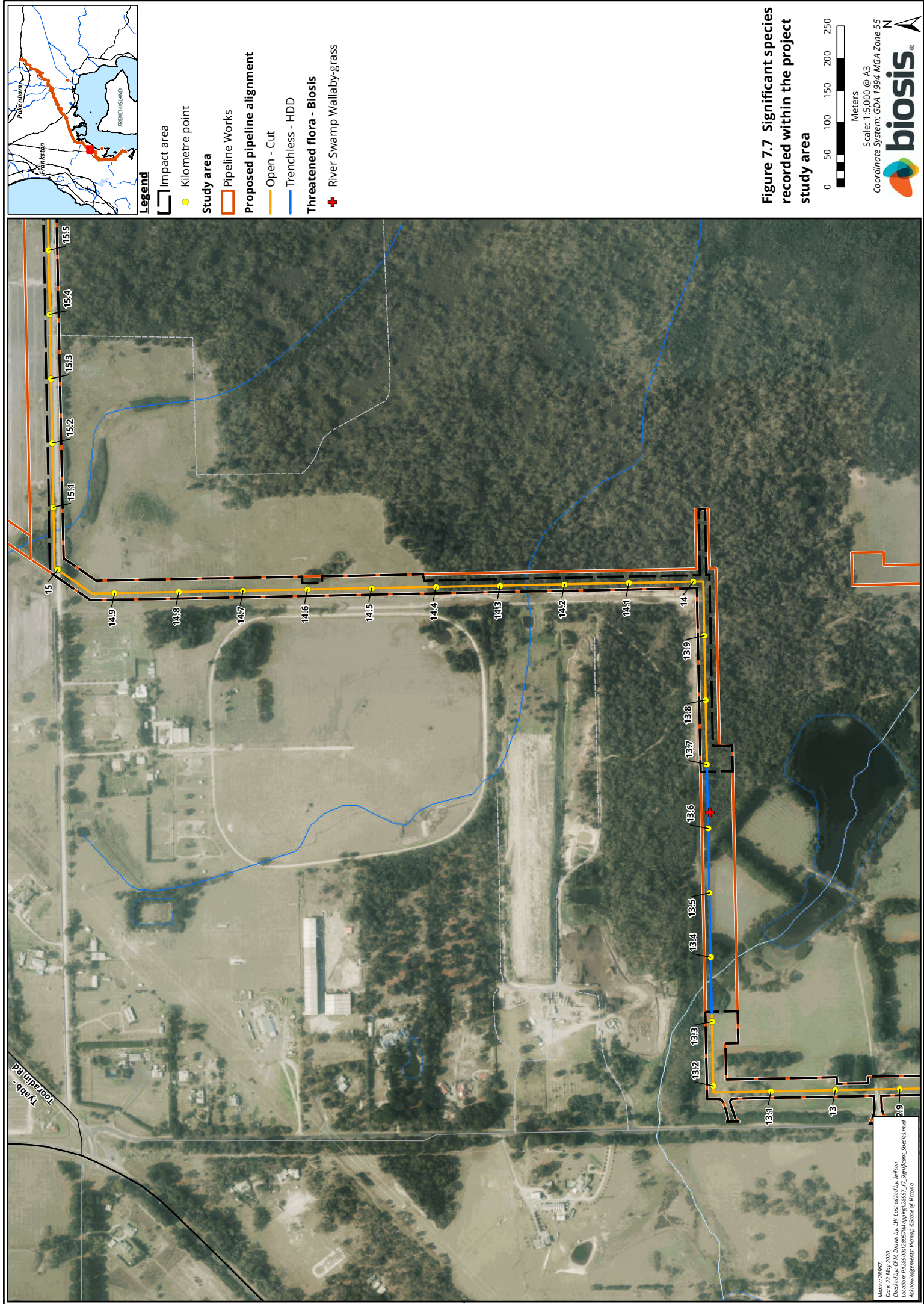
All threatened species recorded within the Pipeline Works study area by Biosis or Monarc Environmental are mapped in Figure 7. Distribution records from the VBA for threatened species are provided in Figure 11 (significant flora), Figure 12 (state significant fauna), Figure 13 (nationally significant fauna), and Figure 14 (fauna species listed as migratory under the EPBC Act).

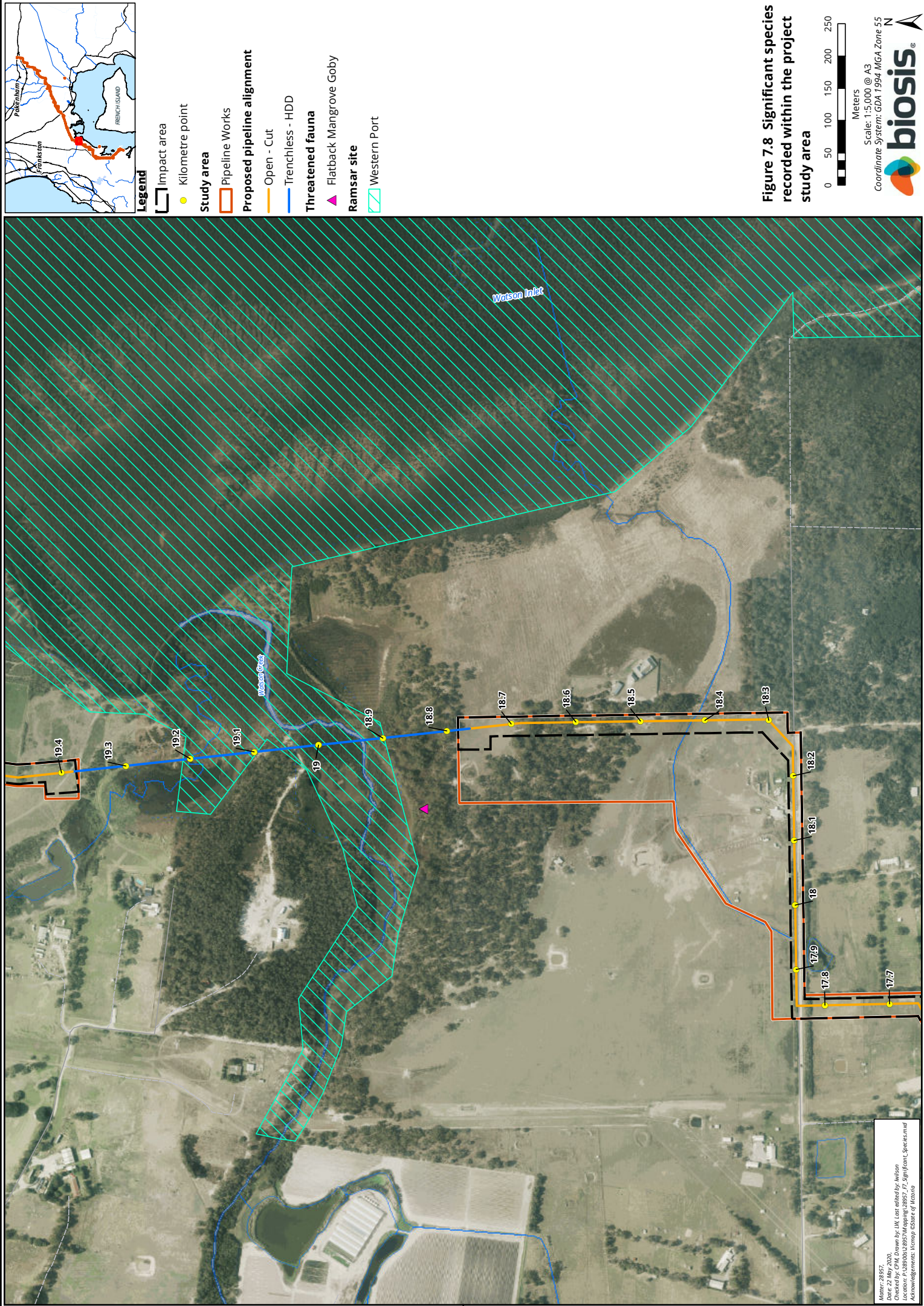


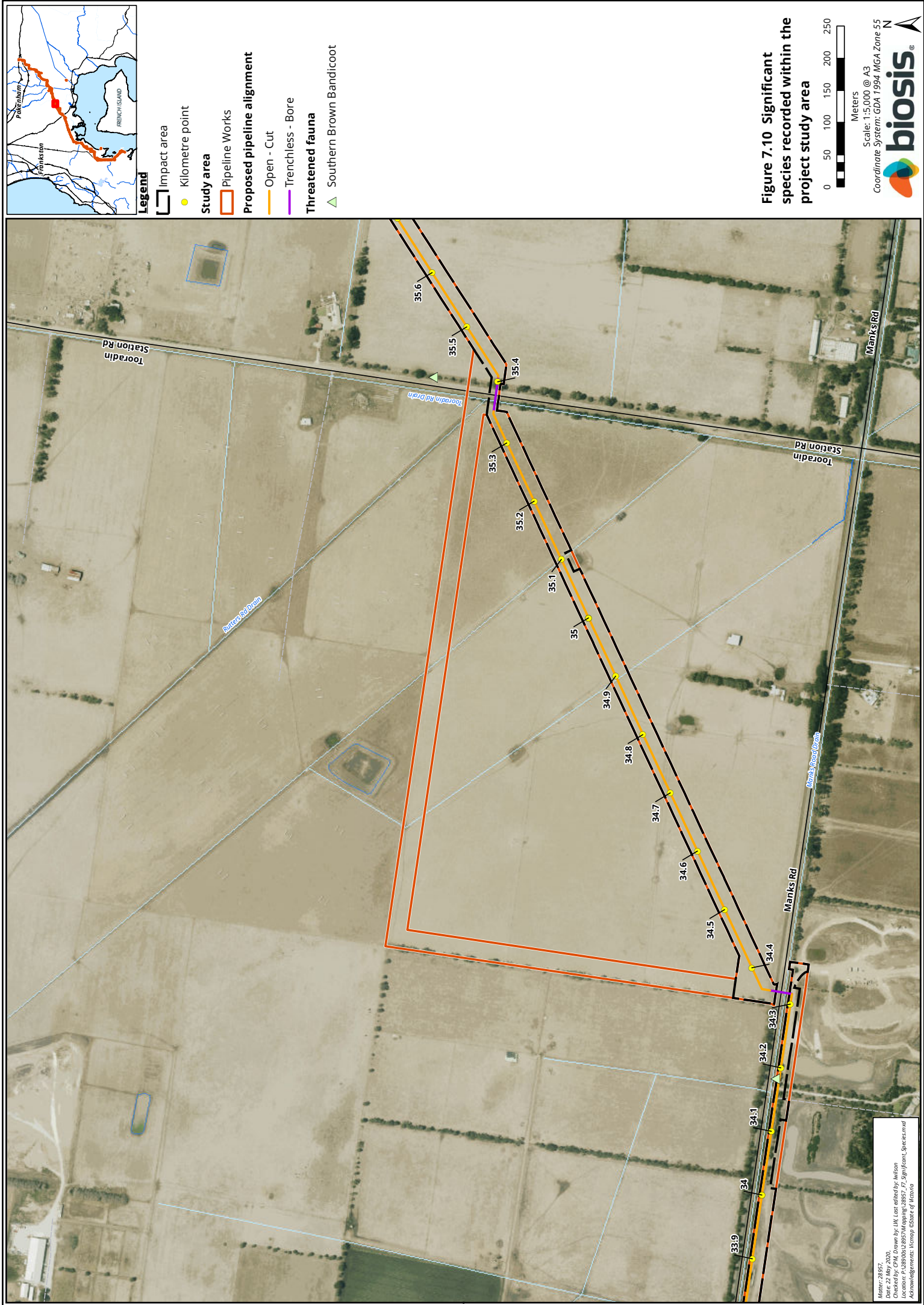


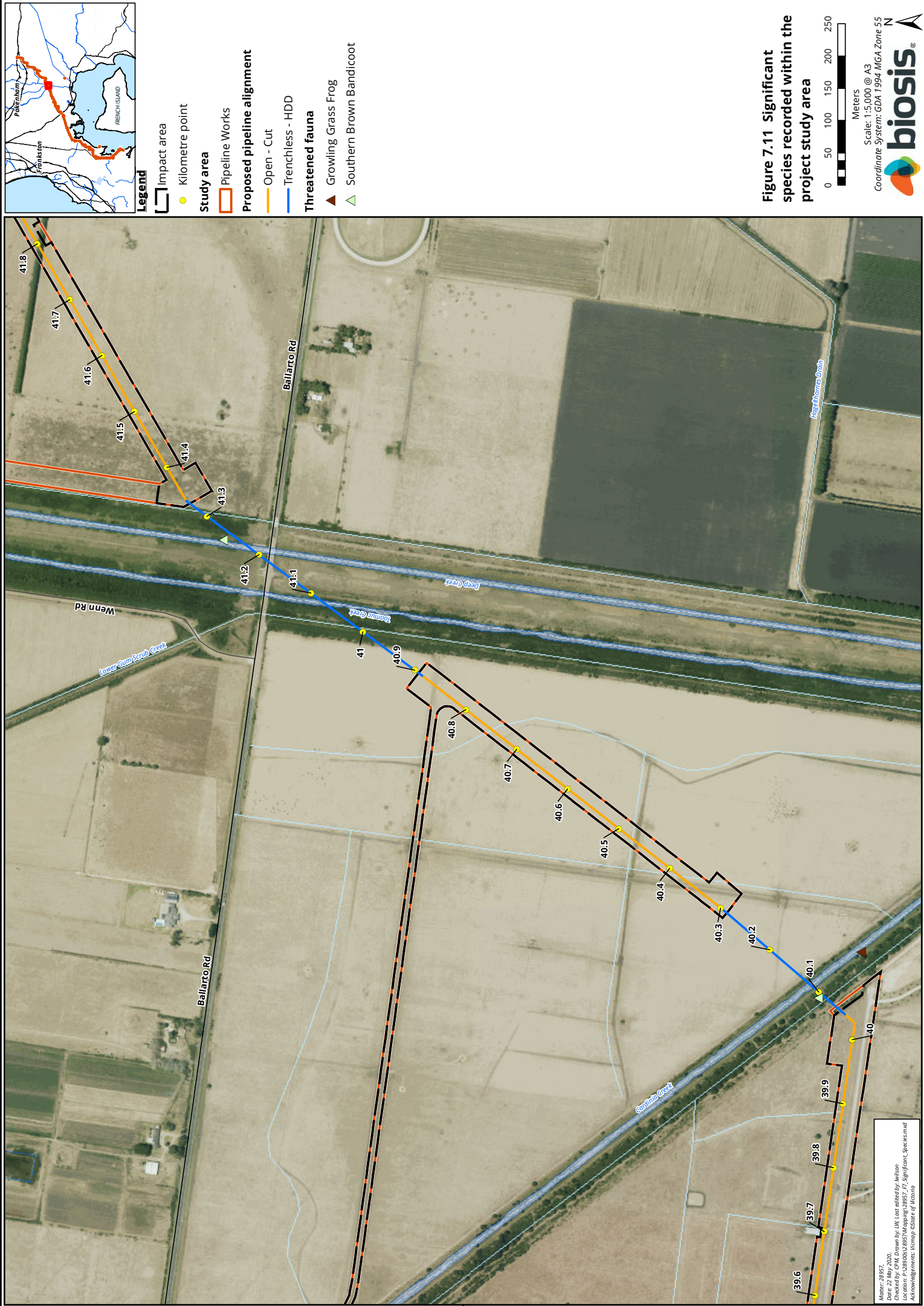


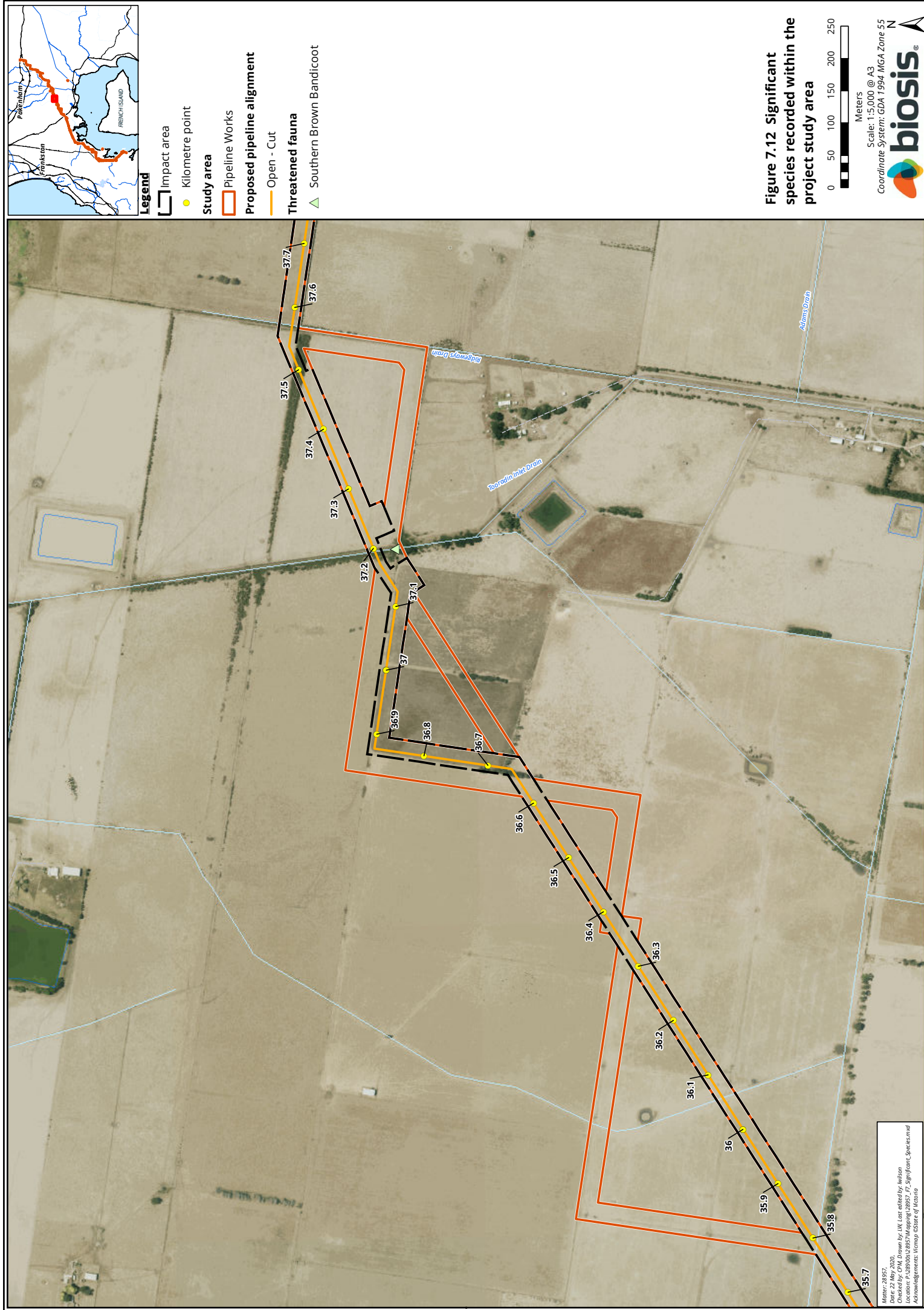












5.2.5 Significant ecological communities

5.2.5.1 EPBC Act listed ecological communities

The background review identified the following significant ecological communities as having potential to occur within the Pipeline Works study area:

- Natural Damp Grassland of the Victorian Coastal Plains (Critically Endangered under EPBC Act).
- Subtropical and Temperate Coastal Saltmarsh (Vulnerable under EPBC Act).
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered under EPBC Act).
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (Critically Endangered under EPBC Act).

Native vegetation within the proposed pipeline alignment was assessed to determine whether it corresponded to any of these significant ecological communities, by assessing the vegetation against relevant condition thresholds and community descriptions published by the Commonwealth of Australia. Only one of these communities; Subtropical and Temperate Coastal Saltmarsh, is present within the proposed pipeline alignment and it is found in one location (habitat zone 1) near South Boundary Road East, Pearcedale (KP 20.2).

The **Subtropical and Temperate Coastal Saltmarsh** ecological community occurs within the subtropical and temperate climatic zones south of the South-east Queensland IBRA bioregion boundary. It spans coastal areas under regular or intermittent tidal influence, and in southern latitudes saltmarsh is often the main vegetation-type. It may also include areas that have groundwater connectivity to tidal water bodies. The community consists mainly of salt-tolerant vegetation including grasses, herbs, sedges, rushes and shrubs and is generally of less than 0.5 metres in height. Species may include, Prickly Spear-grass *Austrostipa stipoides*, Chaffy Saw-sedge *Gahnia filum*, Sea Rush *Juncus kraussii* and Creeping Brookweed *Samolus repens* var. *repens*. This community is listed as vulnerable and is therefore not considered a Matter of National Environmental Significance for the purposes of the EPBC Act (Commonwealth of Australia 2013b).

While not identified by the PMST, a report by Ecology Australia (2019) identified a potential area of the EPBC Act listed **Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains** ecological community within a Council managed reserve at 10 Whitneys Road, Somerville (KP 16.1). A site assessment undertaken by Biosis in January 2020 confirmed that this wetland is the listed ecological community but is too small to qualify as a Matter of National Environmental Significance under the EPBC Act as it is <0.1 hectares in extent. The wetland is located outside the Pipeline Works impact area and proposed mitigation measures outlined in Section 8 would ensure that this area is not indirectly impacted.

5.2.5.2 FFG Act listed ecological communities

The background review identified the FFG Act listed communities as having potential to occur within the Pipeline Works study area:

- Herb-rich Plains Grassy Wetland (West Gippsland) Community
- Plains Grassland (South Gippsland) Community.

The **Herb-rich Plains Grassy (West Gippsland) Community** typically occurs in shallow (less than 50 centimetres deep) seasonal wetlands that fill in winter and spring and are dry by summer. Some may retain water for longer periods, but typically only have surface water for up to six months. The community contains

a rich plant association of grasses, sedges and aquatic herbs. None of the vegetation within the Pipeline Works study area is considered to qualify as this community.

The **Plains Grassland (South Gippsland) Community** varies in structure from closed tussock grassland to open woodland that included a very sparsely-treed shrubby zones associated with drainage lines. None of the vegetation within the Pipeline Works study area is considered to qualify as this community.

5.2.6 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems where a supply of groundwater is required in order to maintain the biota and ecological services and processes that they support (Sinclair Knight Merz 2011a, b). Just as terrestrial and aquatic ecosystems have hydrological requirements to maintain their function, GDEs have requirements including the physical characteristics of the groundwater, such as the quantity, location, timing, frequency and duration of groundwater delivery, or chemical characteristics, such as water quality, salinity and nutrient concentrations and temperature.

Sinclair Knight Merz (2011a, b), Eamus (2009) and Eamus et al. (2006) place GDEs into the following three classes:

- **Aquifer and cave ecosystems (Type 1)**
- **Ecosystems dependent on the surface expression of groundwater (Type 2)**
Include wetlands, lakes, seeps, springs, river baseflow, coastal areas and estuaries that constitute brackish water and marine ecosystems. In these cases, the groundwater extends above the earth surface as a visible expression.
- **Ecosystems dependent on subsurface presence of groundwater (Type 3).**
Includes terrestrial vegetation that depends on groundwater fully or on a seasonal or episodic basis in order to prevent water stress. Groundwater is not visible on surface, and these ecosystems can exist wherever the watertable is within the root zone of the plants.

The Bureau of Meteorology's (BOMs) GDE Atlas is an online model-based tool used to indicate if one of these types of GDEs may be present. A GDEs modelling is based on a range of overlays including depth-to-water, soil water-holding capacity, geology, elevation and vegetation type (structure and/or floristics), wetlands and drainage mapping. A GDE, as a given vegetation community with particular geomorphic, hydrogeological or hydrological features that have been shown to correlate with groundwater dependence in one area, may then be used to infer the presence and distribution of GDEs over larger spatial scales. This approach has been applied to many areas across Australia in the mapping of terrestrial vegetation and wetland GDEs (Sinclair Knight Merz 2011a, b).

The GDE Atlas identifies the following relevant medium or high-potential Type 2 GDEs within the Pipeline Works study area:

- Eleven waterways, including; Warringine Creek, Olivers Creek, Kings Creek, Watson Creek, Langwarrin Creek, Rutherford Creek, Western Outfall Creek, Cardinia Creek, Lower Gum Scrub Creek, Deep Creek and Toomuc Creek (AECOM 2019c).

The GDE Atlas also identifies at least the following EVCs medium or high-potential Type 3 GDEs within the Pipeline Works study area:

- Swamp Scrub, Heathy Woodland, Coastal Saltmarsh, Damp Heathy Woodland, Grassy Woodland, Swampy Riparian Woodland and Damp Sands Herb-rich Woodland.

Locations of these EVCs within the Pipeline Works study area is provided in Figure 2.

The existence of a GDE is verified where modelling coincides with these EVCs and the presence of the GDEs is also assumed to coincide with each of the creeks mentioned above.

Impact on GDEs is briefly discussed in Section 7.1.2, while the impact assessment for GDEs is outlined within the separate Groundwater Impact Assessment for the Project.

5.2.7 Western Port Ramsar site

Habitats within the Western Port Ramsar site are discussed in Section 5.1.6.

The Pipeline Works have two proposed HDD locations that bore under short portions of the Western Port Ramsar site and the following three waterways; Warringine Park, Watson Creek and a small unnamed tributary 100 metres north of Watson Creek. The lowest sections of Watson Creek and the unnamed creek are also part of the North Western Port Nature Conservation Reserve and support coastal saltmarsh vegetation.

Warringine Park is partly included within the Western Port Ramsar site, where it crosses through the Pipeline Works study area, between KP 4 and KP 4.3. This component of the Ramsar site is designated as '*other public land*' (Figure 1.1; Kellogg, Brown & Root, 2010), and is not part of the '*Wetlands*', '*National Park*', or '*Marine National Parks*' components of Western Port.

This area within Warringine Park supports a dense and closed Swamp Scrub vegetation without the typical halophytic vegetation that is present in more coastal and saline areas. It also supports a high cover of Common Reed *Phragmites australis* and Cumbungi *Typha* spp.

Distances from the nearest point of the Pipeline Works study area to important wader and waterbird roost sites, survey sites and primary foraging habitat are shown in Table 26. The locations of waterbird roosts and primary and secondary foraging habitat zones (Hansen et al. 2011) are also shown in Figure 5.

Table 26 Distance from Pipeline Works to waterbird survey sites and primary foraging habitat

Name/Location	Region and location	Nearest distance to Pipeline alignment
Birdlife Australia waterbird survey locations (and/or roost sites)		
Hanns Inlet (& formerly Sandy Point)	SW, mainland	2.0 km
Long Island	NW, mainland	3.2 km
Fairhaven	SW, French Island	5.7 km
North-west French Island	NW, French Island	6.3 km
Barralliar Island and nearby reefs	NW, French Island	7.2 km
Tortoise Head	SW, French Island	7.8 km
Yallock Creek	NE, mainland	9.5 km
Stockyard Point	NE, mainland	16.3 km
Reef Island and nearby parts of Bass Bay	SE, mainland	21.2 km
North Pioneer Bay	NE, mainland	28.1 km
Primary foraging habitat		
Hastings Bight (south)	East of KP 2	0.5 km
North-western Western Port	East of KP 19	0.5 km

Name/Location	Region and location	Nearest distance to Pipeline alignment
Hastings Bight (north)	East of Hastings	0.8 km
North-western Western Port	South-east of KP 14	1.1 km
Sandy Point/Hanns Inlet	South-east of Jetty	2.0 km
French Island (SW corner)	Centre of Western Port	2.0 km
Northern Western Port	South of KP 25	3.0 km

6. Risk assessment

An assessment of risk that the Project may pose for flora and fauna of terrestrial and freshwater ecosystems and for birds that utilise intertidal environments was undertaken in accordance with the method described in Section 4.2. Further information regarding the risk assessment process and the risk register for the Project is detailed in EES Attachment III *Environmental risk report* and results provided here should be read in conjunction with that report.

The initial and residual terrestrial and freshwater biodiversity risks associated with the Project are summarised in Table 27 (construction phase) and Table 28 (operational phase). The purpose of the risk assessment is to inform the subsequent impact assessment.

These risk ratings consider an initial set of mitigation measures (where relevant), which are based on compliance with legislation and standard requirements that are typically incorporated into the delivery of infrastructure projects of similar type, scale and complexity. Risk ratings were applied to each of the identified risk pathways assuming that these mitigation measures are in place.

Where the initial risk ratings were categorised as medium or higher, additional mitigation measures were developed (where possible). These Project-specific mitigation measures were then incorporated into the Project description, Project design or as additional recommendations.

Key findings

The highest identified residual risks (medium or higher) apply to the construction phase of the Pipeline Works and relate to:

- Direct loss of native vegetation during construction (high)
- Removal of native vegetation during construction impacts habitat for threatened fauna (medium)
- Removal of native vegetation during construction impacts habitat for non-threatened fauna (medium)
- Removal of habitat resulting in impact on Southern Brown Bandicoot (medium)

Risk assessment table notes

The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets. This refinement process was applied to all components of the Pipeline Works as a way of avoiding and minimising impacts to known environmental values.

This is regarded as an initial mitigation measure for each risk pathway.

The mitigation measure identifiers (IDs) outlined in Section 8 of this report are referenced within the risk assessment Table 27 and Table 28). Each of these would be included within the relevant Environmental Management Plan (EMP) for the Project.

Mitigation measures outlined may be beneficial across multiple risk pathways. Not all mitigation measures may reduce the likelihood of a risk enough to change the risk rating, however it does inherently reduce the likelihood of that risk further within the same category.

Table 27 Risk assessment (construction phase)

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)		Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)	
				C	L	C		L	Risk
Construction									
FF 1	Both		Direct loss of native vegetation during construction	<p>The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets.</p> <p>Selection of the Gas Import Jetty Works landside footprint considered that this land is reserved for port and related uses under the Mornington Peninsula Planning Scheme and is highly degraded having been heavily modified by previous clearing and ground disturbance.</p> <p>Avoid, minimise and offset of native vegetation in accordance with the Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017a).</p> <p>Pipeline designed with HDD in further locations (including Watson Creek, KP 22.5, KP 20.93), as well as a ROW reduction in multiple locations.</p>	Moderate		Mitigation measures MM-FF01 Unplanned vegetation loss & MM-FF05 Site rehabilitation.	Almost Certain	
					High			Moderate	
					Almost Certain			Almost Certain	
High									

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
FF 2	Both	Direct loss of native vegetation during construction	Removal of native vegetation during construction impacts habitat for threatened fauna. Excluding Southern Brown Bandicoot (refer to FF 9 Southern Brown Bandicoot) and Growing Grass Frog (refer to FF 10 Growing Grass Frog).	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines and the Significant Impact Guidelines 1.1 (EPBC Matters): These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets. Pipeline designed with HDD in further locations (including Watson Creek, KP 22.5, KP 20.93) as well as a ROW reduction in multiple locations.	Minor	Almost Certain	Medium	Mitigation measures MM-FF01 Unplanned vegetation loss, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness &MM-FF05 Site Rehabilitation	Minor	Almost Certain	Medium
FF 3	Both	Habitat removal (undetected threatened fauna)	Removal of native vegetation during construction impacts habitat for threatened fauna (undetected), including: - Swamp Skink - Powerful Owl - Chestnut-rumped Heathwren	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets. Pipeline designed with HDD in areas of dense vegetation.	Moderate	Possible	Medium	Mitigation measures MM-FF01 Unplanned vegetation loss, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness &MM-FF05 Site Rehabilitation.	Minor	Possible	Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
FF 4	Both	Habitat removal (non-threatened fauna)	Removal of native vegetation during construction impacts habitat for non-threatened fauna	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets.	Minor	Almost certain	Medium	Mitigation measures: MM-FF01 Unplanned vegetation loss, MM-FF05 Site Rehabilitation, MM-FF06 Topsoil rehabilitation, and MM-FF15 Lighting impacts to fauna.	Minor	Almost certain	Medium
FF 5	Both	Habitat removal (undetected threatened flora).	Potential removal of threatened flora and/or habitat during construction (including: - Marsh Sun-orchid - Austral Crane's-bill - Crested Sun-orchid - Crimson Sun-orchid - Creeping Rush). Habitat includes areas of Grassy Woodland, Heathy Woodland and near coastal Heathland. Excluding Pallid Sun-orchid and Gaping Sun-orchid (refer to FF14).	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets.	Moderate	Possible	Medium	Mitigation measures: MM-FF01 Unplanned vegetation loss, MM-FF05 Site Rehabilitation, MM-FF06 Topsoil rehabilitation	Moderate	Unlikely	Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
FF 6	Both	Habitat removal (non-threatened flora)	Removal of native vegetation during construction impacts habitat for non-threatened flora	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets.	Negligible	Almost certain	Low	Mitigation measure: MM-FF01 Unplanned vegetation loss	Negligible	Almost certain	Low
FF 7	Both	Fauna injury (construction)	Construction activities physically injure fauna		Minor	Possible	Low	Mitigation measure: MM-FF08 Injury and/or disturbance to fauna.	Minor	Unlikely	Low
FF 8	Pipeline Works	Trench excavation works	Fauna becoming trapped in open trenches during construction causing injury or death		Minor	Possible	Low	Mitigation measures: MM-FF07 Trench entrapment, MM-FF09d Southern Brown Bandicoot.	Minor	Unlikely	Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
FF 9	Pipeline Works	Southern Brown Bandicoot	Removal of habitat resulting in impact on Southern Brown Bandicoot habitat / populations (including habitat fragmentation)	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines and the and the Significant Impact Guidelines 1.1 (EPBC Matters): These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets. Targeted surveys resulted in further design revisions avoiding Southern Brown Bandicoot habitat (such as Cardinia Creek).	Moderate		Almost certain	Mitigation measures: MM-FF04 Contractor awareness, MM-FF09 Southern Brown Bandicoot). Pipeline Works to have temporary (short-term) impacts, avoiding impacts on population viability	Minor		Almost certain

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)		Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)	
					C	L		C	L
FF 10	Pipeline Works	Growing Grass Frog	Removal of habitat or introduction of Chytrid fungus resulting in impact on Growing Grass Frog habitat / populations	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines and the and the Significant Impact Guidelines 1.1 (EPBC Matters): These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets. Targeted surveys for Growing Grass Frog resulted in narrowing of ROW or HDD at KP 22.5, KP 23.5, KP 28.2 & from KP 34.6 to KP 35), HDD from KP 22.5 - KP 22.9, and at Cardinia and Pakenham Creek).	Moderate	Possible	Mitigation measures: MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF11 Growing Grass Frog	Moderate	Unlikely
									Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
FF 11	Pipeline Works	Dwarf Galaxias and Australian Grayling	Construction activities resulting in impacts to Dwarf Galaxias and/or Australian Grayling	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines and the Significant Impact Guidelines 1.1 (EPBC Matters): These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets.	Moderate	Possible	Medium	Mitigation measures: MM-FF02 Aquatic fauna impacts, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness	Moderate	Unlikely	Low
FF 12	Pipeline Works	Merran's Sun-orchid	Construction activities impacting on individuals or habitat of Merran's Sun-orchid.	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets Additional pipeline design alterations to avoid most (approximately 60%) of habitat and individuals of this species, including HDD and reduction in ROW between KP 1.1 to KP 1.6.	Severe	Almost certain	Very High	Due to Very High risk pipeline design altered to avoid all habitat and individuals of this species, including a single 650 metre HDD between KP 1.13 and KP 1.7. Mitigation measures: MM-FF10 Merran's Sun-orchid, Pallid Sun-orchid and Gaping Sun-orchid	Minor	Rare	Very low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
FF 13	Pipeline Works	Gaping Sun-orchid and Pallid Sun-orchid	Construction activities impacting on individuals habitat and individuals for both species, including HDD and reduction in ROW between KP 1.1 to KP 1.6. CEMP for Pipeline Works (Mitigation measures: MM-FF01 Unplanned vegetation loss, MM-FF04 Contractor awareness, MM-FF05 Site Rehabilitation, MM-FF06 Topsoil rehabilitation, MM-FF10 Merran's Sun-orchid, Pallid Sun-orchid and Gaping Sun-orchid). Species habitat benefits from mitigation for Merran's Sun-orchid.	Additional pipeline design alterations to avoid habitat and individuals for both species, including HDD and reduction in ROW between KP 1.1 to KP 1.6.	Severe	Unlikely	High	Due to Very High initial risk for FF 12, pipeline design altered to avoid all habitat and individuals of these species, including a single 650 metre HDD between KP 1.13 and KP 1.7. Mitigation measures: MM-FF10 Merran's Sun-orchid, Pallid Sun-orchid and Gaping Sun-orchid	Minor	Rare	Very low
FF 14	Pipeline Works	River Swamp Wallaby-grass or impact on River Swamp Wallaby-grass	Removal of habitat for River Swamp Wallaby-grass	Additional pipeline design alteration to HDD under the population of River Swamp Wallaby-grass recorded in Bluescope at KP 13.6.	Moderate	Rare	Low	Mitigation measures: MM-FF01 Unplanned vegetation loss, MM-FF04 Contractor awareness, MM-FF05 Site Rehabilitation.	Moderate	Rare	Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
FF 15	Both	Habitat fragmentation results in edge effects, habitat fragmentation and loss of connectivity, leading to disruption to ecosystem function.	Removal of vegetation results in edge effects, habitat fragmentation and loss of connectivity, leading to disruption to ecosystem function.	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets.	Minor	Likely	Medium	Mitigation measures: MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF05 Site Rehabilitation, MM-FF06 Topsoil rehabilitation, MM-FF09 Southern Brown Bandicoot (bandicoot fragmentation mitigation).	Minor	Possible	Low
FF 16	Both	Weeds, pathogens and pests	Environmental weeds, pathogens and pest animals in vegetation/habitat that disrupt ecosystem function	The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets	Minor	Possible	Low	Mitigation measures MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF05 Site Rehabilitation, MM-FF06 Topsoil rehabilitation	Minor	Unlikely	Low
FF 17	Both	Unintended clearing of native vegetation	Loss/damage to vegetation outside of the impact area	As a minimum the Pipeline Works should comply with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management	Minor	Possible	Low	Mitigation measures: MM-FF01 Unplanned vegetation loss, MM-FF04 Contractor awareness..	Minor	Unlikely	Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
				requirements for the construction and operation of gas pipeline assets							
FF 18	Both	Waders and waterbirds / migratory birds	Construction activities impact on these species.	As a minimum the Pipeline Works should comply with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets	Moderate	Unlikely	Low	Mitigation measures MM-FF01 Unplanned vegetation loss, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF08 Injury and/or disturbance to fauna, MM-FF12 Migratory birds, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination, MM-FF15 Lighting impacts to fauna, MM-FF16 Dust impacts to flora/fauna,	Negligible	Unlikely	Very Low
FF 19	Both	Impacts to Western Port Ramsar site	Construction activities impact on the character of Western Port Ramsar site	As a minimum the Pipeline Works should comply with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets	Moderate	Possible	Medium	Mitigation measures MM-FF01 Unplanned vegetation loss, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor	Negligible	Unlikely	Very Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
								awareness, MM-FF08 Injury and/or disturbance to fauna, MM-FF12 Migratory birds, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination, MM-FF15 Lighting impacts to fauna, MM-FF16 Dust impacts to flora/fauna,			
FF 20	Both	Construction noise and vibration impacts on fauna (excluding waders and waterbirds)	Construction noise and vibration impacts on fauna (excluding waders and waterbirds). Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets. Compliance with EPA 1254	As a minimum the Pipeline Works should comply with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets. Compliance with EPA 1254	Minor	Almost certain	Medium	Mitigation measures: MM-FF08 Injury and/or disturbance to fauna	Minor	Possible	Low
		Relevant noise information derived from Technical Report: Noise									

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
			and Vibration (RISK ID NV 2).								
FF 21	Pipeline Works	GDEs	Construction activities impacting on the surface expression of GDEs (i.e. all areas of Swamp Scrub and Heathy Woodland within the Pipeline Works impact area).		Negligible	Possible	Low	Mitigation measures as per hydrogeological impact assessment	Negligible	Possible	Low
FF 22	Pipeline Works	Night lighting disturbing native fauna (excluding waders and waterbirds).	Night lighting causing abandonment of affected habitats. Stress/displacement of native fauna and disruption of ecosystem function.		Minor	Likely	Medium	Mitigation measures: MM-FF15 (Lighting impacts to fauna) as per the light spill technical report.	Minor	Possible	Low
FF 23	Both	Spill to water Assessed in Technical Report: Hydrology (Risk ID - HD 4).	A spill of hazardous materials results in contaminated discharge to surface water in terrestrial areas (note: spills to the marine environment are assessed in CEE 2020)	Comply with requirements of the SEPP (Waters)	Minor	Possible	Low	Mitigation measures: MM-FF14 Surface water contamination	Minor	Unlikely	Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID			Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk				C	L	Risk
FF 24	Both	Dust Assessed in Technical Report: Air Quality (RISK ID AQ 2)	Dust from construction activities impact on flora/fauna.		Moderate	Likely	Medium	MM-FF16 Dust impacts to flora/fauna			Moderate	Unlikely	Low

Table 28 Risk assessment (operational phase)

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
Operation											
FF 01	Gas Import Jetty Works	Operational impacts to Waders and waterbirds / migratory birds	Operational activities including noise and lighting impact on these species.	No mitigation measures suggested.	Minor	Unlikely	Low	Mitigation measures MM-FF08 Injury and/or disturbance to fauna, MM-FF15 Lighting impacts to fauna	Negligible	Unlikely	Very Low
FF 02	Pipeline Works	Operational impacts to Waders and waterbirds / migratory birds	Operational activities including noise and lighting impact on these species.	No mitigation measures suggested.	Negligible	Rare	Very low		Negligible	Rare	Very low
FF 03	Both	Operational impacts to native flora and fauna (excluding waders and waterbirds)	Operational activities resulting in noise and lighting impacts on native flora and fauna (excluding waders and waterbirds).	No mitigation measures suggested.	Negligible	Possible	Low		Negligible	Possible	Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
FF 04	Both	Operational impacts to surface water and GDEs	Operational activities impact on surface water, GDEs and/or habitat (excluding Western Port).		Negligible	Possible	Low	Mitigation measures: MM-FF02 Aquatic fauna impacts, MM-FF14 Surface water contamination	Negligible	Unlikely	Very low
FF 05	Both	Operational impacts resulting on terrestrial weeds, pathogens and pests	Operational activities result in impacts from weeds, pathogens and pests (including edge effects) on terrestrial ecosystem function.		Negligible	Possible	Low	Mitigation measures: MM-FF01 Unplanned vegetation loss, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness	Negligible	Rare	Very low
FF 06	Gas Import Jetty Works	Operational activities impact on Western Port Ramsar site	Operational activities impact on the Ecological Character of Western Port Ramsar site	No mitigation measures suggested.	Minor	Rare	Very Low	MM-FF04 Contractor awareness, MM-FF08 Injury and/or disturbance to fauna, MM-FF12 Migratory birds, MM-FF15 Lighting impacts to fauna. Adherence with Marine Impact Assessment mitigation measures	Negligible	Rare	Very Low

Risk ID	Works area	Risk name	Risk pathway	Initial mitigation measure	Initial Risk (C=Consequence, L=Likelihood)			Additional mitigation measure and ID	Residual Risk (C=Consequence, L=Likelihood)		
					C	L	Risk		C	L	Risk
FF 07	Pipeline Works	Operational activities impact on Western Port	Operational activities impact on the character of Western Port	No mitigation measures suggested.	Negligible	Unlikely	Very low	MM-FF01Unplanned vegetation loss Adherence with OEMP in accordance with Pipelines Act.	Negligible	Unlikely	Very low
		Ramsar site Unplanned clearing of native vegetation	Operational activities impact on native vegetation. Native vegetation protections reduced in an easement.	No mitigation measures suggested	Moderate	Possible	Medium		Moderate	Rare	Low
FF 08	Both										

7. Impact assessment

Potential impacts associated with construction and operation of the proposed Project on flora and fauna of terrestrial and freshwater ecosystems and on birds that utilise intertidal environments are addressed in this section. It aligns with Section 4.2 of the *Scoping requirements for the Gas Import Jetty and Pipeline Project Environmental Effects Statement*.

The Project is not expected to have substantial effects on non-threatened flora, fauna or the functioning of natural ecosystems (i.e. there would not be broad-scale land clearing, habitat destruction or disruption to local wildlife populations). The Gas Import Jetty Works would have an influence on a very limited physical area at Crib Point and is in an immediate environment that is already substantially modified by existing anthropogenic effects, such as noise, vessel movements and artificial light. The Pipeline Works traverse an alignment that is also very substantially modified by agriculture, urban development and past clearing of native vegetation. After construction the pipeline route would be reinstated to match pre-existing modified conditions and can be expected to provide a similar environment for non-threatened flora and fauna as it does currently. Locations where significant species or their habitats have been identified as intersecting with the Project are thus the focus of the assessment.

If species are considered to have a low or negligible likelihood of occurrence within the Project study area (refer to Section 4.1.2) they are not discussed further in this report. Some exceptions are made for species which may once have made significant use of the Project study area but are no longer considered to be within the local area due to habitat loss or population decline not related to the Project (e.g. Orange-bellied Parrot).

Risk identifiers (IDs) that refer to the risk pathway are identified at the end of each section. Each risk pathway within the risk assessment (Section 6), is referenced to the required mitigation measures (Section 8).

Recommended mitigation measures for the Project are provided in Section 8.

7.1 Construction

7.1.1 Native vegetation and habitat loss/modification

Based on information collected by Monarc Environmental and Biosis in relation to the current impact area (Project construction footprint), the EnSym Native Vegetation Removal Reports (NVRs) for the Gas Import Jetty Works and Pipeline Works (Appendix 5) identify $1.603 + 15.352 = 16.955$ hectares of native vegetation proposed for removal. These figures combine patch vegetation loss and scattered tree loss to form an extent of proposed removal as per the *Guidelines for the removal, destruction or lopping of native vegetation*.

The entire Project (Gas Import Jetty Works and Pipeline Works combined) has the following direct terrestrial impacts:

- Loss of 13.903 hectares of patch native vegetation (115 habitat zones, 11 EVCs)
Bioregional conservation status: 6.012 hectares Endangered, 1.395 hectares Vulnerable and 6.495 hectares Least Concern.
- Loss of 50 large patch trees, 29 large scattered trees and 50 small scattered trees.
- Removal of individuals of, and habitat for, significant flora species (Section 7.1.3).

Most native vegetation loss would occur in the southern half of the Pipeline Works study area, in areas around Crib Point (KP 0.5 – KP 1.9), Warringine Park, Hastings rail corridor north of Kings Creek, and south of

Watson Creek. The cleared active pipeline easement between KP 1 and KP 1.9 also qualifies as native vegetation due to the composition of the regenerated ground layer vegetation.

However, isolated pockets of native vegetation and scattered trees are proposed to be removed throughout the Project study area. While all patches of native vegetation are moderately or highly disturbed, they provide a range of habitat values for native fauna. Impacts on fauna may extend beyond the mapped native vegetation used in the NVR calculation as predominantly introduced vegetation, including invasive species such as Blackberry and Kikuyu, may provide habitat for cover-dependent native species such as Southern Brown Bandicoot.

Additionally, construction of the Project has some inherent capacity to adversely impact on adjacent native vegetation or habitat through fragmentation or degradation of existing adjacent habitat, land or water pollution (e.g. spills), noise and vibration, lighting, dust, hydrological change and invasion by pest species or pathogens.

7.1.1.1 Loss of native vegetation, habitat loss and fauna injury

Impacts on native vegetation are summarised in Table 29 and Table 30.

Table 29 Gas Import Jetty Works native vegetation impact summary

Attribute	Loss
Habitat zone loss	1.603 ha
Large patch tree loss	2 trees
Large scattered tree loss	0
Small scattered tree loss	0
Extent of proposed removal	1.603 ha
Habitat zone loss by EVC	
Heathy Woodland	1.573 ha
Swamp Scrub	0.030 ha

Table 30 Pipeline Works native vegetation impact summary

Attribute	Loss
Habitat zone loss	12.300 ha
Large patch tree loss	48 trees
Large scattered tree loss	29 trees
Small scattered tree loss	50 trees
Extent of proposed removal	15.352 ha
Habitat zone loss by EVC	
Aquatic Herbland	0.105 ha
Coastal Saltmarsh	0.134 ha
Damp Heathy Woodland	1.358 ha

Attribute	Loss
Damp Sands Herb-rich Woodland	0.038 ha
Estuarine Scrub	0.252 ha
Heathy Woodland	4.258 ha
Grassy Woodland	1.240 ha
Swamp Scrub	3.972 ha
Swampy Riparian Woodland	0.605 ha
Swampy Woodland	0.061 ha
Tall Marsh	0.278 ha

Habitat hectare calculations for native vegetation patches that are entirely or partly within the Pipeline Works impact area and Gas Import Jetty Works impact area are provided in Appendix 3.

Trees within the Project impact area are listed in Appendix 4.

Offsets to compensate for these impacts are discussed in Section 8.1.2.

Removal of this vegetation is planned to occur and is therefore assessed as ‘almost certain’ with a moderate consequence. Additional mitigation measures cannot reduce the likelihood of this impact. Instead the preliminary Project designs have served to avoid and minimise impacts on native vegetation where practicable, which has lowered the consequence to the ‘moderate’ category. Further detail on Project design modifications to avoid and minimise impacts on native vegetation is provided in Section 7.1.7.

When viewed in wider geographic contexts, the reduction in area of patch native vegetation is relatively minor, equating to 0.06% of the combined extent of native vegetation in the Mornington Peninsula, Casey and Cardinia LGAs. The greatest proportional loss of native vegetation occurs in the Crib Point locality, at 1.61% (Table 31). Crib Point contains more native vegetation cover than the northern sections of the Pipeline Works impact area, which largely traverse cleared agricultural land. Data for calculation of extant native vegetation outside the impact area has been obtained from the Mornington Peninsula Shire vegetation modelling and a restricted area of 2011 DELWP extant vegetation modelling. Where these are not available, the data has been supplemented by the DELWP 2005 extant vegetation layer which is less reliable.

Table 31 Habitat patch loss in geographic context

Suburb	Extant native vegetation area (ha)	Habitat loss area (ha)	Percentage loss (%)
Combined Mornington Peninsula, Casey and Cardinia LGAs	22,969	14.48	0.06
Crib Point	200	3.21	1.61
Bittern	296	2.26	0.77
Hastings	351	1.92	0.55
Tyabb	290	3.04	1.05
Somerville	390	1.87	0.48

Suburb	Extant native vegetation area (ha)	Habitat loss area (ha)	Percentage loss (%)
Pearcedale	703	0.47	0.07
Cannons Creek	312	0.00	0.00
Devon Meadows	477	0.04	0.01
Tooradin	571	0.00	0.00
Clyde	122	0.00	0.00
Koo Wee Rup	492	0.00	0.00
Nar Nar Goon	260	0.03	0.01
Nar Nar Goon North	1,736	0.00	0.00
Rythdale	14	0.00	0.00
Cardinia	100	0.01	0.06
Pakenham South	104	0.00	0.00
Pakenham	1,347	1.06	0.08

Initial mitigation measures associated with this risk are outlined in Risk ID FF1 and are also accounted for in many micro-adjustments to the pipeline alignment. Additional impacts on native vegetation can be avoided with mitigation measures outlined in detail in Section 8, and measures identified in Risk ID FF 15.

Fauna injury (FF 7) and trench entrapment (FF 8) could occur during vegetation removal works and trench construction by fauna coming into direct contact with equipment and falling into trenches. This event is assessed as being 'possible' with minor consequence, with the event being less likely by implementing MM-FF07 Trench entrapment, MM-FF08 Injury and/or disturbance to fauna and MM-FF09 Southern Brown Bandicoot, all of which include measures to identify and remove fauna prior to construction/vegetation clearing (where practicable) and to undertake daily inspections for entrapped fauna.

Indirect impacts, such as on species habitats associated with vegetation removal during construction are outlined in subsequent sections.

7.1.1.2 Habitat fragmentation and edge effects

Habitat fragmentation is the division of a single area of habitat into two or more smaller areas. The resulting area is often inhospitable to the species that would have once otherwise used this area. Habitat fragmentation is likely to have an effect on habitat condition, as it has potential to alter the quality of remaining habitat.

The regional distribution of species, as well as species richness in communities, is greatly influenced by the amount and quality of habitat. Habitat loss is usually accompanied by fragmentation of remaining areas of habitat, which presents an additional threat to biodiversity (Hanski, 2015).

The process of fragmentation may impact on species within the newly created fragments due to barrier effects, genetic isolation and edge effects. These are described below.

Loss of connectivity (barrier effects) – Barrier effects occur where particular species are either unable or unwilling to move between suitable areas of fragmented habitat. This could result in either a complete halt to movement or a reduced level of movement between fragments. Roads through areas of native vegetation can act as barriers, with barrier effects greater for some species than others (Goosem 2002). Species most vulnerable to barrier effects include rare species (even a small reduction in movement can reduce genetic continuity within the population hence reducing the effective population size), small ground-dwelling species and species with low mobility. Species least vulnerable to barrier effects tend to be those that are highly mobile (e.g. birds), although even these species vary in their response to barriers.

Genetic isolation – Genetic isolation occurs where individuals from a population within one fragment are unable to interbreed with individuals from populations in adjoining fragments. Genetic isolation can lead to inbreeding and genetic drift problems for isolated populations, resulting in reduced overall genetic fitness and resilience to environmental change.

Edge effects – A zone of changed environmental conditions (i.e. altered light levels, wind speed, temperature) occurs along the edge of habitat fragments. These new environmental conditions along the edges can promote the growth of different vegetation types (including weeds) and allow invasion by animals specialising in edge habitats. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators (Berry 2002).

Specifically, edge effects can degrade adjacent habitat through:

- Reduction in effective size/area of remaining habitat
- Changes in microclimate (temperature, wind, light, humidity)
- Changes in hydrology (surface and sub-surface flows)
- Alteration to the pattern and frequency of fire
- Increase in sedimentation
- Increased exposure to predation or disturbance
- Invasion by exotic plant and animal species
- Increase in rubbish.

For the current assessment, habitat fragmentation is considered likely to have a minor impact within areas of native vegetation containing trees or large shrubs, such as all areas of Swamp Scrub, Swampy Riparian Woodland, Grassy Woodland, or Damp Sands Herb-rich Woodland (refer to Figure 2). This minor impact would occur north of Kings Creek, immediately south of Watson Creek, and through waterway crossings (refer to Section 5). Impacts arise through loss of connectivity and disruption to the local ecosystem. In some of these areas, such as Warrigine Park, one side of the easement has previously undergone this edge effect through the construction and maintenance of the ESSO pipeline and therefore, in this area alone, habitat fragmentation is likely to have a negligible impact. Impacts through fragmentation have the ability to impact on most flora and fauna that utilise the ROW (refer to Table 26 for species using these habitats). However, a range of mitigation measures identified, particularly MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF05 Site Rehabilitation, and MM-FF06 Topsoil rehabilitation, would reduce impacts for all species such that the risk is considered low, with a possible chance of having a minor impact. Particular threatened species that may be impacted by fragmentation are discussed further in section 7.1.3. Further mitigation of this risk is not considered necessary for most flora and fauna species.

However, it is worth noting the particular relevance to the Pipeline Works of habitat fragmentation for Southern Brown Bandicoot, as a more regionally impacted species. This is due to many remaining areas of

habitat being very narrow and isolated. The fragmentation of some habitat and dispersal corridors is a certainty (refer to *almost certain* in Section 6) and which may temporarily isolate parents from offspring, or separate local populations from their regular resources. Additionally, this loss of connectivity may increase the effects of predators on species moving between isolated fragments of habitat. However, as this impact is only temporary and effective habitat would be reinstated in these areas, this is not considered a long-term or significant impact (significant impact assessment provided in Appendix 7). Due to the temporary nature of works, the planned removal of 1.1 hectares of bandicoot habitat is considered minor, and mitigation measures including MM-FF04 Contractor awareness and MM-FF09 Southern Brown Bandicoot would ensure that short-term impacts are reduced as much as practicable.

Southern Brown Bandicoot home ranges as large as 7 hectares have been recorded, however within the Koo Wee Rup area home ranges are typically 1-2 hectares (S MacLagan, unpubl. data). Much of the remaining habitat with suitable cover throughout the former Koo Wee Rup swamp occurs in linear habitats. This is why rapid reinstatement of habitat should be undertaken during this Project. It is also thought that the surrounding fertile and productive agricultural landscape provides other habitat attributes that maintain the species persistence in linear remnants such as high soil productivity and prey availability (Ecology Australia 2017). While appropriate cover seems to be an important factor in the persistence of the species in this agricultural and peri-urban landscape, the species must be able to cope with surrounding vegetation clearance and management for agricultural purposes, which at times entails movement across cleared areas or even foraging within open environments.

Additional impact assessments associated with Southern Brown Bandicoot are further discussed in Section 7.1.3, including locations where temporary impacts may occur (Figure 16).

7.1.1.3 Leaks or spills

Construction of the Pipeline Works would involve a large number of vehicles and machinery which may result in inadvertent spills or leakage of chemicals within terrestrial or aquatic habitats. The likelihood and volume of spillage for any such event is considered to be similar for that of any similar construction project. It is not likely that any such spill would have capacity to have a significant effect on flora or fauna of terrestrial or freshwater environments. Implementation of a CEMP outlining standard best-practice for such construction activities, including preparedness and spill response measures would reduce the consequence of this risk.

The risk of contamination due to chemical leaks or spills in the marine environment during construction of the FSRU has been addressed by CEE (2020). They note that the FSRU would be fully constructed and equipped and must be certified prior to departure for Western Port. The only marine construction in the Project would be fitting the marine loading arms and gas piping on the Crib Point Jetty to transfer gas from the FSRU to facilities on the shore. This would involve construction over a short period involving jetty works, vehicles and workboats and associated hydraulic fluids, lubricants and diesel. We understand that the types and volumes of such fluids are likely to be similar to those used in many existing shipping and boat-based operations. CEE (2020) consider that the likelihood for spills to occur is unlikely and that any spills are most likely to be small to negligible and contained before reaching the marine environment. They rank the marine environmental consequence for any spill as minor. It is thus unlikely that chemical leaks or spills associated with construction of the FSRU and works on Crib Point Jetty pose a significant risk to waterbirds of Western Port. Risk ID FF 23 applies to this section. Mitigation measures MM-FF13 Surface water sedimentation and runoff and MM-FF14 Surface water contamination reduce the likelihood of an impact on unlikely, and the assessment risk remains low.

7.1.1.4 Noise and vibration

With regards to vibration, AECOM (2020) notes that, *“The risk of adverse vibration impacts through the Project are less likely to occur because of the types of proposed construction and operational activities”*. Thus the assessment is focussed on the potential effects of audible noise.

Many animals rely on acoustic signals (Halfwerk et al. 2010) and depend on sound to communicate, navigate, avoid danger and find food. Human-made noise can alter the behaviour of animals or interfere with their normal functioning and can harm the health of animals as well as alter reproduction, survivorship, habitat use, distribution, abundance, or genetic composition (Bowles, in Forman *et al* (2002)).

A number of activities associated with construction of the Pipeline Works would produce short-term noise levels (refer to Noise and Vibration Impact Assessment, AECOM 2020) that are assessed here for their potential effects on fauna species. The loudest works may produce up to 85 decibels (dB(A)) within 25 metres however no works are anticipated to produce >80 decibels at a distance of 50 metres. At 200 metres, the loudest noise is modelled at about 67 dB(A). As an example of noise outputs by common urban components, a freight train at 15 metres outputs approximately 80 decibels, a motorcycle at 7.5 metres outputs 90 decibels, and an air conditioning unit at 30 metres outputs 60 decibels (Federal Interagency Committee on Noise 1992).

Specific thresholds for artificial noise are not known for most fauna species, but populations of many animals persist and remain viable within habitats that are subject to multiple types and intensities of anthropogenic noise. Key areas within the Project Area have varying levels of ongoing ambient or periodic loud noises that already occur. For example Crib Point Jetty is utilised by marine vessels and associated vehicles, Warringine Park is near roads and a train corridor, and Kings Creek is traversed by a train line and surrounded by urban infrastructure. It is conceivable that within close proximity to construction works there may be a short-term reduction in use by some species, but that is unlikely to significantly impact on any component or function of ecosystems beyond the construction period.

Impact thresholds associated with threatened fauna, such as Growling Grass Frog and Southern Brown Bandicoot are not known. However, as with the non-threatened fauna mentioned above, these species frequently occur within urban or semi-urban environments subject to a range of noise sources. In some instances, such as with Southern Brown Bandicoot and Growling Grass Frog that persist along the rail corridor near Pakenham, these species occur within 15 metres of the frequently used train line, where they are routinely subjected to short periods of noise levels of 80 dB(A).

Qualitatively, in lieu of noise thresholds for these species and inference from their distributions within urban environments, the Project is almost certain to have a minor disturbance effect on these species in the immediate vicinity, for the duration that machinery is operating (Risk ID FF 20). With further noise mitigation measures applied, including MM-FF08 Injury and/or disturbance to fauna, it is still possible that noise may have a minor and short-duration effect on these species.

Noise distribution modelling in the noise and vibration impact assessment by AECOM (2020) indicates how noise levels produced by HDD rapidly decay. The construction noise modelling shows that noise beyond approximately 250–300 metres of a HDD location would be less than 50 decibels, which amounts to less than normal human speech. All but one of the proposed HDD locations would be at least 700 metres from primary foraging habitat for waterbirds (from Hansen et al. 2011, refer to Figure 5). Given the way in which noise has been modelled to decline over distance, there is no realistic means by which this noise would deleteriously affect the use of primary foraging habitat in Western Port. There is one HDD location (KP 1.7) proposed approximately 250 metres from primary foraging habitat at Jacks Beach, Crib Point. As described in Section 7.1.3.2, this HDD at KP 1.7 is proposed to avoid direct impacts to a population of Merran’s Sun-orchid. The

modelled noise from this HDD suggests that noise within the primary foraging habitat is unlikely to exceed 60 dB(A) (AECOM 2020).

Secondary foraging habitat is located within 150 metres of two HDD locations, KP 1.7 (Crib Point) and KP 4.37 (Warrigine Park). The modelled noise from these HDD locations suggests that there may be periods where noise levels at these areas of secondary foraging habitat would be between 55 and 70 dB(A) (AECOM 2020). This is a short-term, unavoidable impact that may cause temporary disturbance to the use of these areas of habitat for a period of between two and four weeks. The predicted levels are not high enough that they would cause direct impacts on any species, instead they may cause individuals to temporally seek alternative foraging habitat while the noisier works occur.

The closest distance between a HDD location and an identified waterbird roost site (south of Long Island Point in the north of Hastings Bight) is approximately 3 kilometres (roost sites from Hansen et al. 2011, refer to Figure 5). At those distances, there is no realistic potential for noise from an HDD operation to affect waterbirds using the foraging habitat or the roost area.

Construction activities at, and in the vicinity of Crib Point Jetty, are those considered to have the greatest potential for negative effects on waterbirds including listed threatened and migratory species.

While the effects of noise on birds has been widely investigated, the methods used have also differed considerably as have the types and measures of noise studied. A recent review of international studies of traffic and road construction noise effects on birds is provided in California Department of Transportation (2016). It outlines a number of studies that show the typical human can hear a single vehicle, traffic noise, and construction noise at a much greater distance from a roadway than can the typical bird. That report says that this provides a *“valuable, common sense and easy-to-apply risk criterion”* when considering effects of noise on birds.

Multiple investigations have demonstrated that there is a strong correlation between the range of hearing in birds and the frequency spectrum of their calls, which for most birds is in the range 1–6 kHz. Some birds have been noted to have altered their call frequencies and timing in order to be heard over anthropogenic noise (Fuller et al. 2007, Halfwerk et al. 2011). California Department of Transportation (2016) provides a general guideline indicating that noise in the range of 50–60 dB(A) is unlikely to noticeably alter behaviours of birds. The noise level between 50 and 65 dB approximates that of a normal conversation.

A relatively few studies have been made of the effects of noise on the types of birds that utilise Western Port and the examples (only) here are cited because of their relevance to this suite of species.

Brown (1990) played pre-recorded aircraft noise (i.e. without additional stimuli such as visual effects of aircraft in flight) and reported that maximum responses observed, preparing to fly or flying off, were restricted to exposures greater than 85 dB(A).

A study by Phoenix Environmental Sciences (2011) assessed road traffic noise on Australian wetland birds, including migratory birds at a series of sites in Western Australia. A number of the species they studied utilise Western Port. In their study, the highest noise measurements reached 62 dB(A), and at that level no detectable correlation between noise and wetland-site occupancy was observed.

Surveys undertaken for the Project found very few shorebirds or other waterbirds in the vicinity of the Crib Point Jetty (Monarc Environmental 2018a, Jacobs 2018a, b, Biosis this report). A number of common avian species, including; Pied Cormorant, Little Pied Cormorant, Black Cormorant and Silver Gull, utilise the pipe infrastructure upon the jetty despite noise due to current ship movements and other human activities. Primary or secondary foraging habitats for waterbirds are mapped by Hansen et al. (2011) (see also Figure 5 and note about precision of mapped habitats [section 5.1.6.3]). Databases including the VBA, ALA and Birdlife (including the Shorebirds 2020 database) contain no data for waterbirds from the mapped areas of foraging

habitat that occur within a distance of approximately 1 kilometre of the project at Crib Point Jetty and the Crib Point Receiving Facility. This does not discount the habitat values of the shorebird and waterbird habitat nearby to the proposed Gas Import Jetty Works, and up to 22 species of waders or other waterbirds are considered to have some potential to use the area around the Crib Point Jetty but there is no evidence to suggest that the area is significantly utilised by such species, particularly in comparison with habitat usage data collected over many years from other highly significant areas in Western Port that support large numbers of roosting and foraging shorebirds and waterbirds.

The capacity to forage is of particular importance to migratory shorebirds during periods in which they need to replenish or to accumulate body reserves required to successfully complete their annual migration journeys of several thousands of kilometres. All habitats for migratory shorebirds within the Western Port Ramsar site meet the criteria for important habitat as defined in *EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (Commonwealth of Australia 2017) by virtue of the designation of the Ramsar site.

To the south of the jetty secondary foraging habitat extends for approximately two kilometres and the closest primary foraging habitat is south of Stony Point. To the north of the jetty secondary foraging habitat extends in a band approximately 250 metres wide, seaward from the high tide line. Primary foraging habitat occurs in a zone to the north and seaward of the secondary habitat, commencing approximately 250 to 300 metres north of the nearest part of the jetty and a similar distance to the north-east of the Crib Point Receiving Facility. The proposed FSRU berth located on the existing jetty is approximately 600 metres from the closest mapped primary foraging habitat. The closest locations at which noise modelling was undertaken are Woolleys Beach Reserve and HMAS Otama Lookout Beach (AECOM 2020). Both of these locations are adjacent to secondary foraging habitat and closer to the jetty than any primary foraging habitat. The HMAS Otama Lookout Beach location is approximately 250 metres from the nearest point on the jetty. Construction noise levels from 12 potential types of sources are modelled by AECOM (2020). At the Woolleys Beach location the predicted range of construction noise levels is between 55 and 64 dB(A). Noise levels from seven of the 11 potential sources are between 55 and 60 dB(A). At HMAS Otama Lookout Beach location the predicted range of construction noise levels is between 55 and 66 dB(A). Noise levels from four of the 11 potential sources are between 55 and 60 dB(A). AECOM (2020) provide recommendations for mitigation measures intended to reduced noise levels at Woolleys Beach Reserve and HMAS Otama Lookout Beach during periods of noisy works, particularly those associated with bulk earthworks and road construction in which noise levels of up to 66 dB(A) are modelled for those locations. These measures would be expected to reduce noise levels by 10 – 15 dB (AECOM 2020). Modelled noise levels of between 55 and 60 dB(A), mitigated by between 10 – 15 dB, are expected to occur at parts of secondary foraging habitat closest to the jetty and Crib Point Receiving Facility with those levels expected to attenuate at greater distances.

In early April 2020 AECOM measured current noise levels within mapped primary foraging habitat and immediately adjacent to the large mapped roost area at Long Island Point offshore from the Long Island Point Fractionation Plant (██████ Principal Acoustics Engineer, AECOM, pers. comm. 07/04/2020). Maximum sound level, the maximum sound pressure level documented over the measurement interval (L_{Amax}) at those sites was between 64 and 75 dB. While this monitoring was undertaken for the purposes of evaluating potential noise related to the operational phase of the Project (see Section 7.2.1.3), rather than the construction phase, its results provide useful context for noise level predictions for construction works at Crib Point Jetty. Maximum noise levels currently being experienced at the primary shorebird foraging and roosting habitats at Long Island Point are equal to, and in some cases higher, than noise levels predicted to reach the closest extremities of secondary and primary foraging habitats near Crib Point Jetty due to construction of the Project.

It is not expected that noise of the levels predicted for construction activities associated with the Project at Crib Point Jetty and the FSRU would have measurable effects on use of foraging habitat by any species of waterbird that uses Western Port.

Roost sites used by waterbirds are of vital importance to the natural functioning of their populations. Important roost sites for waders and other waterbirds are shown in Hansen et al. (2011, and reproduced here as Figure 5). The closest of these to Crib Point Jetty are south of Long Island Point in the north of Hastings Bight and between Fairhaven and Tankerton Pier on French Island. These sites are approximately 3.5 and 4 kilometres, respectively, from the Crib Point Jetty and noise from construction at and near the jetty can be expected to attenuate to the point of inaudibility to birds at those and all other known roost sites. It is thus improbable that noise from construction works for the Project would be sufficient to impact in any measurable way on any roost sites of any listed threatened or migratory birds.

A number of common waterbirds (gulls, terns and cormorants) use the existing Jetty for roosting, however they are known to continue to roost whilst ships are berthed and lit-up at night. Use of anthropogenic structures by such species is very common and it is considered unlikely that they would be adversely impacted by the presence of additional shipping. Many of these species also utilise jetty and port structures at other locations in Western Port where human disturbance and noise are prevalent.

7.1.1.5 Lighting

A number of lights are required at night during construction of the Project, in locations including HDDs and road crossings and in possible emergency situations. The Crib Point Receiving Facility and Pakenham Delivery Facility would also require fixed permanent lighting (discussed in Section 7.2). Construction lights need to be sufficiently bright for personnel to safely operate during construction activities.

Diurnal rhythms and day-length are important components of animal behaviour and biology (Rich & Longcore, 2006; Gaston, Visser, & Holker, 2015). Artificial lighting, including that from cars and streetlamps (present through-out many locations within the Project, particularly near Hastings), can have a wide range of effects on animals. While some animals avoid full moon lighting, others are known to prefer foraging at this time. Extra lighting is known to benefit some bats, due to the concentrated attraction of insects (Rich & Longcore 2006), but it may deter other mammals including some other species of bats.

Additionally, night-length can be very important for birds, as it can determine the onset of the breeding season and migration. Artificial lighting can induce hormonal, physiological and behavioural changes that initiate breeding in birds (Lofts & Merton 1968). However, there is no known or important habitat for such species adjacent to the Pipeline Works study area, and only a small number of locations with HDD would be lit during night-time hours, therefore it is highly unlikely these lights would impact on normal functions of any species.

There is little evidence of direct light attraction or repulsion in reptiles. Negative effects of attraction to light has been well documented in newly hatched marine turtles (none of which breed in southern Australia), and frog studies have shown mixed behaviour reactions to artificial light (Outen 2003).

As the vast majority of construction activities would be restricted to between 6am-6pm on weekdays and between 6am-3pm on Saturdays, the requirement for artificial lighting would be minimal and the consequent likelihood of an impact on any species is minor. Nevertheless, there would be some construction activities that require 24-hour lighting, specifically thrust-boring and HDD areas.

Species such as Southern Brown Bandicoot and Growling Grass Frog may exhibit behavioural responses to artificial lighting that alter or inhibit foraging, breeding or predator evasion in a similar to fashion to fauna in general, however, these impacts are planned to be of short-duration and extremely localised within the immediate vicinities of each HDD.

The Commonwealth of Australia (2020) has developed *National Light Pollution Guidelines for Wildlife*, including marine turtles, seabirds and migratory shorebirds. The guidelines outline the following two broad aims to ensure that artificial light is managed such that wildlife is:

1. not disrupted within, nor displaced from, important habitat, and
2. able to undertake critical behaviours such as foraging, reproduction and dispersal

An assessment of lighting undertaken for the Project (AECOM 2019b), and the review of existing literature on the impacts of light to fauna (as outlined in this section), suggest that the construction phase of the Project is unlikely to disrupt or displace wildlife from important habitat, nor is it likely to prevent wildlife from undertaking critical behaviours including foraging, reproduction and dispersal. The Project is thus consistent with the general aims of the National Light Pollution Guidelines (Commonwealth of Australia 2020),

Mitigation measures (MM-FF15 Lighting impacts to fauna) would ensure that possible impact on fauna would be minor. Lighting impacts on migratory birds are expected to be on-going at the Crib Point Jetty, and are discussed in Section 7.2.1.4.

7.1.1.6 Dust

Vehicle movements, earthworks and use of machinery generating increased levels of mobilised dust that may impact on native flora, fauna and surface water ecosystems. Dust settling on vegetation affects the photosynthetic capability and fauna that breathe dust may suffer a burden to the respiratory tract (Hartung & Saleh 2007). Dust may also cause a potential deterioration in water quality (increased turbidity in particular) as a result of dust settling within or in the vicinity of waterbodies where runoff into the waterway is likely to occur (e.g. banks and riparian zones). Any contaminants that may be contained within the dust can exacerbate these effects. As the Project is linear, the available dust at any one location is not considered significant. Larger projects, such as quarries or subdivisions have a higher risk of mobilising more dust within a confined area.

Dust is likely to have a minor impact on ecosystem function, however with mitigation measures MM-FF16 Dust impacts to flora/fauna the risk is reduced from medium to low.

7.1.1.7 Hydrological or hydrogeological change

Temporary changes to hydrological regimes may occur within a number of creeks and waterways. This could occur through the alteration to catchment area leading directly into a waterway, or through the impacts of HDD. Additionally, works may result in increased mobilisation of sediments leading into waterways.

Changes resulting from alteration of the catchment include:

- Loss of riparian vegetation that would filter the water, including sediment deposits within it.
- Loss of vegetation that would slow and regulate the flow of water into the waterway.
- Pumping of groundwater to the surface without sedimentation mitigation measures.

In a system with a natural occurrence of vegetation near the waterway, riparian vegetation performs multiple functions. It serves to filter and uptake some of the water that is flowing across or through the top-soil. Additionally the vegetation acts as a physical barrier, which impedes and impounds the movement of water into the nearest waterway, thus slowing its movement. These are jointly referred to as fluvial functions and provide a vital role in management of waterways.

Temporarily during and following construction there would be no vegetation within the ROW at each waterway crossing that is open-trenched. Without effective erosion and sedimentation controls, rainfall could

result in minor increases in sedimentation within waterways, including additional sediment deposits within Western Port. However, as the Pipeline Works impact area is a long and relatively narrow footprint, the contribution to each waterway is likely to be minor. The total contribution to Western Port Ramsar site as a result of each individual waterway without mitigation is unclear, however with mitigation, the chance of an impact occurring is considered unlikely (MM-FF13 Surface water sedimentation and runoff & MM-FF14 Surface water contamination).

The Project involves no water extraction activities that might adversely affect biodiversity through the ecophysiological performance of woody vegetation (i.e. trees and shrubs).

The Project Groundwater Impact Assessment has identified that approximately 14.5 kilometres (26%) of the proposed pipeline alignment may intersect with the local groundwater table. A total of 11 main waterways would need to be crossed, and approximately 58 unnamed waterways would be crossed (Coffey, 2018). However given that construction activities would be completed over a relatively short time-frame, and are spread over a minor extent of the pipeline, the Pipeline Works are not posed to have adverse impacts to groundwater.

Table 32 summarises construction methods for each major waterway crossing along the pipeline route and a brief assessment of the likely impacts on aquatic habitat for each crossing.

Table 32 Major waterway crossings

Waterways	Contains aquatic habitat for significant species	Method of construction	Potential impact on aquatic habitat
Warringine Creek (KP 4.85)	Yes	HDD	Unlikely
Olivers Creek (KP 9.65)	Yes	Trench	Short-term and localised impacts only
Kings Creek (KP 7.05)	Yes	HDD	Unlikely
Watson Creek (KP 18.9)	Yes	HDD	Unlikely
Pearcedale South Creek (KP 19.2)	Yes	HDD	Unlikely
Langwarrin Creek (KP 21)	Yes	HDD	Unlikely
Rutherford Creek (KP 29.57)	Yes	HDD	Unlikely
Western Outfall Drain (KP 31.54)	Yes	Trench	Short-term and localised impacts only
Tooradin Inlet Drain (KP 37.2)	Yes	Trench	Short-term and localised impacts only
Cardinia Creek (KP 40.1)	Yes	HDD	Unlikely
Lower Gum Scrub Creek (KP 41)	Yes	HDD	Unlikely
Toomuc Creek (KP 41.07)	Yes	HDD	Unlikely
Deep Creek (KP 41.2)	Yes	HDD	Unlikely
Hagelthornes Drain (KP 45.25)	Yes	Trench	Short-term and localised impacts only
Pakenham Creek (KP 49.22)	Yes	HDD	Unlikely

A number of locations along the proposed pipeline alignment would be constructed using HDD techniques. Dewatering is not required as part of construction HDDs, therefore water drawdown would not be an issue for waterways.

At the locations where thrust boring is proposed (Figure 9), temporary dewatering to a maximum depth of 4 metres below ground may be required. There may be short-term drawdowns (less than one week) at these locations while bores/HDDs are occurring but these would be completed as quickly as possible. Coffey (2018) outlines that water drawdown would be temporary (less than one week). Construction would vary depending on weather conditions and how many times they have to stop/start. The scale of trench/holes are minimal in any one area, as it is only a 600 millimetre diameter pipe.

Dwarf Galaxias, Australian Grayling and/or Growling Grass Frog (habitats provided in Section 5; Table 24) are unlikely to be impacted by loss of water within the system. This is due to the extremely localised scale of trenching, negligible anticipated impacts of drawdown and short construction time-frames. Additionally, many freshwater fish species are adapted to variable or unpredictable flow conditions (Morrongiello *et al* (2011).

With mitigation measures MM-FF14 Surface water contamination, MM-FF13 Surface water sedimentation and runoff and MM-FF02 Aquatic fauna impacts applied, risk from water drawdown and sedimentation determines the chance of an impact to be rare, and the consequence to be minor. An HDD management plan that includes contingency measures for prevention of mud release, as well as measures for containment and remediation of such an event would be prepared and implemented by the contractor following approval from APA and submitted to the Pipeline Regulator for decision.

7.1.1.8 Invasion from weeds, pests and pathogens

Construction of the Project may result in modification of nearby habitats or native vegetation as a consequence of invasion of weeds, pests and pathogens.

Weeds and pests

Weeds in the context of this ecology report refer to any species that are not native to the area, and may be referred to as introduced. Noxious weeds are those listed under the CaLP Act (refer to Section 5).

Weed levels along the length of the proposed pipeline alignment differ greatly. In some places, vegetation is entirely comprised of weeds (i.e. the majority of the northern section of the pipeline alignment beyond KP 30). In these areas, weeds generally consist of pasture weeds from use in agriculture, however also include sporadic occurrences of noxious weeds.

By virtue of their existing, predominantly weedy state, the clearing of introduced flora within the northern sections is unlikely to result in adverse impacts within the ROW. However, in places such as Warringine Park or south of Crib Point and between KP 0.5 – KP 1.9, there is a larger risk that weeds may recolonise the ROW, and subsequently disperse into remaining adjacent native vegetation.

Due to the level of compaction that the ROW would sustain, it is highly likely that areas that once contained native vegetation would be colonised by species able to more readily grow within compacted soils.

Pest invasion within the ROW is unlikely to have a major impact, as all pests are likely to currently occupy available environments along the length of the Project.

With mitigation measures in place, including top-soil and site rehabilitation; the management of weeds post-construction and use of defined access points it is unlikely that weeds or pests would impact on the ecology of the ROW in the long-term. The consequence of the impact is considered minor (mitigation measures

include MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF05 Site Rehabilitation, MM-FF06 Topsoil rehabilitation.

Pathogens

Construction of the pipeline has the potential to contribute to the spread of known pathogens of flora and fauna, such as Cinnamon Fungus *Phytophthora cinnamomi* and Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis*.

Cinnamon Fungus and Chytrid Fungus are already present within the Pipeline Works study area, as these pathogens are widespread within the landscape, however a risk remains that a novel strain of the pathogen is introduced. Controls should be put in place to ensure the further spread these pathogens is minimised. Mitigation measures MM-FF03 Invasive weeds, pests, pathogens and waste and MM-FF04 Contractor awareness can effectively control the risk associated with spread of these diseases.

With mitigation measures in place, including MM-FF11 Growling Grass Frog the spread or effects of pathogens are unlikely to impact on the ecology of the ROW in the long-term.

7.1.2 Groundwater Dependent Ecosystems

As mentioned in Section 5.2.6, the BOM's GDE Atlas identifies the following relevant GDEs within the Project study area:

- Eleven waterways, including; Warringine Creek, Olivers Creek, Kings Creek, Watson Creek, Langwarrin Creek, Rutherford Creek, Western Outfall Creek, Cardinia Creek, Lower Gum Scrub Creek, Deep Creek and Toomuc Creek (AECOM 2019c) (refer to Figure 2 for locations).
- EVCs, including; Swamp Scrub, Heathy Woodland, Coastal Saltmarsh, Damp Heathy Woodland, Grassy Woodland, Swampy Riparian Woodland and Damp Sands Herb-rich Woodland (refer to Figure 2).

Impacts to GDEs can include works that have the potential to adversely impact an ecosystem function by changing groundwater conditions. Examples include abstraction of groundwater leading to a decline in groundwater level and reduced rates of groundwater discharge; vegetation clearing; land use change resulting in reduced recharge rates; and reduced stream flow (Sinclair Knight Merz 2011a). For EVCs, impacts include the decline in health or surface expression of the vegetation in response to the altered groundwater.

The water table in the Project study area is generally shallow (less than 4 metres below ground) and lies mostly within Quaternary sediments and Tertiary Red Bluff Sandstone. The water levels in most monitoring wells installed along the proposed pipeline alignment are deeper than the depth of the pipeline trench (typically 2 metres). There is no Project specific monitoring data available on seasonal groundwater level fluctuations. However, fluctuations of up to 0.5 to 2 metres are typical in comparable shallow groundwater environments. Water levels tend to be shallowest in late winter and spring and deepest in late summer (AECOM 2019c).

While dewatering of the trench (if required) has potential to temporarily reduce groundwater levels the impacts on GDEs is anticipated to be negligible AECOM (2019a), even when assessed using conservative values for time spent pumping, hydraulic conductivity and the inputs for the aquifer scenario testing. Additionally, due to the highly localised area of works, small size of the trenching and highly localised nature of the potential groundwater impacts and drawdown, it is unlikely that the Pipeline Works would have an adverse impact on any GDEs.

Similar impacts (decline in stream flows and impacts on groundwater dependent EVCs on the Mornington Peninsula) were anticipated within the impact assessment for the level crossing removal at Edithvale and Bonbeach (AECOM 2019a, c; GHD 2018). These level crossing removal projects involve impacts that are

several orders of magnitude greater than those proposed for the construction of the pipeline, and included trench depths of up to 24 metres wide, 15 metres deep and 1,300 metres long. The drawdown impacts on adjacent GDEs were considered negligible, however with such a large scale project the impacts to coastal vegetation GDEs were classified as unknown (AECOM 2019a, c; GHD 2018).

7.1.3 Significant species

This section addresses potential for impacts on significant species to occur as a consequence of the Project. Individual species are addressed separately if they have been recorded or are considered to have a moderate or high likelihood of occurrence.

Significant species are defined in Section 4.1.3. A number of significant species that are found within the Project search area (within 5 kilometres of the Project study area) are not likely to occur within the Project study area. The reasons for this, often in combination, may include:

- No suitable habitat (habitat may be degraded, or the Project is outside of the species normal range).
- No recent records (may have once been common in the area but now considered no longer extant in the area).
- Targeted surveys did not record any individuals.

Some species were not recorded during targeted surveys but are still considered likely to occur within the Project study area. Additionally, highly mobile species may opportunistically utilise habitat within the Project Area, however due to their life cycle or habitat preferences they would not be impacted by the removal of vegetation or other forms of disturbance due to the Project.

7.1.3.1 Environment Protection and Biodiversity Conservation Act

Species listed as threatened and/or migratory under the EPBC Act are MNES. These species are generally assessed against the *Significant Impact Guidelines 1.1* (Commonwealth of Australia 2013b), or against a published species-specific referral guideline.

Under the *Significant Impact Guidelines 1.1* an action is likely to have a significant impact on a **critically endangered** or **endangered** species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of a population
- Reduce the area of occupancy of the species
- Fragment an existing population into two or more populations
- Adversely affect habitat critical to the survival of a species
- Disrupt the breeding cycle of a population
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- Introduce disease that may cause the species to decline, or
- Interfere with the recovery of the species.

An action is likely to have a significant impact on a **vulnerable** species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of an important population of a species
- Reduce the area of occupancy of an important population
- Fragment an existing important population into two or more populations
- Adversely affect habitat critical to the survival of a species
- Disrupt the breeding cycle of an important population
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- Introduce disease that may cause the species to decline, or
- Interfere substantially with the recovery of the species.

An assessment for each EPBC Act listed species based on the *Significant Impact Guidelines 1.1* is provided in Appendix 7.

For each species with additional Commonwealth requirements for impact assessment, these are also provided in Appendix 7, and a summary is provided below.

A single **Strzelecki Gum** was initially recorded within the Pipeline Works study area, however a follow-up assessment concluded that the tree more closely fits Mountain Swamp-gum *Eucalyptus camphora* subsp. *humeana*, and is unlikely to be Strzelecki Gum (DellBotany 2019). Strzelecki Gum is no longer considered likely to be present. In any event, the Pipeline Works impact area now avoids this tree.

Orange-bellied Parrot has no records within the proposed pipeline alignment. There are, however, two records for the species within 5 kilometres of the proposed pipeline alignment in 1987 approximately 1200 metres from the proposed pipeline alignment. The species inhabits coastal vegetation including saltmarshes, dunes, pastures, shrublands, sewage plants, saltworks, islands, and beaches. This species was once more common within areas of Coastal Saltmarsh along the Victorian coastline, however a decline in the species in more recent decades has resulted in a population of less than 60 remaining in the wild. This species now likely to be an irregular visitor to Western Port with no records for the past 20 years (Hale 2016). The Pipeline Works are unlikely to have an impact on Orange-bellied Parrot. It would remove a very small area (<0.134 hectares) of potential habitat. The Pipeline Works may disturb this species through noise, vibration or light impacts if it is present at the time of construction.

Southern Brown Bandicoot has been confirmed inside the Pipeline Works study area in eight locations north of South-Gippsland Highway, including: Manks Road, Tooradin Station Road, Tooradin Inlet Drain, Cardinia Creek and Koo Wee Rup Road. These habitats are varied, ranging from relatively intact Heathy Woodland, to degraded Swamp Scrub as well as exclusively exotic vegetation. Degraded swamp scrub forms the majority of habitat within the Project study area. Database searches in the Project study area identify 91 additional records for this species. Suitable habitat within the impact area is shown in Figure 16.

The Pipeline Works would involve removal of known and/or assumed habitat for Southern Brown Bandicoot at 19 locations totalling 1.1 hectares. This would principally result from ROW creation through linear habitat corridors along farmland fence-lines or drain-lines and is depicted in Figure 16. Significant impact on this species is avoidable by the implementation of mitigation measures outlined in Section 8.

Application of those measures would ensure the Pipeline Works do not constitute a significant impact as defined by both the *Significant Impact Guidelines 1.1*, and the *Draft referral guidelines for the endangered Southern Brown Bandicoot (eastern)* *Isodon obesulus obesulus* (Commonwealth of Australia 2011a).

The draft referral guidelines for this species determines that a high risk of a significant impact will occur if a proposed action will directly or indirectly effect Southern Brown Bandicoot resulting in:

- Loss or long term modification of suitable habitat known or likely to support Southern Brown Bandicoots, of:
 - greater than 1% in patches less than 100 hectares; or
 - greater than 5% in patches greater than 100 hectares; or
- reduced connectivity or fragmentation of suitable habitat known or likely to support Southern Brown Bandicoots, that results in:
 - a distance greater than 50 metres over natural surfaces; or
 - a distance greater than 10 metres over artificial surfaces; or
- reduction in suitable vegetation corridor core width to less than 50 metres; or
- any reduction in width of suitable vegetation corridors, which are less than 50 metres in width and likely to be utilised by southern brown bandicoots; or
- as a result of fire management procedures, at any given time, greater than 20% of suitable habitat has a reduced understorey vegetation structure below an average of 50% foliage density.

The Pipeline Works has a low likelihood of triggering any of these criteria, especially in the medium-long term, and it is considered unlikely to have a significant impact on Southern Brown Bandicoot under the EPBC Act. Nevertheless, a range of mitigation measures should be adopted to ensure any potential impacts to individuals are minimised wherever possible and to maintain dispersal corridor functionality. The species is not considered to be impacted as defined by the criteria outlined within the *Significant Impact Guidelines 1.1*.

Dwarf Galaxias prefers to inhabit still water, often less than 30 centimetres deep with abundant aquatic vegetation, there may be the potential for this species to occur within other nearby wetlands and farms dams which have those characteristics. Suitable habitat outlined in Table 24.

While no Dwarf Galaxias were recorded during either of the targeted surveys, it is highly likely that they are present within areas containing suitable aquatic habitat. The species can often be difficult to detect. It is unlikely that any sedimentation or pollutant run-off associated with the Pipeline Works would impact on aquatic habitat for this species, however mitigation measures that prevent this type of impact would further reduce the risk. Four of the 16 waterways that contain potential habitat for this species are proposed to be open-trenched, including Craigs Lane Drain, Western Outfall Drain, Tooradin Inlet Drain and Hagelthornes Drain. These works may result in short-term impacts on the species through habitat fragmentation, however, as the waterways would not be physically blocked, and given that the scale of impact is small and the duration of impact is short, the implementation of basic mitigation measures would ensure that a significant impact as defined within the *Significant Impact Guidelines 1.1* will be avoided.

Australian Grayling generally inhabits rivers and streams with a cool, clear, moderate flow and a gravel substrate. Suitable habitat exists within the study area, as outlined in Table 24. While no individuals were recorded during the targeted surveys, it is highly likely that the species is present within areas containing suitable aquatic habitat. It is unlikely that any sedimentation or pollutant run-off associated with the Pipeline Works would impact on aquatic habitat for this species, however mitigation measures that prevent this type of impact would further reduce the risk. Open-trench works proposed at Craigs Lane Drain, Western Outfall

Drain, Tooradin Inlet Drain and Hagelthornes Drain are unlikely to impact on this species, as no potential habitat was identified within these waterways.

Australian Fairy Tern has a low likelihood of being affected by noise and lighting from the Project. These are likely to be associated only with the construction phase and thus to be short-term, and are not likely to result in impacts on the population or to harm individuals. Mitigation measures may reduce minor impacts further.

Growling Grass Frog have been detected within Cardinia Creek at the end of Bloomfield Lane (KP 40.1). It is also presumed present in connected waterways, including Cardinia Creek south-east of Ballarto Road and in Lower Gum Scrub Creek. A total of 185 database records occur within the northern half of the Pipeline Works study area, demonstrating the existence of a population in that area.

As no habitat is proposed to be permanently removed as part of the works, and mitigation measures for sedimentation and hygiene protocols (i.e. to mitigate introduction/spread of chytrid fungus – refer to Section 7.1.1.8) would be followed as proposed, the Pipeline Works are unlikely to have a significant impact on Growling Grass Frog. Disturbance is likely to occur at some locations from nearby construction activities. However, these impacts are likely to be short-term. The species is not considered likely to be significantly impacted as defined by the criteria outlined within the *Significant Impact Guidelines 1.1* or the *Significant impact guidelines for the vulnerable Growling Grass Frog (Litoria raniformis), Nationally threatened species and ecological communities EPBC Act policy statement 3.14* (Commonwealth of Australia 2009).

Swift Parrot has suitable foraging habitat available within the Project study area in all areas containing eucalyptus species, including Heathy Woodland and Grassy Woodland as well as scattered trees across the length of the entire Project. However, this is a highly mobile species and as such in the context of available foraging resources in the landscape the removal is considered negligible. The Swift Parrot has not been recorded within the Project study area and concentrations of preferred habitat for the species occur in other regions of Victoria and more widely in south-eastern Australia.

Any impacts to this species are likely to be short-term and are unlikely to result in harm to individuals, or the population as a whole. The Project is unlikely to have a significant impact on Swift Parrot as defined by the criteria outlined within the *Significant Impact Guidelines 1.1*.

Grey-headed Flying-fox has suitable foraging habitat available within the Project study area in all areas containing eucalyptus species, including Heathy Woodland and Grassy Woodland as well as scattered trees across the length of the entire Project. The Project study area is located approximately 50 kilometres away from the large, permanent colony at Yarra Bend Park in Melbourne, however a camp was first recorded at nearby Department of Defence property HMAS Cerberus, approximately 3 kilometres to the south-west (Ecology Australia 2016; CSIRO 2014). Advice from Department of Defence (pers. comm. May 2020) is that a camp has been present there between January and April of each year since 2014, except in 2020. A permanent camp is also located in Doveton, approximately 27 kilometres to the north-west (CSIRO 2014). The Grey-headed Flying-fox is a highly mobile species and as such, in the context of available foraging resources in the landscape, the removal of this vegetation is considered to result in negligible impacts to this species. Therefore, the Project is unlikely to have a significant impact on Grey-headed Flying-fox as defined by the criteria outlined within the *Significant Impact Guidelines 1.1*.

River Swamp Wallaby-grass is recorded within the Pipeline Works study area in an area that was proposed for open-trenching. Impacts on this species would be avoided through use of HDD. The individuals and population at this location are unlikely to be impacted by the Pipeline Works. Targeted surveys of suitable habitat elsewhere within the proposed pipeline alignment determined that this species is unlikely to be present.

Migratory birds, including waders and waterbirds

Assessment of impacts of the Project on migratory birds against criteria set out in EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* and against *Thresholds of significant impacts on migratory shorebirds* (reproduced from the EPBC Act Policy Statement 3.21, Commonwealth of Australia 2017) is provided in Appendix 7.

As defined in the EPBC Act Policy Statement 1.1 Significant Impact Guidelines, an action is likely to have a significant impact on an EPBC Act listed migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Significant impact judgements must be made on a case-by-case basis and with consideration for the context of the action. The potential for a significant impact on migratory shorebird species will depend on the:

- Timing, intensity, duration, magnitude and geographic extent of the impact
- Sensitivity, value and quality of the environment within and around the area
- Combined effects of impacts within and outside the area, direct and indirect impacts, as well as cumulative impacts already sustained
- Presence of this and other MNES

Impacts that may constitute a significant impact on migratory shorebirds are outlined in Table 35.

Table 33 Significant impact thresholds for migratory shorebirds (reproduced from the EPBC Act Policy Statement 3.21, 2015)

Ecological element	Significant impact	Comment
Important habitat	Loss of habitat	The loss (for example, clearing, infilling or draining) of important habitat areas is likely to have a significant impact when it results in a reduction in the capacity of the habitat to support migratory shorebirds. The magnitude of the impact may increase with the number of shorebirds using the area, the regional significance of the site and/or the extent to which the loss reduces carrying capacity.
	Degradation of habitat leading to a substantial reduction in migratory shorebird numbers.	Defining substantial reduction is made on a case-by-case basis. Factors to consider include: <ul style="list-style-type: none"> • the number of migratory shorebirds historically using an area (based on surveys and historical data) • likely resultant changes in bird numbers and species diversity • alterations to the value, quality, geographic extent of the area (for example, will the area still be classed as important habitat) • the function and role of the area (roosting, foraging) and likely changes in ecology and hydrology • the regional and local context of the area
	Increased disturbance leading to a substantial reduction in migratory shorebird numbers.	
	Direct mortality of birds leading to a substantial reduction in migratory shorebird numbers.	

Ecological element	Significant impact	Comment
		<ul style="list-style-type: none"> the nature, extent, duration and timing of impacts, their likelihood and consequence.

Waterbirds have been counted in Western Port at least three times per year since 1973, in a co-ordinated citizen science survey run by Birdlife Australia. These have focused on strategic sites including high-tide roosts, stretches of coast and nearby wetlands (Loyn *et al.* in Melbourne Water 2018). Between 1973 and 2012 there have been five surveys per year occurring in late summer (January or February), autumn (April or May), winter (June, July or early August), spring (September or October) and early summer (November or December). Spring and autumn counts were discontinued from 1994, and only three surveys per year were conducted thereafter. These surveys have been of high-tide roosts and nearby stretches of coast.

Shorebirds 2020 data, obtained from BirdLife Australia, indicates that the same species assemblages for waders and waterbirds have been recorded from the long-term monitoring sites at nearby Hastings Bight, Long Island and Hanns Inlet/Sandy Point during surveys undertaken since 2011 and that habitats at Crib Point have not recorded any listed migratory bird species.

The primary and secondary foraging habitats in the intertidal zone offshore from Woolleys Beach meets the criteria for important habitat because all habitats for migratory shorebirds within the Western Port Ramsar site meet the criteria for important habitat as defined in *EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (Commonwealth of Australia 2017) by virtue of the designation of the Ramsar site.

Based on the risk assessment criteria, as well as the *Significant Impact Guidelines*, and *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species*, the risk of a significant impact on waders and waterbirds within the Project study area is negligible.

The full assessment is provided in Appendix 7.

7.1.3.2 Flora and Fauna Guarantee Act

Merran's Sun-orchid has a recorded population of up to 391 plants between KP 1.13 and KP 1.7. Originally, it was proposed to use a combination of HDD and open trench construction through the area occupied by the population of this orchid. However, this would have resulted in a loss of approximately 13% of the population and this was considered to represent a severe. Accordingly, it is now proposed to avoid any disturbance to the orchid population from trenching by using HDD beneath the entire population at this site. This would involve a HDD of approximately 650 metres in length from the southern side of Woolleys Road (near KP1.8) exiting to the south of the orchid population. A 640 metre by 10 metre area for the pipe string is required to the south of the exit point which would extend into regrowth vegetation and disturbed industrial land on former Western Port Refinery (Viva) land. A temporary return line would run along the existing cleared easement between the drill entry and exit points which consists of HDPE piping. This return line would be used during the drilling only, and would be located to avoid the orchid population. It would be removed once the HDD is completed. The risk of this pipe failing is negligible, as it would not be under pressure and would be subject to routine inspection on foot.

Remaining individuals within the ROW should be avoided using exclusion fencing. Mitigation measure MM-FF10 Merran's Sun-orchid, Pallid Sun-orchid and Gaping Sun-orchid would ensure that impacts to the Merran's Sun-orchid are avoided. The residual risk to the Merran's Sun-orchid population is considered to be very low.

Flatback Mangrove Goby was recorded by Biosis (2019a) within Watson Creek. The Pipeline Works are unlikely to impact on this species, as it is implementing HDD within all areas of suitable habitat. It is unlikely that sedimentation or pollutant run-off would impact on aquatic habitat for this species with mitigation measures MM-FF13 Surface water sedimentation and runoff and MM-FF14 Surface water contamination in place.

Swamp Skink was not recorded during targeted surveys by Monarc Environmental (2018e), however, there are records within 100 metres of the Pipeline Works study area. There are a total of 31 observations within 5 kilometres of the proposed pipeline alignment, recorded as recently as 2010 (DELWP 2017b). Its preferred habitat includes densely vegetated swamps and associated watercourses, wet heaths, sedgeland and saltmarshes. It is highly likely that Swamp Skink is present within parts of the Pipeline Works study area, despite not being recorded during targeted surveys by Monarc Environmental. The Pipeline Works are likely to have a localised impact through mortality of individuals and removal of habitat within the ROW in suitable areas of habitat (refer to Table 25). Impacts to habitat are likely to be localised and short-term, and once vegetation has re-established within the ROW, the species can be expected to recolonise the area (MM-FF01 Unplanned vegetation loss, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF05 Site Rehabilitation). MM-FF08 (injury and/or disturbance to fauna) recommends that a specific protocol be developed for clearing Swamp Skink and Glossy Grass Skink habitat in consultation with Mornington Peninsula Shire, with reference to the management activity guidelines developed by Robertson and Clemann (2015) for Swamp Skink.

Lewin's Rail was recorded within the Pipeline Works study area. Habitat for the species includes densely vegetated wetlands, farm dams, swamps, saline lakes and river flats where they are able to wade for invertebrates in the shallows. This species would likely suffer some loss of suitable foraging or dispersal habitat within areas of agricultural land that becomes seasonally inundated. Noise and vibration impacts may temporarily displace this species from the immediate vicinity of construction works. Lighting within areas employing HDD may also temporarily displace this species from the area. These impacts are generally unavoidable, but can be mitigated (refer to Section 8) in order to lessen harm to individuals and to reduce long-term impacts on populations (MM-FF01 Unplanned vegetation loss, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF05 Site Rehabilitation).

Baillon's Crake has no records within the proposed pipeline alignment. There are, however, six records for the species recorded within 5 kilometres of the proposed pipeline alignment. The species habitat includes well-vegetated permanent and temporary fresh and brackish wetlands. Most observations have been recorded nearby to dams on properties west of the Pakenham Water Recycling Plant. This species (if present) would likely suffer short-term noise and vibration impacts that may temporarily displace this species from the immediate vicinity of construction works. Lighting within areas employing HDD may also temporarily displace this species from the area. These impacts are generally unavoidable, but can be mitigated (refer to Section 8) in order to lessen harm to individuals and to reduce long-term impacts on populations (MM-FF01, MM-FF03, MM-FF04, MM-FF05).

Blue-billed Duck has one record within the Pipeline Works study area (Monarc Environmental 2018a). The species is almost wholly aquatic, preferring open or densely vegetated wetlands. Observations for the species have been recorded predominantly near dams surrounding the South East Water Somers Treatment Plant (Somers), the Pakenham Water Recycling Plant as well as along Hodgins Road in Hastings. This species is unlikely to be impacted by the Project. There is suitable habitat adjacent to the proposed pipeline alignment that may be affected by noise associated with construction. Blue-billed Duck is a mobile species within south-eastern Australia with significant capacity to disperse widely in response to seasonal environmental conditions (Frith 1967) and may experience temporary displacement for the duration of works. No medium or long-term impacts are likely (MM-FF01 Unplanned vegetation loss, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF05 Site Rehabilitation).

Little Egret was recorded within Hastings Bight by Biosis during the current assessment, and is likely to utilise a range of wetland habitat throughout the Project Area. The Pipeline Works may impact on suitable foraging habitat within areas of agricultural land that becomes seasonally inundated. Noise and vibration impacts may temporarily displace this species from the immediate vicinity of construction works. Lighting within areas employing HDD may also temporarily displace this species from the area. These impacts are generally unavoidable, but can be mitigated (refer to Section 8) in order to lessen harm to individuals and to reduce long-term impacts on populations.

The Pipeline Works may impact on suitable foraging habitat for **Intermediate Egret** within areas of agricultural land that becomes seasonally inundated. Noise and vibration impacts may temporarily displace this species from the immediate vicinity of construction works. Lighting within areas employing HDD may also temporarily displace this species from the area. These impacts are generally unavoidable, but can be mitigated (refer to Section 8) in order to lessen harm to individuals and to reduce long-term impacts on populations.

Eastern Great Egret was recorded by Biosis during the current assessment, and is likely to utilise a variety of wetland habitat throughout the Project Area. The Pipeline Works may impact on suitable foraging habitat within areas of agricultural land that becomes seasonally inundated. This species was observed within the Pipeline Works study area, and is anticipated to use other areas despite not being observed. Noise and vibration impacts may temporarily displace this species from the immediate vicinity of construction works. Lighting within areas employing HDD may also temporarily displace this species from the area. These impacts are generally unavoidable, but can be mitigated (refer to Section 8) in order to lessen harm to individuals and to reduce long-term impacts on populations.

The Pipeline Works may impact on suitable foraging or dispersal habitat for **Australian Little Bittern** within areas of agricultural land that becomes seasonally inundated. Noise and vibration impacts may temporarily displace this species from the immediate vicinity of construction works. Lighting within areas employing HDD may also temporarily displace this species from the area. These impacts are generally unavoidable, but can be mitigated (refer to Section 8) in order to lessen harm to individuals and to reduce long-term impacts on populations.

White-bellied Sea-eagle is unlikely to be impacted by the Project construction. This species would not utilise habitat that is impacted by the Project, and as a consequence, noise, vibration and lighting are unlikely to affect it.

Powerful Owl foraging habitat would be impacted in the vicinity of Watson Creek where the most recent records for this species in the vicinity of the Pipeline Works study area occur. In this area, there are a number of large trees (~70 centimetres DBH), many of which provide hollows. Tree species include Messmate, Narrow-leaf Peppermint and Coastal Manna Gum. None of these hollows are likely to be large enough to provide suitable breeding sites for Powerful Owl, however many appear suitable for prey species such as Brush-tailed Possum. There would be a large number of trees with hollows remaining. The majority of other areas do not support large hollow-bearing trees, and species impacts are unlikely.

Caspian Tern was recorded from within the Gas Import Jetty Works study area by Biosis in 2019 and has also been recorded near Crib Point in 1976. Many additional records occur within 5 kilometres. Caspian Terns inhabit fresh to brackish waters in natural and artificial environments including estuaries, inlets, bays, lagoons, inland lakes, flooded pasture and sewage ponds. The species breeds in a variety of coastal habitats including banks, ridges and beaches of sand and shell, often in open or among low or sparse vegetation. Potential minor impacts to Caspian Tern could occur in response to noise and lighting within the vicinity of the Project. These are likely to be short-term, and not result in impacts to populations or harm individuals. Mitigation measures may reduce minor impacts further.

Chestnut-rumped Heathwren is likely to be subject to minor impacts associated with habitat removal, and may be locally displaced as a result of noise, vibration and lighting for construction of the Project. Mitigation measures may reduce the short-term effects on this species. The removal of habitat is unlikely to have a long-term impact on the species and an abundance of coastal habitat remains around the impacted areas.

7.1.3.3 DELWP Advisory Listed species

Direct impacts

There are a further 12 species listed under the DELWP Advisory list that are likely to occupy habitat within the Project study area. These species are not considered for offsets as these are triggered when vegetation removal exceeds a threshold of remaining habitat for each species.

Creeping Rush was not recorded within the current pipeline alignment. Strict adherence to standard mitigation measures for avoiding and minimising impacts to native vegetation may reduce impacts in saltmarsh. Impacts to this species at population and local scales are considered negligible.

Austral Crane's-bill may be directly impacted through construction activities as part of the Pipeline Works. This species was not directly recorded within the current pipeline alignment. Individuals of this species may be lost during construction activities. Strict adherence to standard mitigation measures for avoiding and minimising impacts to native vegetation may reduce impacts further. Impacts to this species at population and local scales are considered negligible.

Southern Toadlet were recorded during targeted surveys. A total of 72 other sightings have been recorded as recently as 2016. Habitat of the species is varied, consisting of open forests, lowland woodlands and heathlands where adults shelter beneath leaf litter and other debris in moist soaks and depressions near to water sources. It is likely that construction of the ROW would impact on individuals of this species, at least in the short-medium term as habitat is fragmented. Pipeline Works construction activities may impact on this species on a localised scale.

Glossy Grass Skink has 10 records within 5 kilometres of the Pipeline Works study area, listed as recently as 2010 and as close as 110 metres from the proposed pipeline alignment. The species can be found in damp environments like drainage lines, soaks and the margins of creeks (particularly in dense vegetation including rank grass, reeds and sedges) as well as long the fringes of coastal saltmarshes. Most observations of the species have been predominately within Coastal Saltmarsh near Kings Creek within Hastings Foreshore Reserve and Warringine Creek within Warringine Park. The species has also been recorded in association with drainage lines which run through farmland south of Pakenham and the Princes Highway, between Toomuc Creek and the Pakenham Water Recycling Plant. The Pipeline Works are likely to have a localised impact through mortality of individuals and removal of habitat within the ROW in suitable areas of habitat (refer to Table 25), however the reinstatement of habitat following the completion of works is expected to allow the species to recolonise these areas and recover in the longer term. Mitigation measures relevant to this species are provided in Section 8, and includes the development of a specific protocol for clearing Swamp Skink and Glossy Grass Skink habitat to minimise impacts (MM-FF08 Injury and/or disturbance to fauna).

Hardhead has 112 records for the species within 5 kilometres of the Pipeline Works study area, listed as recently as 2013 and as close as 45 metres from the proposed pipeline alignment. The species is almost wholly aquatic, preferring to roost on low branches and stumps close to freshwater swamps and wetlands, and occasionally in sheltered estuaries. This is consistent with records from the South East Water Somers Treatment Plant (Somers) and wetlands within Swamp Scrub just east of the plant which drain into a nearby inlet. Suitable habitat adjacent to the proposed pipeline alignment would not be impacted by the Pipeline Works and the Project is not likely to impact this species.

Musk Duck has similar habitat preferences to Hardhead and is a diving duck that is substantially reliant on deep-water wetlands and also uses sheltered estuaries. The Project would not impact upon habitat suitable for the species and the Project is not likely to impact upon it.

Gaping Sun-orchid has at least six pre-existing records from within 5 kilometres of the Pipeline Works study area, the latest from 2006. The species is currently known only from Crib Point and French Island where it inhabits near-coastal heathy woodland on seasonally damp sandy soil. Targeted survey of the area found two individuals growing with Merran's Sun-orchid on the existing pipeline easement beside Woolleys Road between KP 1.13 and KP 1.7. These plants would be avoided by HDD. Suitable habitat for this species co-exists with areas supporting Merran's Sun-orchid along the easement adjacent to Woolleys Road. Mitigation works for Merran's Sun-orchid would also benefit habitat for Gaping Sun-orchid.

Crested Sun-orchid has no records within the proposed pipeline alignment. There are three records from 1999 for the species within 5 kilometres of the study area, approximately 1700 metres away. The species, believed to be a natural hybrid between *Thelymitra ixiodes* and either *T. carnea* or *T. rubra*, occurs sporadically where the parent species grow intermingled. It can be found in many habitats including swamps, heathland on sandy soils, low woodlands, open woodlands and grassland. Records were found within Coastal Saltmarsh within Woolleys Beach Reserve and Swamp Scrub within the HMAS Cerberus Reserve. Some suitable habitat for this species co-exists with areas containing Merran's Sun-orchid, as both suspected parent species are present adjacent to Woolleys Road. Mitigation works for Merran's Sun-orchid is likely to also benefit habitat for Crested Sun-orchid.

Marsh Sun-orchid has two records within the Project Area, one within 300 metres of the Gas Import Jetty Works study area south of Crib Point. There is suitable habitat within the study area adjacent to Crib Point, and between KP 1.13 and KP 1.7 in similar habitat to Merran's Sun-orchid, which would be avoided through the use of HDD in this area. Mitigation measures as per Merran's Sun-orchid would mitigate impacts.

Pallid Sun-orchid has three pre-existing records within the Project Area, one within 150 metres of the Gas Import Jetty Works study area south of Crib Point. There is suitable habitat within the study area adjacent to Crib Point, and targeted survey of the area found two individuals growing with Merran's Sun-orchid on the existing pipeline easement beside Woolleys Road between KP 1.13 and KP 1.7. These plants would be avoided by HDD.

Crimson Sun-orchid has suitable habitat within the study area adjacent to Crib Point and adjacent to Woolleys Road in similar locations to Merran's Sun-orchid, which would be avoided through the use of HDD. This species was not observed during surveys in the area, however mitigation measures for Merran's Sun-orchid are expected to also benefit potential habitat for this species.

Green Leek-orchid has 10 records within the Project Area, with a considerable number of records at Stony Point. There is suitable habitat adjacent to the study area south of the Crib Point Jetty. This area is not proposed to be impacted, and therefore this species is unlikely to be impacted. No leek orchids were observed during targeted surveys for Dense Leek-orchid at this location, or adjacent to Woolleys Road further north. An impact on this species, if it is present, would be unlikely to affect the population as a whole.

White-throated Needletail has 47 records within the proposed pipeline alignment, as recently as 2010. This species is listed as Vulnerable under the EPBC Act, and is also a listed Migratory species. It is mostly an aerial species that occurs over most types of habitat, and is not reliant on habitat provided by the study area and the Project has no known capacity to have any impact on this species.

Impacts on modelled habitat for rare or threatened species

Impacts to habitat for species listed on a DELWP Advisory List are calculated across the Project and are calculated within the Native Vegetation Removal Report (Appendix 5). The following species would have more than 0.005 per cent of their total modelled habitat impacted by the proposed works:

- Tiny Arrowgrass *Triglochin minutissima*
- King Quail *Coturnix chinensis victoriae*
- Coast Helmet-orchid *Corybas despectans*
- Coast Twin-leaf *Zygophyllum billardiarei*
- Coast Wirilda *Acacia uncifolia*
- Coast Bitter-bush *Adriana quadripartita*.

None of these species were recorded within the Project study area, however the study area does contain suitable habitat for all of them apart from King Quail, which is believed to be confined to French Island. Impacts and offset prescriptions associated with these species are discussed in Section 8.2.

7.1.4 Significant ecological communities

The Project study area contains one EPBC Act listed ecological community (subtropical and temperate saltmarsh), which occurs in one location at KP 20.2, near South Boundary Road East, Pearcedale. This community is listed as vulnerable and is therefore not considered a Matter of National Environmental Significance for the purposes of the EPBC Act (Commonwealth of Australia 2013b).

The Project study area does not contain, and is considered unlikely to impact on, any FFG Act listed ecological communities.

7.1.5 Western Port Ramsar site

As defined in the EPBC Act Policy Statement 1.1 Significant Impact Guidelines, an action is likely to have a significant impact on the ecological character of a declared Ramsar wetland (in this instance the Western Port Ramsar site), if there is a real chance or possibility that it will result in:

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

An assessment of impacts to the Ramsar site following the Significant Impact Guidelines is presented in Appendix 7. A significant impact is not expected to occur.

The critical elements of the ecological character of Western Port have been amended (Hale 2016) since its original listing in 1982. This is due to a variety of causes, including historical and current activities that threaten the character of the site, such as:

- Historical catchment alterations (i.e. large scale vegetation clearance, wetland drainage and channelization)
- Catchment and coastal erosion
- Deteriorating water quality
- Shipping
- Recreational activities
- Pest plants and animals
- Climate change
- Urban development
- Grazing
- Fishing.

Amendments to the Ecological Character Description (ECD) for the Western Port Ramsar site by Hale (2016) include refined Limits of Acceptable Change (LAC) for Critical Components, Processes and Services (CPS). A summary is provided in Table 34 of the current assessment against these revised LAC.

Table 34 Summary of assessment against LAC for the Western Port Ramsar site. (Reproduced from Hale 2016).

Critical CPS	Limit of Acceptable Change	2016 Assessment (Hale 2016)	Assessment for the Project
Wetland bathymetry	No loss of intertidal mudflat area (270 km ²)	Although there has been work on coastal erosion, there is no current information on the extent of intertidal mudflat area. Insufficient data to permit assessments against this LAC.	Project is not directly impacting upon intertidal mudflats.
Geomorphology and sedimentation	No LAC set	Not applicable	Project is unlikely to affect geomorphology of Western Port or to cause sedimentation that might alter the character of the Ramsar site. Mitigation MM-FF17 is intended to further minimise such effects.
Marine invertebrates	No LAC set	Not applicable	
Flora – Seagrass	Total seagrass extent will not decline below 5400 hectares for a period of greater than 10 continuous years.	Melbourne water measured 15 000 hectares in 2011 (Holland et al. 2013). LAC is met.	Project is unlikely to reduce extent of seagrass. No direct removal of seagrass proposed. CEE (2020) marine assessment concludes risk of impacts to seagrass as very low.

Critical CPS	Limit of Acceptable Change	2016 Assessment (Hale 2016)	Assessment for the Project
Flora – mangrove	Total mangrove extent will not decline below 900 hectares.	The most recent assessment of mangrove extent in Western Port indicates 1700 hectares. This represents an increase of 40% since the time of listing. LAC is met.	Project is unlikely to reduce extent of mangroves. No direct removal of mangroves proposed. CEE (2020) marine assessment concludes risk of impacts to mangroves as very low.
Flora – Saltmarsh	Total saltmarsh extent will not decline below 850 hectares.	The most recent assessment of saltmarsh extent in Western Port (Boon et al. 2011) indicates 1143 hectares. There is no evidence of a significant decline in saltmarsh extent. LAC is met.	Project would require removal of a very small (0.134 ha) area of coastal saltmarsh. CEE (2020) marine assessment concludes risk of impacts to saltmarsh as very low. This extent would not result in exceedance of the LAC.
Fauna - Waterbirds	<p>Abundance of waterbirds will not decline below the following (calculated as a rolling five-year average of maximum annual count):</p> <p>Total waterbirds – 12 000 Migratory waders – 5300 Australasian waders - 800 Ducks - 500 Fishers - 550 Gulls - 1600 Large wading birds - 980 Swans – 1600</p> <p>Breeding of beach nesting birds annually within the site</p>	<p>Average maximum count of each group of waterbirds from 2011 – 2015 was as follows (data from BirdLife Australia and Richard Loyn):</p> <p>Total waterbirds – 20,100 Migratory waders - 8500 Australian waders - 2500 Fishers - 810. Ducks - 2100 Gulls - 2300 Large wading birds - 1200 Swans -2600</p> <p>Breeding of beach nesting birds has been recorded annually (Driessen and Maguire 2014)</p> <p>LAC is met.</p>	<p>Project is not considered to have capacity to affect waterbirds or their habitats, directly or indirectly, to the extent that could exceed relevant LAC. The Project would not involve any direct physical disturbance of intertidal flats and is not expected to have any measurable indirect impact on these communities. Trophic impacts that might affect waterbirds are considered to be unlikely (CEE 2020).</p> <p>There is negligible likelihood that the Project would result in any of these LACs being exceeded.</p>
Supports threatened species - birds	<p>Abundance of eastern curlew, curlew sandpiper and fairy tern will not decline below 1% of the population as stated in the most recent Wetlands International Population estimate (based on a five-year rolling average of annual maximum counts). Presence of bar-tailed godwit, lesser sand plover and red knot in at least three out of every five years.</p>	<p>Data from 2011 – 2015 indicate that the average abundance of the three species were as follows:</p> <p>Eastern Curlew – 438 (1% of population)</p>	<p>Project is not considered to have capacity to affect waterbirds or their habitats, directly or indirectly, to the extent that could exceed relevant LAC. Project would not directly impact upon known important habitat areas for waterbirds, including secondary or primary foraging areas or roosts. The Project would not involve any direct physical disturbance of intertidal flats and is not expected to have any measurable indirect impact on these communities.</p>

Critical CPS	Limit of Acceptable Change	2016 Assessment (Hale 2016)	Assessment for the Project
		<p>Curlew Sandpiper – 622 (0.5% of population)</p> <p>Fairy Tern – 22 (1.5% of population)</p> <p>Data from 2011 – 2015 indicate presence of the three species:</p> <p>Bar-tailed Godwit – all five years</p> <p>Lesser Sand Plover – three years</p> <p>Red Knot - three years</p> <p>LAC is exceeded for Curlew Sandpiper, but met for all other species. Exceeded LAC for Curlew Sandpiper is likely to be result of impacts in northern hemisphere.</p>	There is negligible likelihood that the Project would result in any of these LACs being exceeded.
Fauna – Supports threatened species of fish	Australian Grayling continues to be supported in one or more of the catchments draining into Western Port.	<p>Data from the Bunyip River (2008 – 2010) indicates that the Australian Grayling are present, spawning and migrating through this system (Koster and Dawson 2010).</p> <p>LAC is met.</p>	<p>With sedimentation / contamination mitigation measures in place (refer to Section 8), the Project would not adversely impact on aquatic habitat. Project would maintain aquatic habitat connectivity during breeding periods.</p> <p>There is negligible likelihood that the Project would result in any of these LACs being exceeded.</p>

In Kellogg, Brown and Root (2010) changes to facets of the ecological character of Western Port were unable to be determined. While three species of wader had shown evidence of a decrease in numbers, the general counts of other waders and waterbirds had remained somewhat stable. Marine invertebrates also appeared to have remained stable, while fish numbers appeared to have fallen by 50 per cent from 1982 to 2007.

HDD is being utilised at the only two locations of the pipeline alignment that overlap with the Western Port Ramsar site, therefore the Pipeline Works are considered unlikely to result in an increase or alteration to any of these components. A CEMP for the Pipeline Works would outline on-site requirements for pollutant and sediment control to mitigate the potential for litter or nutrient rich run-off to enter Western Port.

No impacts on water drawdown, flow durations, or water levels are likely to occur within the Western Port Ramsar site. Any potential impacts resulting from sedimentation or pollution of waterways is unlikely to be of a scale that would be measurable within Western Port. As such, impacts on the extent of habitat and therefore on waterbird diversity and abundance are unlikely to occur. Construction impacts are unlikely to alter critical components of the Western Port Ramsar site.

In reference specifically to the revised LAC (Hale 2016) in Table 36, the Project in relation to CPS categories Wetland bathymetry, Flora – Seagrass, Flora – mangrove and Flora – Saltmarsh would not result in the loss of intertidal mudflat area, as no portion of the works or operation are located within the intertidal zone and is

also unlikely to impact on saltmarsh, mangrove, mudflat, intertidal seagrass, subtidal seagrass and channel slope communities and sensitive species that occupy habitats to a water depth of 12.5 metres (CEE 2020).

For category *Fauna – Waterbirds* and category *Supports threatened species – birds*, construction and operation of the Project are unlikely to significantly impact upon any of these groups and/or species given what is known about the relative usage and location of important roost and foraging sites within the Western Port Ramsar site. The extent of available habitat for these groups and species of birds that exists close to the FSRU and along the Pipeline Works are minor in comparison to the available habitat within the remainder of the Western Port Ramsar site and effects of the Project are considered to be very low. Impacts on any of these species measured in terms of international population decreases below 1% and/or ongoing presence within the Western Port Ramsar site in three out of every five years are unlikely to be caused by the Project.

It should be noted that for Curlew Sandpiper the LAC was exceeded between 2011 and 2015. It has been shown that impacts occurring for this migratory species in the northern hemisphere have caused a population decline and this is reflected in reduced individuals returning to the southern hemisphere (Studds et al. 2017). It is likely that the global population estimate for this species will be considerably lower in the next revision of the Waterbird Population Estimates (Hale 2016).

Fauna – Supports threatened species of fish – Australian Grayling has been previously recorded within the catchment draining into Western Port and is likely to remain present. However, targeted surveys undertaken in 2018 by Monarc Environmental did not record the species. The Project would ensure that fish passage is maintained at locations where this species may migrate between freshwater and estuarine habitats.

The potential for impacts of the Project on both the Western Port Ramsar site and waterbirds is centred on Crib Point Jetty, where the FSRU would be located, and three locations where the transfer pipeline traverses beneath the Ramsar Site via HDD within Warringine Park and Watson Creek environs, with the latter sites discussed in Section 5.2. The wader and waterbird habitats that are nearby to the Crib Point Jetty include the shorelines and exposed mudflats at Woolleys Beach. North and south of the Crib Point Jetty the coastal zone of Woolleys Beach is noted as secondary foraging habitat. This is contiguous with a band of secondary foraging habitat extending from Hastings to Stony Point along the coast. A far greater area of mud flats is exposed at low tide to the north of Crib Point Jetty which is contiguous with the extensive primary foraging habitat described within Hastings Bight (Hansen 2011; Figure 5). Observations made by Biosis in March 2019 included large numbers of ibis, egrets, ducks, gulls, spoonbills and swans using the Hastings Bight area, with similar species also using Woolleys Beach at the same time in much lower numbers. This is likely a reflection of the smaller area of exposed mudflats at low tide and shallow water at high tide at Woolleys Beach in comparison with the larger Hastings Bight.

7.1.6 Cumulative impacts

The scoping requirements for the Project call for a consideration of the potential for the Project to contribute to a greater cumulative effect on biodiversity “in combination with other projects or actions taking place or proposed nearby”. The *Ministerial Guidelines for Assessment of Environmental Effects under the Environment Effects Act 1978* (DSE 2006) provides information about how cumulative effects may be considered in light of practical ability for a proponent to know the types or extent of impacts that other projects may entail. It says that because of the factors constraining quantitative assessment of cumulative effects, often only a qualitative assessment would be practicable.

‘Projects or actions taking place or proposed nearby’ were identified on the basis that relevant information for them was publicly available; that they individually provide some measured evaluation of likely effects on receptor species and/or ecological communities and that they were within the same region or catchment as the Project and/or were geographically within close proximity to it. In light of the fact that existing conditions

provide the baseline against which to evaluate impacts, projects that are recent or in current planning were included in consideration of potential cumulative impacts.

The geographic region local to the project has been subject to very considerable anthropogenic modification in the period since European settlement. Industry, urbanisation and agriculture have changed the local environment and continue to have effects. By way of example, it is probable that waterbirds using Western Port have been influenced by all of these and more particular effects such as fisheries and recreational uses of beaches. However, studies of waterbirds in Western Port that have included consideration of deleterious effects on their populations (e.g. Hansen et al. 2011; Loyn et al. [in Melbourne Water 2018]) have not been able to quantify the impacts of any of the currently operating influences within the region on waterbird populations. Hansen et al. say, "for the majority of these species, there are no obvious biological or environmental factors for which adequate data was available, which could be tested to explore possible causal relationships". In view of the over-riding lack of such information, it is not feasible to specify how the current project might add to the cumulative effects of individual or collective components of the array of pre-existing influences on biodiversity.

Other current development projects that were identified for their capacity to contribute to cumulative impacts in combination with the construction or operation of the present Project have been identified to include:

- High Capacity Metro Trains Depot in Nar Nar Goon.
- Healesville-Koo Wee Rup Road upgrade works, Pakenham South.
- Port of Hastings upgrade of Crib Point Jetty (Berth 2).

A brief outline of each of these projects is provided below.

The **High Capacity Metro Trains Depot** runs adjacent to the Pipeline Works for a number of kilometres at the northern end of the study area alongside the rail corridor, north of Bald Hill Road. This project has completed the construction phase, and is moving into operational phase. Principal flora and fauna values that were considered to have potential to be impacted by development of the High Capacity Metro Trains Depot were Southern Brown Bandicoot, Growling Grass Frog, Dwarf Galaxias, Matted Flax-lily and Maroon Leek-orchid (Kellogg Brown & Root 2014). Potential for effects on vegetation communities, migratory species, listed ecological communities and the Western Port Ramsar site were also evaluated and the project was referred under the EPBC Act (referral 2014/7263). In August 2014, the High Capacity Metro Trains Depot project was deemed to be a controlled action under the EPBC Act.

The assessments considered that the potential for impacts on these receptor species were low or negligible and the project received planning approval. The referral indicated that there were some small areas of potential habitat for Southern Brown Bandicoot and Growling Grass Frog that would be removed by the project. It did not quantify these areas of possible habitat

Healesville-Koo Wee Rup Road upgrade is a proposal in the planning stage. The works associated with this project within the vicinity of Pipeline Works study area include the widening of Healesville – Koo-Wee-Rup Road, with one additional lane in each direction for a length of approximately 10 kilometres. The principal flora and fauna values that were considered to have potential to be impacted by the Healesville-Koo Wee Rup Road upgrade are Southern Brown Bandicoot, Grey-headed Flying-fox, Australasian Bittern, Growling Grass Frog and Dwarf Galaxias (Arcadis 2019). Potential for effects on vegetation communities, migratory species, listed ecological communities and the Western Port Ramsar site were also evaluated and the project was referred under the EPBC Act (referral 2019/8487). In late August 2019, the Healesville-Koo Wee Rup Road upgrade project was deemed to be a controlled action under the EPBC Act.

Principal assessments for species and ecological communities determined that, with the exceptions of Southern Brown Bandicoot and Growling Grass Frog, the risk of a significant impact from the Healesville-Koo Wee Rup Road upgrade would be low even without mitigation measures. Arcadis (2019) determined that approximately 5.079 hectares of habitat for Southern Brown Bandicoot will be removed in the Healesville-Koo Wee Rup Road upgrade construction footprint, which will reduce the area for foraging and dispersing for the species.

For Growling Grass Frog a total of approximately 64.428 hectares of habitat (breeding and foraging/dispersal) will be removed in the Healesville-Koo Wee Rup Road upgrade construction footprint. This consists of 0.255 hectares of wetland habitat that is suitable for breeding, including sites for egg laying and habitat for tadpoles plus another 64.173 hectares of foraging and dispersal habitat.

The effects upon both the Southern Brown Bandicoot and Growling Grass Frog were assessed as potentially significant in the short to medium term, but not significant in the long term provided appropriate mitigation measures are applied.

Port of Hastings Crib Point Jetty upgrade. The Port of Hastings is planning an upgrade to the Crib Point Jetty to enable continued and effective use of the jetty facility. These works are separate from those included in the current Project and are not subject to this EES process. The proposed works were the subject of ecological assessments (PKA 2015, 2016) and a subsequent management plan (Jacobs 2018b).

The Jacobs assessment concluded that the project is not expected to impact on migratory birds due to the lack of suitable habitat within the study area. Further, the Southern Brown Bandicoot has suitable habitat present within and around the terrestrial portion of the study area, however, a previous targeted survey (PKA 2015) failed to detect the species there.

The Crib Point Jetty Upgrade project has received consent under the Marine and Coastal Act.

Potential for cumulative impacts

With the exception of native vegetation, it is not feasible to consider potential cumulative impacts of all of these projects on all potential receptors in a quantitative manner. Impacts upon native vegetation are measured and assessed according to the *Guidelines for the removal, destruction or lopping of native vegetation* (refer to Sections 7.1.1 and 7.2.1) and, in effect, that process manages cumulative effects on native vegetation on a state-wide basis

The assessments provided here consider that potential impacts of the current Project on all other biodiversity values and receptors would be low or negligible. A variety of mitigation measures (refer to Section 8) are recommended and can be expected to further limit the capacity for the Project to have negative residual effects.

The Pipeline Works for the present Project would involve removal of known and/or assumed habitat for Southern Brown Bandicoot at 19 locations totalling 1.1 hectares. The very great majority of that total area would be rehabilitated specifically to restore habitat for the species and thus that loss would be short-term. The Healesville-Koo Wee Rup Road upgrade is expected to remove approximately 5.079 hectares of habitat for the species. The amount of habitat that might have been lost for the High Capacity Metro Trains Depot is not known and the Port of Hastings Crib Point Jetty upgrade is not expected to affect habitat for the species. The present Project can thus be expected to add to the regional cumulative effect on the Southern Brown Bandicoot population by a relatively small amount and for a short duration.

The present Project has identified known or potential breeding and/or movement corridor habitat for Growling Grass Frogs where the pipeline route intersects with Cardinia Creek at the end of Bloomfield Lane, and at the connected series of drains comprised of Lower Gum Scrub Creek, Toomuc Creek and Deep Creek. At all of the identified wetland locations suitable for the species is proposed to be HDD so no habitat for the

species at those locations would be removed as part of the Project works. Some terrestrial environments adjacent to known or potential wetland habitats for the species where trenching is proposed may represent overwintering habitats, but the cryptic nature of the species during this part of its life-cycle is poorly understood and it is not possible to map the extent of such possible habitat areas. All of these locations would be rehabilitated following construction so any effects on terrestrial environments that may be used by the species would be temporary and of short duration. The present Project is thus not expected to add to a measurable cumulative effect on the regional Growling Grass Frog population.

In a qualitative manner there is thus very little likelihood that the Project would contribute to the effects of other local projects to the extent or degree that their combined impact would be significant for any species or ecological community, nor on the character or functioning of Western Port Ramsar site.

7.1.7 Avoid and minimise statement

The *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017a) require an *avoid and minimise statement* that describes any efforts to avoid the removal of, and minimise the impacts on, the biodiversity and other values of native vegetation, and how these efforts focussed on areas of native vegetation that have the most value. The statement should include a description of the following:

- Strategic level planning – any regional or landscape scale strategic planning process that the site has been subject to that avoided and minimised impacts on native vegetation across a region or landscape
- Site level planning – how the proposed use or development has been sited or designed to avoid and minimise impacts on native vegetation.
- That no feasible opportunities exist to further avoid and minimise impacts on native vegetation without undermining the key objectives of the proposal.

7.1.7.1 Pipeline Works impact area

Changes in alignment or width of the construction footprint and HDDs designed to avoid or minimise impacts on biodiversity values in the Pipeline Works impact area are summarised in Appendix 8 which indicates where the proposed pipeline has been sited or designed to avoid or minimise impacts as part of site level planning.

7.1.7.2 Gas Import Jetty Works impact area

The terrestrial component of the Gas Import Jetty Works impact area is located on an area that was cleared of native vegetation in the 1960s and has been allowed to regenerate since the mid-1970s. The proposed Crib Point Receiving Facility location on the north side of the Crib Point Jetty has a relatively lower condition score than adjacent undisturbed vegetation. A linear strip immediately south of the Crib Point jetty between The Esplanade and coast with potential habitat for significant orchids has been avoided.

7.2 Operation

Impacts associated with the operation of the Project would involve very different activities from those of the construction phase, for both the Pipeline Works and the Gas Import Jetty Works.

The pipeline operation is considered to have negligible potential for impacts on terrestrial and freshwater biodiversity, including at the delivery facility and EOLSS. However, following construction, the pipeline would have on-going requirements for aerial and on-ground inspections, as well as routine inspections using a pipeline inspection gauge every 5 to 10 years.

The Gas Import Jetty Works would require on-going shipping, berthing, loading and unloading, transferring of liquid natural gas and routine maintenance to the jetty or jetty facilities.

This section discusses the different risk pathways for impacts to terrestrial and freshwater biodiversity during the operational phase of the Project.

7.2.1 Native vegetation and habitat loss / modification

7.2.1.1 Loss of native vegetation

There is no removal of native vegetation beyond the initial Project impact area anticipated with the operation of the Project.

It is conceivable that in rare circumstances, maintenance may be required along an area of the pipeline alignment outside the initial Project impact area that contains native vegetation. In this circumstance, there could be requirements for removal of native vegetation however it is not possible to quantify what level of impact would occur. Other components of the Project, including the delivery and receiving facilities, are unlikely to require vegetation removal. Risk ID FFO5 and FFO8 applies to this section. Mitigation measure MM-FF01 provides proposed mitigation for the rare event in which unplanned removal of native vegetation may be required during the operational phase.

7.2.1.2 Leaks or spills

A spill or leak could occur during the operational phase of the Project. The highest risk areas include the Pakenham Delivery Facility, the Crib Point Receiving Facility and within the interactions between the FSRU and LNG carriers and other vessels.

It is unlikely that a spill or leak would occur in association with the operation of the pipeline itself, such as from a maintenance vehicle. Additionally, the consequence of any such spill would be negligible and would be confined to the immediate area surrounding the vehicle conducting the maintenance procedure. EES Technical Report K: *Safety, hazard and risk*, and the accompanying EES chapter identifies the potential for spills or leaks to occur.

Spills or leaks at the Pakenham Delivery Facility are unlikely to impact on native vegetation or fauna, as neither occur in the immediate vicinity. The Crib Point Receiving Facility does contain some areas of native vegetation and fauna habitat, however spills and leaks in this area are unlikely to extend outside the operational footprint to reach such areas.

A spill associated with the FSRU could result in impacts within the immediate vicinity of the vessel, and depending on the size of the spill could extend with the tidal currents to affect waterbirds and their habitats. The risks of spillage and leakage are considered to be low for the following reasons.

The FSRU will operate under a designed OEMP which considers the Port of Hastings guidelines and regulations and is consistent with the *Victorian Marine Safety Act 2010* and the *Marine Regulations 2012*. Only minor quantities of fuels and chemicals will be stored and used on the FSRU, in containers within bunded storages. The FSRU will be moored in relatively calm waters, so there is little potential for accidental spillage, other than due to human mistake.

LNG carriers use natural gas from their own cargo in their engines, unlike other ships such as oil tankers, container ships or bulkers that carry and burn large amounts of marine distillate or heavy fuel oils in their engines. Because LNG carriers use boil-off gas from the cargo as their primary source of fuel; they carry only relatively small quantities of bunker fuels. They also carry small stores of marine diesel on board because the self-ignition temperature of natural gas used in the engines is too high to ignite the natural gas. They use the

diesel as “pilot fuel” in the combustion process. Typically, the amount of pilot fuel used is below one percent of the energy used by the engine.

In addition, LNG carriers are double hulled. There is no single point on the vessel where bunkers (or the LNG cargo) are in direct contact with the outer “skin” of the vessel. For a significant loss of fuel oil to occur, the outer and inner hull of the vessel would have to be breached at the exact point where the bunkers are stored on the vessel. In the unlikely event of this happening, there are also multiple bunker tanks meaning it would be improbable for a full complement of bunkers to be lost.

The small amount of oil on board LNG ships means the risk of an oil spill is low, and it is also highly unlikely due to their double hull construction. Furthermore, if there were a loss of containment in one tank, the ship’s crew would react quickly and transfer bunkers into remaining good tanks, to minimise any loss. If there was LNG spill, natural gas (methane) rises and dissipates to the atmosphere and therefore cannot form a slick on the water.

An EMP relating to the FSRU’s EPA operating licence must include commitments to minimize and manage potential spills to the marine environment. In addition, the FSRU will have a comprehensive Emergency Response Plan, with documented response procedures and appropriate equipment readily available.

The types of vessels and activities proposed for operation of the FSRU do not seem likely to add to the risks posed by existing operations within Western Port in a manner that would substantially alter the potential for effects of spills or leaks on waterbirds that use Western Port.

Mangroves are extremely susceptible to damage from oil spills, which can smother, foul, asphyxiate, poison and cause the absorption of toxic substances. The Victorian EPA lists mangroves of Western Port as ‘ecologically stressed and extremely sensitive to disturbance and other impacts’ (EPA 1996), however, the nearest patch of mangroves is one kilometre distant from Crib Point Jetty. For the reasons set out above, the proposed operation of the FSRU does not seem likely to add to the risks posed by existing operations within Western Port in a manner that would substantially alter the potential for effects on mangroves within Western Port.

Project spill mitigation (MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination) would ensure that spills or leaks are contained as effectively as possible.

Impacts of spills and leaks on marine fauna is addressed in the marine impact assessment report (CEE, 2020).

7.2.1.3 Noise and vibration

With regards to vibration, AECOM (2020) notes that, *“The risk of adverse vibration impacts through the Project are less likely to occur because of the types of proposed construction and operational activities”*. Thus the assessment is focussed on the potential effects of audible noise.

A summary of how noise may affect fauna, particularly birds, is provided in Section 7.1.1.4.

Potential noise impacts on fauna associated with operation of the Project are considered to be restricted to the Gas Import Jetty Works (Crib Point Receiving Facility and the FSRU). The Pakenham Delivery Facility does not have adjacent habitat for fauna. Operation of the FSRU would entail additional vessel movements in Western Port, which are outlined below.

AECOM (2020) provides a technical assessment of all potential sources of noise that is likely during operation of the Gas Import Jetty and FSRU. Potential sources of noise include operation of the FSRU, LNG carriers (including tugboat movements), Pierhead 2 and Crib Point Receiving Facility. The report also provides predicted noise levels at receptor sites under five potential scenarios (1. LNG carrier berthing (closed loop), 2. LNG carrier berthed (closed loop), 3. FSRU operation (closed loop), 4. LNG carrier berthed (open loop), 5. LNG

carrier berthed and nitrogen off-loading (closed loop)). AECOM (2020) set out the frequency and timing of operations that may be involved in production of noise as follows:

- Twelve LNG carriers are expected at the Crib Point Jetty (Berth 2) in the first year of operation, and up to 40 LNG carriers per year are predicted per year in future.
- LNG carriers would berth for ~36 hours at a time.
- LNG carriers would take around one-hour to arrive and to depart while tug-assisted during mooring.
- The number of times that mooring scenarios would occur is twice the number of LNG carrier arrivals (this accounts for both the arrival and the departure of the LNG carriers).

The project is expected to function under scenario 4 during most of its operation. Scenario 4 has the lowest associated noise levels. Scenario 1 may be considered to be a 'worst case' for human amenity due to some night-time noise. In consideration of the effects of operational noise on fauna, scenario 5 is likely to represent a 'worst case' because it has the highest modelled noise levels associated with nitrogen offloading, although that activity would be limited to day and evening times.

To the south of the jetty, secondary foraging habitat for waterbirds extends for approximately two kilometres and the closest primary foraging habitat is south of Stony Point. To the north of the jetty secondary foraging habitat extends in a band approximately 250 metres wide, seaward from the high tide line. Primary foraging habitat occurs in a zone to the north and seaward of the secondary habitat, commencing approximately 250-300 metres north of the nearest part of the jetty. The proposed FSRU berth located on the existing jetty is approximately 600 metres from the closest mapped primary foraging habitat. The closest locations at which noise modelling was undertaken are Woolleys Beach Reserve and HMAS Otama Lookout Beach (AECOM 2020). Both of these locations are adjacent to secondary foraging habitat and closer to the jetty than any primary foraging habitat. The HMAS Otama Lookout Beach location is approximately 250 metres from the nearest point on the jetty.

Figure 8 shows contours for modelled noise propagation from Crib Point Gas Import Jetty and Receiving Facility under scenario 5. A noise level of 45 dB(A) is comparable to a quiet conversation. That noise level is predicted to occur at parts of secondary foraging habitat closest to the Gas Import Jetty and Receiving Facility and levels will continue to attenuate at greater distances. The predicted noise levels at these locations and further beyond them into areas of secondary and primary foraging habitats for waterbirds, are well below levels that would be expected to elicit any response by any species of bird..

As noted previously (Section 7.1.1.4) there is little empirical evidence that the area of Woolleys Beach close to Crib Point Jetty is significantly utilised by shorebirds or other waterbirds. Nonetheless, up to 22 species of such species are considered to have some potential to use the area.

In early April 2020 AECOM measured current noise levels within mapped primary foraging habitat and immediately adjacent to the large mapped roost area at Long Island Point offshore from the Long Island Point Fractionation Plant [REDACTED] Principal Acoustics Engineer, AECOM, pers. comm. 07/04/2020). Maximum sound level, the maximum sound pressure level documented over the measurement interval (L_{Amax}) at those sites was between 64 and 75 dB. Results of this monitoring provide useful context for noise level predictions for operation of the Project at Crib Point Jetty. Maximum noise levels currently being experienced at the primary shorebird foraging and roosting habitats at Long Island Point are equal to, and in some cases higher, than noise levels predicted to reach the closest extremities of secondary and primary foraging habitats near Crib Point Jetty due to construction of the Project.

There are numerous other examples in Australia and internationally of locations where waterbirds, including migratory shorebirds, persist and continue to use suitable foraging habitats in close proximity to noise

emanating from operational infrastructure such as ports, airports, refineries, and heavy industries. Examples in Australia include:

- Curtis Island, Gladstone, Qld. shorebird foraging and roosting areas exist directly adjacent to a major industrial centre with aluminium refineries and smelters, cement production works, chemical plants, a liquefied natural gas facility and Queensland's largest power station.
- Port Botany, NSW shorebird habitat beside a container terminal dock, refinery and Sydney Airport.
- Port Kembla, NSW, shorebird habitat adjacent to steelworks and significant shipping port.
- Port of Brisbane, Moreton Bay, QLD, migratory shorebird habitat adjacent to significant shipping port.

It is not expected that noise of the levels predicted for operational activities associated with the Project at Crib Point Jetty would have measurable effects on use of foraging habitat by any species of waterbird that uses Western Port.

Roost sites used by waterbirds are of vital importance to the natural functioning of their populations. Important roost sites for waders and other waterbirds are shown in Hansen et al. (2011, and reproduced here as Figure 5). The closest of these to Crib Point Jetty are south of Long Island Point in the north of Hastings Bight and between Fairhaven and Tankerton Pier on French Island. These sites are approximately 3.5 and 4 kilometres, respectively, from the Crib Point Jetty and noise from operations at and near the jetty can be expected to attenuate to the point of inaudibility to birds at those and all other known roost sites. It is thus improbable that noise from operations of the Project at Crib Point would be sufficient to impact in any measurable way on any roost sites of any listed threatened or migratory birds.

Operational risk IDs relating to waders and waterbirds/migratory birds apply to this section (FF O1, FF O2 and FF O3; Table 28).

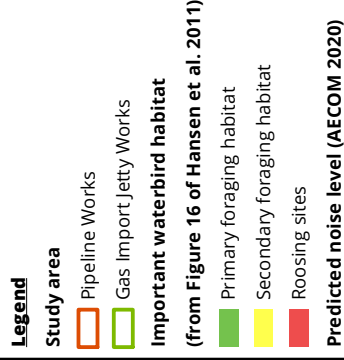
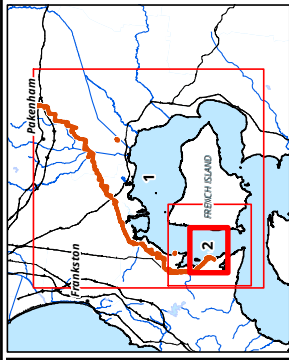
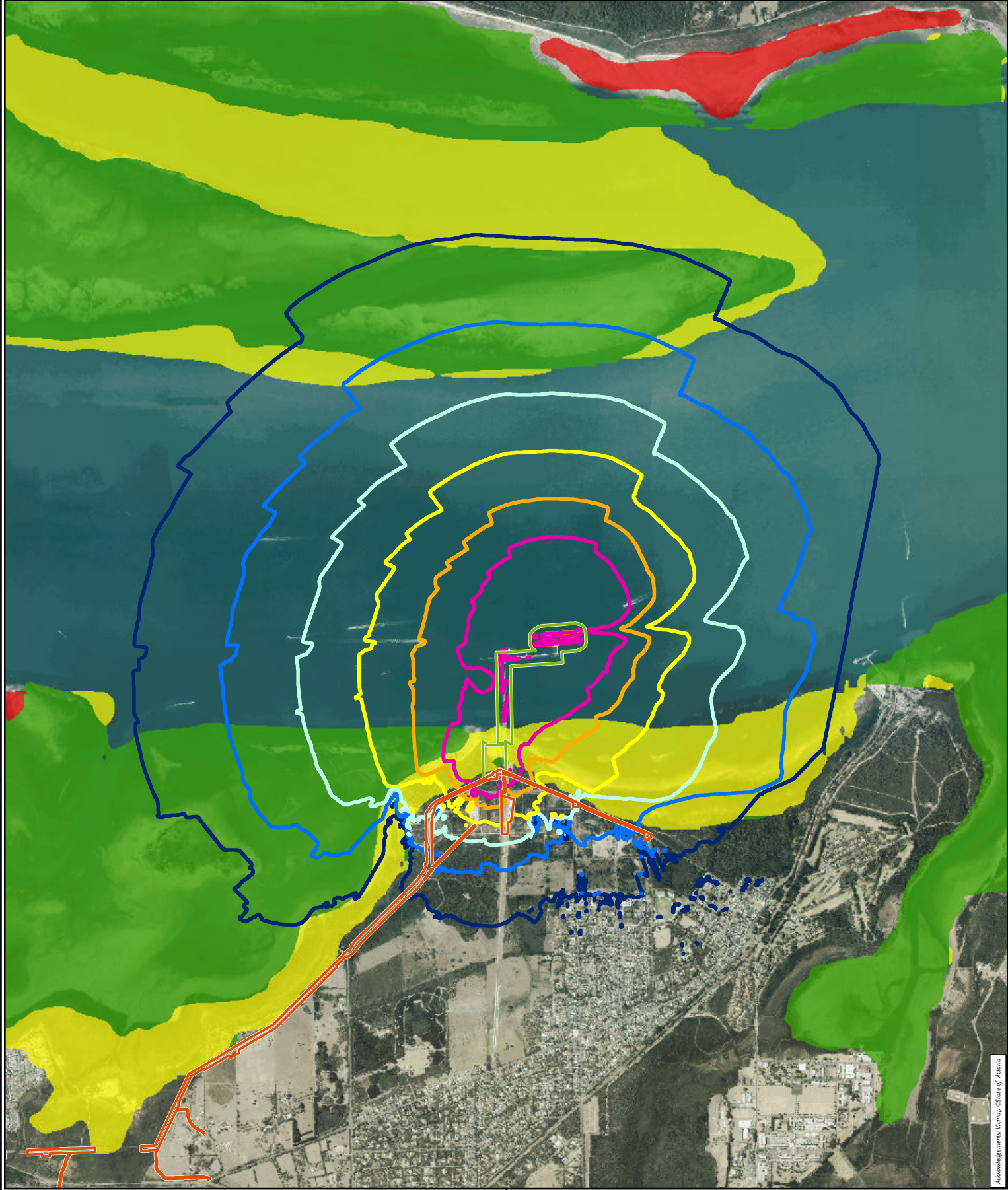
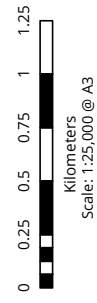


Figure 8 Noise contours (Scenario 5, AECOM 2020) and important waterbird habitat within Western Port



7.2.1.4 Lighting

A number of permanent lights would be required to operate at the Crib Point Receiving Facility and Pakenham Delivery Facility. Both facilities would have four 10 metre light poles at each corner of the facility, which would each be installed with three 400 watt floodlights with the aim of illuminating the general facilities. One 400 watt floodlight would also be installed over the carpark of each facility, along with a number of additional smaller fluorescent lights at key locations (APA 2019).

A number of species may be impacted by artificial lighting associated with operation of the Project. As light sources associated with operation of the pipeline are restricted to the Pakenham Delivery Facility, this section relates only to the operation of the Crib Point Receiving Facility and the FSRU (including supply vessels). Therefore, lighting has the capacity to modify or impact habitat for:

- Terrestrial fauna adjacent to the Crib Point Receiving Facility.
- Migratory shorebirds and other waterbirds.
- Marine fauna (not covered within this report).

Contextual information regarding artificial light impacts is discussed in Section 7.1.1.5.

To reduce any potential or unidentified impacts of lighting of the Crib Point Receiving Facility, light levels should be minimised to the extent practicable. In particular, this could be achieved by the use of directional lighting and light shields to reduce light spill into Western Port and towards Woolleys Beach. In order to limit the potential for lights to attract waterbirds from a distance, all necessary lights should be positioned as low as is practicable and shielding especially in the directions of open water and mapped roosting areas on the French Island coast south from Fairhaven. It is possible that behaviours of some nocturnal species of terrestrial fauna in the immediate vicinity may be affected, but in the context of existing artificial lighting at Crib Point, Bittern and Hastings, the additional lighting involved is not likely to have a measurable impact on the population of any such species.

Night-length can be very important for birds, as it can determine the onset of the breeding season and migration. Artificial lighting can induce hormonal, physiological and behavioural changes that can modify breeding behaviour in birds (Lofts & Merton 1968). Lighting involved with the operation of the Crib Point Jetty may have some potential to affect avifauna within the vicinity of the jetty. As noted above (Section 7.1.1.4) there is little empirical evidence that the area of Woolleys Beach close to Crib Point Jetty is significantly utilised by shorebirds or other waterbirds. Nonetheless, up to 22 species of such species are considered to have some potential to use the area. A number of common avian species, including; Pied Cormorant, Little Pied Cormorant, Black Cormorant and Silver Gull, utilise the pipe infrastructure upon the jetty despite the currently employed lighting.

AECOM (2019b) modelling shows that the additional area to be lit by the FSRU equates to 4,500 square metres, with the existing illuminated area of Western Port approximating 10,200 square metres or 0.0014% of the surface area of Western Port. For comparison the predicted FSRU light spill would equate to 0.002% of the surface area of Western Port. Other vessels already using the port at Crib Point may illuminate a similar area (CEE 2020). There is currently lighting present on the Crib Point Jetty and Crib Point Receiving Facility area as well as extensive lighting associated with other areas of Western Port such as Hastings and the Long Island Point Fractionation Plant, as well as the number of vessels within Western Port making use of the existing jetty. The permanent lighting locations associated with the FSRU and Crib Point Receiving Facility, in the context of the other light sources mentioned above, is unlikely to impact on foraging success of birds and other fauna in Western Port. This is due to the distance from existing roost sites and foraging habitat, with the secondary foraging habitat for waders and waterbirds along Woolleys Beach being located at least 500 metres from the proposed FSRU location and sitting outside of the area effected by light spill. The well-known

foraging location and roost-site for these same migrating species at Long Island Point is permanently exposed to over 1 kilometre of the extensively lit Hastings foreshore.

Experience with fledging Short-tailed Shearwater *Ardenna tenuirostris* on Phillip Island, where significant breeding colonies are present, has shown that reduction of light pollution can mitigate attraction to artificial lighting and subsequent mortality from road vehicle collisions (Rodriguez et al 2014).

Short-tailed Shearwater also breed at Tortoise Head on the south-western end of French Island within Western Port approximately 7 kilometres from the existing Crib Point Jetty and while they are most likely to forage over the open ocean they are also known to forage in the deeper waters of the Western Arm in Western Port (Melbourne Water 2011). Implementation of the impact mitigation measures below would assist in reducing attraction to the facility by shearwaters and other nocturnally active birds.

To reduce any potential or unidentified impacts of lighting of the FSRU, light levels should be minimised to the extent practicable. In particular, this could be achieved by the use of directional lighting and light shields to reduce light spill into Western Port and towards Woolleys Beach. In order to limit the potential for lights to attract waterbirds from a distance, all necessary lights should be positioned as low as is practicable and shielding especially from the directions of open water and mapped roosting areas on the west coast of French Island.

The operational lighting associated with the Project is not expected to constitute a measurable impact on terrestrial fauna or waterbirds.

The Commonwealth of Australia (2020) has developed *National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds*. The guidelines outline the following two broad aims to ensure that artificial light is managed such that wildlife is:

1. not disrupted within, nor displaced from, important habitat, and
2. able to undertake critical behaviours such as foraging, reproduction and dispersal

Lighting calculations undertaken for the Project (AECOM 2019b), and the review of existing literature on the impacts of light to fauna (as outlined in this section and in Section 7.1.1.5), suggest that the operational phase of the Project is unlikely to disrupt or displace wildlife from important habitat, nor is it likely to prevent wildlife from undertaking critical behaviours including foraging, reproduction and dispersal. The Project is thus consistent with the aims of the National Light Pollution Guidelines (Commonwealth of Australia 2020). An adaptive management framework would also be incorporated into the OEMPs for the Project to detect and respond to any documented impacts of artificial light on migratory birds and/or Ecological Character of the Ramsar site. Adaptive mitigation measures may include utilising red filters, shields and directional lighting where practicable and within the constraints of relevant health and safety requirements.

Operational risk assessment IDs relating to waders and waterbirds/migratory birds apply to this section, including FF O1 (Jetty), FF O2 (Pipeline) and FF O3 (whole Project; Table 28).

7.2.1.5 Invasion from weeds, pests and pathogens

Operation of the Project, particularly periodic traversing of the Pipeline alignment for maintenance checks may result in transportation of invasive weed species or pathogens into, between or from the study area. Invasive weeds, such Bathurst Burr *Xanthium spinosum* or pathogens such as Chytrid fungus or Cinnamon fungus *Phytophthora cinnamomi*, are sporadic in their distribution and are easily transported on vehicle tyres and footwear.

Due to the current high levels of pest species within the Project study area, invasive weed spread is unlikely to result in irreversible damage, however it can result in problematic infestations on a localised scale that

require control. Pathogens are harder to control and once spread are likely to persist in the area. Therefore, the Project OEMPs should incorporate mitigation measures which are consistent with those provided in Section 8. If mitigation measures are implemented, the risk associated with invasive weeds, pests and pathogens is considered very low.

Operational risk assessment ID FF O5 *Operational impacts resulting on terrestrial weeds and pests* applies to this section (Table 28).

Marine pests are not considered within this report.

7.2.2 FSRU impacts

In order to operate the FSRU, specifically the heat-exchange system required for the regasification of liquid natural gas, three main processes must occur. The following processes may result in impacts that represent the operation of the FSRU in both open loop system (seawater) and closed loop system (gas-fired boilers) operations:

- Cooler-water discharge – open loop system
- Warm water discharge – closed loop system
- Chlorination of seawater – open and closed systems
- Entrainment of marine biota – open and closed systems
- Contaminants and spills
- Physical disturbance
- Biological disruption.

The processes could impact marine biota (including plankton and large marine fauna), and indirectly impact migratory birds that feed on these resources, seagrasses or flora communities that utilise tidal or intertidal habitats, as well as the defined ecological character of Western Port.

For all of the above noted processes that present environmental risks, CEE (2020) conclude that the impacts would be highly localised to the area immediately adjacent to the proposed FSRU location and that impacts would not occur to the adjacent secondary wader and waterbird foraging habitats of Woolleys Beach or nearby seagrass beds and mangroves, nor would impacts occur to the food chain such that effects would be felt to any of these nearby sensitive receptors or habitats. Based on CEE (2020), there would be no risk of change in the ecological character of the Western Port Ramsar site and no significant impacts for listed threatened and migratory species from the above FSRU operational processes. Risk ID FF O6 *Operational activities impact on Western Port Ramsar site* applies to this section.

7.2.3 Significant species

This section outlines the significant fauna using the Project study area that may be at additional risk based on the operation of the Gas Import Jetty Works and Pipeline Works. Impacts that are shared with construction (refer to section 7.1) are not repeated in this section. Additionally, impacts in this section are restricted to closed-loop operation of the FSRU, while open-loop operation is outlined in Section 7.2.2.

7.2.3.1 Terrestrial fauna

The operation of the Project is unlikely to impact on terrestrial fauna outside of the mechanisms already discussed in Section 7.2.1.

7.2.3.2 Waders and waterbirds/Western Port Ramsar site

Operation of the FSRU and pipeline would generate noise, vibration and light that has minor potential to impact upon the Ecological Character of the Western Port Ramsar site, including the waders and waterbirds it supports. The nature and potential effects of these are addressed in Section 7.2.1, above. Based on the results of CEE (2020) it is predicted that impacts to ecosystem elements such as seagrass beds, mangroves, saltmarsh and intertidal areas are likely to be low.

Limits of Acceptable Change defined within the Ecological Character Description for the Western Port Ramsar site are unlikely to be exceeded for noise and other impacts as per the discussion in Section 7.1.5.

7.2.4 Cumulative impacts

Refer to Section 7.1.6 for discussion of cumulative effects for both construction and operational phases of the Project.

8. Mitigation measures

This section outlines the recommended mitigation measures for terrestrial and freshwater biodiversity and relevant waterbirds identified as a result of the risk and impact assessment.

The pipeline alignment was selected and refined to minimise loss of remnant vegetation in accordance with AS2885.1-2012 Section 4.2 and the APGA Code of Environmental Practice: Onshore Pipelines. These documents specify the design, safety and environmental management requirements for the construction and operation of gas pipeline assets. These design refinements include reductions in the construction footprint ROW, re-routing of the pipeline and underground boring through sensitive areas. Furthermore, a range of Mitigation Measures (MMs) to further reduce impacts during and following construction and operation of the Pipeline Works are outlined below.

The recommended mitigation measures listed in Table 35 combine the initial and additional mitigation measures applied during the risk assessment to arrive at recommended mitigation measures for the design, construction and operation of the Gas Import Jetty Works and the Pipeline Works. In the course of finalising this report, consultation was undertaken with AGL and APA and other members of the team (designers, contractors and other specialists) to ensure that the recommended mitigation measures would be achievable and compatible with those proposed by other specialists. These recommended mitigation measures have been refined as a result of those discussions and should be incorporated into the EMF, which would be implemented through the Project approvals as described in Chapter 25 *Environmental Management Framework* to effectively manage the environmental performance of the Project. All mitigation measures are referenced within the Risk Assessment (Section 6) using the Mitigation ID.

Table 35 Recommended mitigation measures

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
MM-FF01	Unplanned vegetation loss	<p>Vegetation clearing during construction should be restricted to the impact area and approved through issuing of the pipeline licence. This includes avoidance of clearing in all areas where trenchless crossings are proposed, unless an access track or other infrastructure has been identified as part of the impact area. In the unlikely event that clearing of native vegetation outside of the impact area is required during the construction and/or operational phase, the area cleared should be the minimum necessary to complete the work and should be assessed and offset in accordance with the <i>Guidelines for the removal, destruction or lopping of native vegetation</i> (DELWP 2017a). This requirement should be listed as a commitment in the CEMP and OEMP. If unplanned clearing (including operational maintenance) occurs in areas that were not initially mapped and assessed, a site assessment should be undertaken by an experienced ecologist and the highest habitat score from adjacent uncleared vegetation assigned to determine offset requirements.</p> <p>The approved vegetation clearing extent, including retained environmental features within the impact area, should be clearly demarcated and identified during the construction stage as set out below. Specifics of applicable protective measures should be provided in the CEMP for the Pipeline Works and the EMP for the Gas Import Jetty Works.</p> <ol style="list-style-type: none"> Para-webbing, construction fencing or fauna-specific temporary fencing in areas of special concern including, but not limited to, areas identified in Table 25 (e.g. Merran's Sun-orchid population, Southern Brown Bandicoot, Swamp Skink, Growing Grass Frog, Warringine Park and any other areas of special concern noted during pre-clearance inspections). Specific areas should be confirmed in the CEMP and EMP and located in consultation with a Project environmental advisor. Bunting in any other areas of native vegetation and/or habitat features to be retained within the Project impact area. Survey pegs in remaining areas of cleared or non-native vegetation. <p>Para-webbing or bunting should not be placed across existing access tracks so that access for landholders is maintained.</p> <ol style="list-style-type: none"> Establish Tree Protection Zones for retained trees as per Australian Standards. 	Both	Both

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
MM-FF02	Aquatic fauna impacts	<p>Construction works should not occur during wet months (e.g. June – September) unless conditions are such that land degradation and surface water management problems can be avoided or appropriate mitigation measures implemented.</p> <p>Where practicable, all trenched watercourse crossings should be constructed during no or low flow conditions.</p> <p>Where this is not practicable, to further mitigate potential impacts to Australian Grayling and Dwarf Galaxias, work should be undertaken in accordance with the following measures:</p> <ol style="list-style-type: none"> Flow diversion measures should be installed where construction of trenched watercourse crossings during no flow conditions is not feasible. Flow diversion measures may include pumps to ensure that water can be moved from one side of trench to the other, screened inlets (or other appropriate equipment) to minimise the entrapment of aquatic fauna and outlet structures that are designed to avoid scouring of the channel. Where watercourses are trenched, all obstructions to flow should be removed as soon as practicable after the pipe has been laid and backfilled. Watercourses should be reinstated such that bank stability at the crossing location is the same or better than prior to construction. Stabilising materials such as rock armouring, hydro mulch, jute matting or other suitable geotextile materials should be applied to watercourse banks where necessary. The pipeline should be assembled and prepared so that it can be immediately installed once the trenching across the watercourse has been undertaken. 	Construction	Pipeline Works
MM-FF03	Invasive weeds, pests, pathogens and waste	<p>The following measures should be implemented to manage biosecurity risks:</p> <ol style="list-style-type: none"> Consultation with landholders regarding property specific biosecurity management arrangements/plans which are in place and followed by landholders. Operate in accordance with relevant elements of existing property specific biosecurity plans which landholders operate under. Undertake a baseline weed survey of the ROW to identify locations of existing weed infestations. Satisfy Australian Quarantine and Inspection Service (AQIS) regulatory requirements for any vehicles and equipment sourced from overseas. Inspection and certification of all vehicles and machinery upon arrival at site. Vehicles and machinery should not access the ROW until certified as clean. All footwear and equipment arriving from other locations is to be clean and free of accumulated soil and seeds. Vehicles, plant and equipment should not go outside of the impact area or approved roads 	Both	Both

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
		<p>and tracks unless undertaking non-intrusive survey or property management activities as agreed with the land owner.</p> <p>h. Vehicles and equipment that access vegetated land outside the ROW, laydown areas or approved access routes should be re-certified prior to re-entry (construction).</p> <p>i. Monitoring of the condition of the ROW and other disturbed areas should be completed post-construction and remedial measures undertaken, as required, with the aim that all disturbed areas are re-profiled to a stable landform consistent with original contours and drainage lines and vegetated with a non-pest groundcover species (in consultation with landholder land use requirements). Any weed control should be undertaken in a staged manner and in consultation with an ecologist/zoologist to minimise impacts to fauna utilising weedy vegetation as shelter, particularly Southern Brown Bandicoot.</p> <p>j. Waste is to be managed in accordance with MM-C09 (construction waste management) and MM-C10 (operation waste management), which should require provision of lidded refuse containers to prevent fauna access, and their appropriate monitoring and removal.</p> <p>k. Any topsoil imported for easement maintenance should be of an appropriate quality and weed and disease free.</p> <p>l. Develop a protocol for preventing spread of Cinnamon Fungus <i>Phytophthora cinnamomi</i>, including maps identifying any known areas, requirements for managing surface run-off and wash down locations/requirements.</p>		
MM-FF04	Contractor awareness	All Project personnel should be required to attend an induction that outlines environmental management requirements. This would include information on the biodiversity values of the Project study area, specifically areas of threatened flora and fauna habitat. A Project environmental advisor should be appointed to assist with inductions and to provide ecological advice throughout the course of the Project.	Both	Both

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
MM-FF05	Site Rehabilitation	<p>Habitat features removed during construction such as large hollow logs and large rocks should be returned to the ROW as soon possible during rehabilitation, if consistent with rehabilitation objectives at a particular location. If habitat features such as logs and rocks are not able to be reinstated within the ROW, every effort should be made to locate them in suitable nearby sites, such as nearby Council-managed bushland reserves (upon Council approval).</p> <p>Landholder requirements should be considered prior to returning habitat features to the ROW.</p> <p>Rehabilitation by assisted natural regeneration should be undertaken on the ROW in the following areas where there is an increased risk of habitat fragmentation:</p> <ul style="list-style-type: none"> - Warringine Park (excluding existing pipeline easements) - KP 7.3 to 8.3 (excluding existing access roads) - KP 13.7 to 14.4 - KP 18.5 to 18.7 <p>For areas within 4 m of the pipeline, natural regeneration should be limited to shallow-rooted ground cover species.</p> <p>A site specific Rehabilitation Plan is to be prepared for Warringine Park in consultation with Mornington Peninsula Shire.</p> <p>The CEMP (and any relevant Site Rehabilitation Plans) should contain requirements for effective monitoring of the success of assisted natural regeneration and adaptive management responses for additional remediation works, if required. The impact area should be reinstated with consideration of the vegetation composition and ground surface adjacent to the area and in consultation with the landholder.</p>	Construction	Pipeline

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
MM-FF06	Topsoil rehabilitation	<p>The following mitigation measures should be implemented to manage topsoil:</p> <ol style="list-style-type: none"> Topsoil should be stripped across the impact area to maximum depths determined during pre-construction surveys. Topsoil should not be stripped when saturated. Vegetation should be cleared prior to stripping of topsoil. Stripped topsoil should be stockpiled separately from woody material and subsoil stockpiles, and only stockpiled for the minimum duration necessary. Topsoil stockpiles should only be located on flat surfaces and heights should not exceed two metres. Gaps in the linear topsoil stockpiles should be left at appropriate intervals for drainage and for the movement of vehicles and fauna through the site. Topsoil stockpiles, other than linear stockpiles on the ROW, should be clearly signposted. Topsoil should not be used as a padding material. Stockpiled topsoil should be respread over the impact area to a minimum depth of 100 mm, or to the depth that topsoil was stripped if this was less than 100 mm. Topsoil should not be respread for rehabilitation when saturated. 	Construction	Both
MM-FF07	Trench entrapment	<p>The following mitigation measures should be implemented to manage fauna trench entrapment:</p> <ol style="list-style-type: none"> Minimising the period of time the trench is open. Providing opportunities for fauna to egress the trench such as ramped trench plugs or other appropriate mechanisms, at minimum intervals of one per 500 m along the length of open trench, or as otherwise directed by the Project Ecologist in response to local site conditions and survey results. Daily inspections of the open trench, by suitably qualified personnel, to remove trapped fauna as required. Install fauna shelter devices, such as sawdust filled bags, at minimum intervals of one per 100 m along the length of open trench. 	Construction	Both

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
MM-FF08	Injury and/or disturbance to fauna	<p>A suitably qualified wildlife handler should be present for clearing woody vegetation (i.e. trees and shrubs) and stockpiles to:</p> <ol style="list-style-type: none"> Inspect habitat in advance of clearing. This should include a walk-through/visual inspection of the habitat to be removed immediately prior to clearance to flush out fauna and capture and relocate. Advise on clearing techniques that minimise fauna impact. Keep records of important fauna interactions, listing the species concerned, the nature of the interaction and GPS coordinates. <p>A fauna management protocol should be included in the Gas Import Jetty Works EMP and Pipeline Works CEMP, along with a protocol for encountering any unexpected finds and/or threatened species. A specific protocol should be developed for clearing Swamp Skink and Glossy Grass Skink habitat (as described in Table 25), in consultation with Mornington Peninsula Shire, which should refer to the management activity guidelines developed by Robertson and Cleemann (2015) for Swamp Skink. This protocol should be included in the EMP and CEMP.</p> <p>Noise impacts to fauna should be managed in accordance with MM-NV01 (managing noise from construction activities), MM-NV04 (noise management measures) and MM-NV05 (HDD noise control). Noise produced by the operational Gas Import Jetty and FSRU will be managed as per MM-NV13 (post-commissioning measurements), to confirm compliance with Recommended Maximum Levels. Those levels have been assessed here as unlikely to deleteriously affect fauna</p>	Both	Both
MM-FF09	Southern Brown Bandicoot	<p>The following measures should be implemented to manage Southern Brown Bandicoot, in addition to general measures outlined in MM-FF08:</p> <ol style="list-style-type: none"> As soon as practicable following clearing, fencing suitable to exclude Southern Brown Bandicoots should be installed at the edges of the impact area where it is adjacent to any of the 19 locations of Southern Brown Bandicoot habitat to reduce the likelihood of animals entering the impact area. The CEMP should outline requirements for effective monitoring of fencing to ensure any repairs required are identified and completed as soon as possible. In the event that Southern Brown Bandicoot are discovered within the impact area, all mobile construction equipment in the surrounding area should cease work, excluding the use of light vehicles to move staff to and from the area. Mobile construction equipment should not recommence work until a wildlife handler has removed the individual or confirmed that it has moved out of the impact area. Captured individuals should be removed and relocated to nearest adjacent habitat away from the impact area by the wildlife handler. 	Construction	Pipeline Works

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
		<p>c. Dense cover of suitable native shrubs, or vegetation of similar structure, should be rapidly reinstated as soon as practicable in all of the 19 locations of densely vegetated Southern Brown Bandicoot habitat within the impact area by planting of semi-mature native shrubs or fast-growing tubestock, other than within 4 m of the pipeline and a narrow track to allow ground access for surveillance patrols. For areas within 4 m of the pipeline, revegetation should be limited to shallow-rooted ground cover species. The aim is to re-establish dense understorey vegetation in the 0.2–1 m height range as soon as practicable.</p> <p>d. Easement agreements with landholders should require that this vegetation be reinstated and protected. The CEMP should contain details on monitoring to ensure success of revegetation, including appropriate responses for any detected failures.</p> <p>e. provide temporary Southern Brown Bandicoot shelter sites to provide interim cover / refuge whilst vegetation is re-established.</p>		
MM-FF10	Merran's Sun-orchid, Pallid Sun-orchid and Gaping Sun-orchid	<p>The Pipeline Works should avoid threatened orchids and their habitat. A single HDD should be used to avoid orchids and habitat between KP 1.13 and KP 1.7. During construction, a return line would need to be placed across orchid habitat to transport drilling mud between the HDD entry and exit points. The following measures should be put in place to protect orchids:</p> <ul style="list-style-type: none"> a. Return line to be constructed from high quality HDPE pipe welded together to ensure risk of spill is negligible. b. Project Ecologist to supervise the placement of the return line, which should be micro-sited to avoid threatened orchids. c. Return line to be subject to visual inspection twice per day during drilling. d. Mud spill kits to be prepared and kept at drilling sites to allow for quick deployment in the very unlikely event of a mud spill. e. No vehicle access to be permitted in orchid habitat. f. Project Ecologist to supervise dismantling of return line and complete inspection of habitat following completion of drilling. 	Construction	Pipeline Works
MM-FF11	Growing Grass Frog	<p>The following mitigation measures should be implemented to manage impacts to the Growing Grass Frog:</p> <ul style="list-style-type: none"> a. Two nocturnal pre-clearance surveys of the construction footprint for the Growing Grass Frog (as per Commonwealth of Australia 2009) should be undertaken at each of the following locations within four days prior to clear and grade activities commencing, but only if clear and 	Construction	Pipeline Works

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
		<p>grade activities at these locations are to occur during the breeding season (spring and summer):</p> <ul style="list-style-type: none"> - Farm dams adjacent to KP 21.5: KP 21.4 to KP 21.6 - Western Outfall Drain: KP 30.8 to KP 31.8 - Cardinia Creek: between KP 39.9 and the western cadastral boundary of Crown Allotment 24A Parish of Koo Wee Rup - Cardinia Creek: section of the access track linking to Ballarto Road, where it lies directly adjacent to Lot 1 Title Plan 828572X - Lower Gum Scrub Creek, Deep Creek and Toomuc Creek: KP 40.8 to KP 40.9 - Lower Gum Scrub Creek, Deep Creek and Toomuc Creek: between the eastern cadastral boundary of Crown Allotment 97F Parish of Nar-Nar-Goon and KP 41.5 - any additional wetland habitat identified within the CEMP b. A wildlife handler should be present to monitor construction activities in all areas of identified habitat for the species. c. The CEMP should contain a protocol to relocate any Growing Grass Frogs in the event they are found incidentally, or during pre-construction surveys, within or immediately adjacent to the impact area. d. Hygiene protocols as set out in Murray et al. (2011) must be followed to prevent spread of diseases to frog populations, particularly Amphibian Chytrid Fungus. 		
MM-FF12	Migratory birds	<p>The EMP and OEMP should include a monitoring program for waders and waterbirds at Woolleys Beach and Jacks Beach to allow for potential responses to the construction and operation of the FSRU to be detected and, if appropriate, mitigated through an adaptive management response.</p> <p>Project should adhere to principles set out in <i>National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds</i> (Commonwealth of Australia 2020). The primary mechanism to minimise effects is to design-out by use of limited, directional lighting that is shielded to prevent light-spill into any primary foraging or roost locations. The OEMP should contain a monitoring procedure and an adaptive management response in order to detect, and appropriately respond to, migratory bird strikes with lighting or light entrapment. Appropriate responses might include red light filters on floodlights, use of green lamps, or dimming/reducing lighting at sensitive times. These have been shown to significantly reduce avian casualties resulting from bird strikes. Specific thresholds were not identified for migratory birds, however a number of qualitative assessments have shown that lighting of</p>	Both	Both

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
		foraging areas does not substantially affect occupation of a foraging area but may impact on migration routes.		
MM-FF13	Surface water sedimentation and runoff	<p>Erosion and sediment controls should follow EPA publication 480 (EPA Victoria 1996) and be included in the Gas Import Jetty Works EMP and Pipeline Works CEMP. Specific measures that would mitigate impacts to ecological values are included in MM-SW01 (discharge water), MM-SW02 (managing runoff), MM-SW04 (watercourse trenching) and MM-SW05 (watercourse trenchless crossing) and summarised below:</p> <ul style="list-style-type: none"> a. Water velocity reduction measures and redirection of runoff to stable ground in accordance with MM-SW01 (discharge water). b. Testing, treatment and management of discharge water to minimise sedimentation and erosion in accordance with MM-SW01 (discharge water). c. Implementation of diversion banks and sediment control devices in accordance with MM-SW01 (discharge water) and MM-SW02 (managing runoff). d. Regular monitoring of all diversion banks and sediment control devices to ensure these are maintained in good condition throughout the construction phase. <p>Land-based construction works at the Crib Point Receiving Facility site are not to occur within the boundary of the Western Port Ramsar site.</p>	Construction	Both
MM-FF14	Surface water contamination	<p>Dangerous goods, as defined by the Australian Dangerous Goods Code, and flammable and combustible liquids should be stored and handled in accordance with all relevant Australian Standards and in accordance with MM-SW06 (fuel and chemical storage). Additional measures are outlined below.</p> <ul style="list-style-type: none"> a. Routine visual monitoring and recording of chemicals and fuel storage facilities should be undertaken. b. Refuelling and maintenance of vehicles and machinery should be undertaken in accordance with MM-SW08 (refuelling of vehicles and mobile machinery) and MM-C08 (fuel and chemical leaks/spills) to minimise the potential for leaks or spills to occur. This includes the requirement for refuelling to occur in designated areas that are not within 50 m of a watercourse. d. Spill kits should be available at locations where machinery/plant are operating, refuelling points and fuel and chemical storage locations and managed in accordance with MM-SW07 (spills). e. Waste is to be managed in accordance with MM-C09 (construction waste management) and MM-C10 (operation waste management). 	Both	Both

Risk ID	Risk name	Mitigation measure	Stage	Works impact area
MM-FF15	Lighting impacts to fauna	<p>Light generated during construction should be managed in general accordance with the guidance measures described in <i>National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds</i> (Commonwealth of Australia 2020).</p> <p>Note - orange/yellow low frequency lighting or red filters are preferred (if not conflicting with the above requirements or safety requirements of the site).</p> <p>The Gas Import Jetty Works EMP and Pipeline Works CEMP should contain an artificial light management plan which contains monitoring requirements and an adaptive management framework to ensure proposed lighting continues to be managed to avoid significant impacts to fauna, particularly threatened and migratory species.</p>	Both	Both
MM-FF16	Dust impacts to flora/fauna	<p>Management of construction activities should be undertaken in accordance with EPA Victoria Publication No. 480 <i>Guidelines for Major Construction Sites</i> (1996) in respect to dust, odour and construction vehicle emissions to minimise amenity impacts during construction.</p> <p>In accordance with MM-AQ01, dust suppression should be used at construction sites using water sprays, water carts or other devices on unpaved work areas, sand, spoil and aggregate stockpiles and during the loading and unloading of dust generating materials.</p> <p>Crushed rock should be placed on unsealed access tracks to suppress dust from vehicle movements, in accordance with MM-AQ03 (crushed rock on access tracks).</p> <p>Vehicle movements should be restricted to within designated access paths, turning circles and the impact area, in accordance with MM-AQ02 (restricted vehicle movements).</p> <p>Monitoring of weather conditions and dust should be undertaken in accordance with MM-AQ06 (weather monitoring) and MM-AQ07 (dust monitoring), which require works to modify or cease if weather conditions and/or dust levels are likely to exceed the thresholds specified.</p>	Construction	Both

8.1 Offsets

This section outlines the offsets that are proposed to be secured to compensate for impacts to vegetation, threatened species habitats and/or threatened species.

8.1.1 Federal offsets

An assessment against the relevant significant guidelines for MNES most likely to be impacted by the Project has determined that it is unlikely that a significant impact would occur to any MNES (Appendix 7). However, in the event that the assessment and approval process determines otherwise, federal offsets would be secured to the satisfaction of the Victorian Minister for Planning and/or the Australian Government Minister for the Environment.

8.1.2 State offsets

State offsets arise through the removal of native vegetation, which sometimes corresponds with modelled habitat for threatened flora and fauna under the DELWP advisory lists. They are calculated in accordance with the *Guidelines for the Removal, Destruction or Lopping of Native Vegetation*, which is an incorporated document within the Victoria Planning Provisions under Clause 52.17 (Native Vegetation). It is noted that the Pipeline Works are exempt from the application of Planning Scheme requirements through s85 of the *Pipelines Act 2005* and that the Gas Import Jetty Works would be seeking approval through the use of the Specific Controls Overlay and Incorporated Document which would set out that other controls of the Scheme do not apply. Offsets are nevertheless proposed to be provided pursuant to the Guidelines.

Guidelines for the Removal, Destruction or Lopping of Native Vegetation

The proposed removal of native vegetation would trigger both general and species offsets. Table 36 identifies these offset requirements for the Project.

Table 36 Offset requirements for the Project

Attribute	Pipeline Works	Gas Import Jetty Works	Project Area (combined)
Location category	3	2	3
Native vegetation removal extent	15.352 ha	1.603 ha	16.955 ha
Assessment pathway	Detailed	Detailed	Detailed
Offset type	General and species habitat (considering Gas Import Jetty Works as past permitted clearing)	General and species habitat (considering Pipeline Works as past permitted clearing)	General and species habitat
Offset amount: general habitat units	0.985	0.021	1.007
General offset vicinity	Port Phillip and Western Port CMA or Cardinia Shire, City of Casey or Mornington Peninsula Shire areas.	Port Phillip and Western Port CMA or Mornington Peninsula Shire areas.	Port Phillip and Western Port CMA or Cardinia Shire, City of Casey or Mornington Peninsula Shire areas.

Attribute	Pipeline Works	Gas Import Jetty Works	Project Area (combined)
General: minimum Strategic Biodiversity Value Score	0.296	0.684	0.299
Offset amount: Species habitat units	<ul style="list-style-type: none"> Tiny Arrowgrass: 0.177 Coast Helmet-orchid: 7.400 Coast Twin-leaf: 3.969 Coast Wirilda: 4.549 Coast Bitter-bush: 3.859 	<ul style="list-style-type: none"> Coast Helmet-orchid: 1.217 Coast Twin-leaf: 1.217 Coast Wirilda: 1.217 Coast Bitter-bush: 1.217 	<ul style="list-style-type: none"> Tiny Arrowgrass: 0.177 Coast Helmet-orchid: 8.617 Coast Twin-leaf: 5.186 Coast Wirilda: 5.766 Coast Bitter-bush: 5.076
Large tree attributes	77 large trees	2 large trees	79 trees

8.1.2.1 Offset availability

The Project is anticipated to be able to satisfy all offset requirements. One species has limited availability on DELWP's Native Vegetation Credit Register: Tiny Arrowgrass. Therefore, an offset strategy is being prepared that will outline how the Project can satisfy its offset requirements. The offset strategy will outline that AGL and APA are to enter into a memorandum of understanding (MoU) with credit site owners, with the intention to purchase the credits upon approval of the Project. In the event that species habitat units become unavailable in the interim, the strategy would outline alternative arrangements for species offsets, including the steps outlined in Section 11.3 of the *Guidelines for the removal, destruction or lopping of native vegetation*:

- If a suitable species offset cannot be identified an applicant may:
 - consider further steps to avoid or minimise impacts to reduce offset requirements
 - appoint an ecologist to review offset requirements and/or species habitat units available at an offset site, as described in section 9.4 of the above guidelines.
 - consider activities or alternative management actions that will generate additional gain for the species at an offset site
 - contact landowners or land managers of sites that may be able to be used to generate species habitat units that meet the offset requirements.

If the above actions do not address the inability to secure a species offset, the applicant can propose an alternative offset for the species habitat. The alternative offset must generate improvements for the species that provide equivalent compensation for the removal of its habitat.

Offset availability is assessed in accordance with units currently available on the Native Vegetation Credit Register (state offsets), or in consultation with DAWE using offset calculators (federal).

The Project is unlikely to require offsets for MNES as the Project is unlikely to have a significant impact on MNES. In the event that EPBC Act offsets are required, the Project would secure offsets in accordance with the level of impact determined by the Minister for Planning in consultation with DAWE and the offset calculators.

Additional notes

All offset availability (general, species and EPBC Act) are based on current evaluations and are subject to change over time.

9. Conclusion

A biodiversity impact assessment has been undertaken to determine the potential impacts of the Project on flora and fauna of terrestrial and freshwater ecosystems and birds that utilise intertidal environments, and to identify recommended mitigation measures where appropriate in order to reduce potential risks of the Project.

9.1 Impact assessment summary

The Project is not expected to have substantial effects on non-threatened flora, fauna or the functioning of natural ecosystems. The Gas Import Jetty Works would have influence on a very limited physical area at Crib Point and is in an immediate environment that is already substantially modified by existing anthropogenic effects, such as noise, vessel movements and artificial light. The Pipeline Works traverse an alignment that is also very substantially modified by agriculture, urban development and past clearing of native vegetation. After construction, the pipeline alignment would be reinstated to match pre-existing modified conditions and can be expected to provide a similar environment for non-threatened flora and fauna as it does currently.

The Gas Import Jetty and Pipeline Project would have minor impacts on native vegetation and habitat for some threatened species.

Evaluated against published criteria for significant impacts under the EPBC Act, the assessment concludes that the Project is not likely to have a significant impact on any Matter of National Environmental Significance.

The Gas Import Jetty Works would result in the direct loss of 1.603 hectares of native vegetation comprising four habitat zones and two large patch trees. The Pipeline Works would result in the direct loss of 15.352 hectares of native vegetation comprising 111 habitat zones, 48 large patch trees, 29 large scattered trees and 50 small scattered trees. The Native Vegetation Removal Reports (NVRR) combine these features into one overall extent of removal. In accordance with the NVRR, the Project would require the removal of 16.955 hectares of native vegetation, comprising 11 ecological vegetation classes (EVCs), as follows:

- Five EVCs, 6.012 hectares of patch vegetation, Bioregional Conservation Status of Endangered
- Three EVCs, 1.395 hectares of patch vegetation, Bioregional Conservation Status of Vulnerable
- Three EVCs, 6.495 hectares of patch vegetation, Bioregional Conservation Status of Least Concern.
- Tree removal accounts for the balance of total area of native vegetation removal.

This removal may also result in the modification of adjacent native vegetation over time through associated edge effects.

In order to compensate for losses of native vegetation and species habitats at a state level, Native Vegetation Removal Reports (NVRR) prepared for the Pipeline Works and the Gas Import Jetty Works have outlined the following offset requirements:

- 1.007 general habitat units (when rounded: 0.985 units for the Pipeline Works and 0.021 units for the Gas Import Jetty Works).
- Species habitat units (SHUs) for the following DELWP Advisory Listed species for the Pipeline Works and Gas Import Jetty Works combined:
 - 0.177 species units of habitat for Tiny Arrowgrass

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- 8.617 species units of habitat for Coast Helmet-orchid
 - 5.186 species units of habitat for Coast Twin-leaf
 - 5.766 species units of habitat for Coast Wirilda
 - 5.076 species units of habitat for Coast Bitter-bush.

The Project would result in the short-term loss and fragmentation of habitat for Southern Brown Bandicoot, listed as Endangered under the EPBC Act.

The Project would have the following impacts on FFG Act-listed values:

- The short-term minor loss and fragmentation of habitat for Southern Brown Bandicoot
- Loss of some habitat for Southern Toadlet
- Removal of some habitat suitable for Swamp Skink.

9.2 Residual risk

A risk assessment was used that identified potential construction and operational risks and associated risk pathways, consequences of impacts on flora and fauna of terrestrial and freshwater ecosystems and birds that utilise intertidal environments and the likelihood of these impacts occurring to arrive at a risk rating.

With the mitigation measures in place, there are four risks that have a residual risk of rating of medium or above. These are:

- Direct loss of native vegetation during construction
- Habitat removal (detected threatened fauna)
- Habitat removal (non-threatened fauna)
- Habitat removal (Southern Brown Bandicoot).

While each of these potential impacts presents a risk to the environment, the mitigation measures have avoided, mitigated and managed the risks as far as is reasonably practicable.

Based on the outcomes of the assessment of potential impacts in this assessment report, the Project is considered to satisfy the relevant evaluation objective.

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Appendices

Appendix 1 Flora

The flora list below (Table A3.1) amalgamates the Monarc Environmental (2018a) and Biosis flora lists.

Notes to tables:

EPBC Act: CR - Critically Endangered EN - Endangered VU - Vulnerable PMST – Protected Matters Search Tool	DEPI 2014a: e - endangered v - vulnerable r - rare k - poorly known
FFG Act: L - listed as threatened under FFG Act P - protected under the FFG Act (public land only)	Noxious weed status: SP - State prohibited species RP - Regionally prohibited species RC - Regionally controlled species R - Restricted species # - Native species outside natural range

Appendix 1 Flora species recorded

Table A1.1 Flora species recorded for the Project

Status	Scientific Name	Common Name
Indigenous species		
P	<i>Acacia aculeatissima</i>	Thin-leaf Wattle
P	<i>Acacia longifolia</i> subsp. <i>sophorae</i>	Coast Wattle
P	<i>Acacia mearnsii</i>	Black Wattle
	<i>Acacia melanoxylon</i>	Blackwood
	<i>Acacia paradoxa</i>	Hedge Wattle
P	<i>Acacia pycnantha</i>	Golden Wattle
P	<i>Acacia verticillata</i>	Prickly Moses
	<i>Acaena novae-zelandiae</i>	Bidgee-widgee
	<i>Acaena ovina</i>	Australian Sheep's Burr
P	<i>Acianthus pusillus</i>	Small Mosquito-orchid
P	<i>Acrotriche serrulata</i>	Honey-pots
	<i>Allocasuarina littoralis</i>	Black Sheoak
	<i>Allocasuarina paludosa</i>	Scrub Sheoak
	<i>Allocasuarina verticillata</i>	Drooping Sheoak
VU I	<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass
	<i>Amyema pendula</i>	Drooping Mistletoe
P	<i>Astroloma humifusum</i>	Cranberry Heath
r	<i>Atriplex paludosa</i> subsp. <i>paludosa</i>	Marsh Saltbush
	<i>Austrostipa densiflora</i>	Dense Spear-grass
	<i>Austrostipa rudis</i>	Veined Spear-grass
	<i>Austrostipa</i> spp.	Spear Grass
	<i>Austrostipa pubinodis</i>	Tall Spear-grass
	<i>Austrostipa stipoides</i>	Prickly Spear-grass
r	<i>Avicennia marina</i> subsp. <i>australasica</i>	Grey Mangrove
P	<i>Azolla filiculoides</i>	Pacific Azolla
	<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>	Coast Banksia
	<i>Banksia marginata</i>	Silver Banksia
	<i>Baumea acuta</i>	Pale Twig-sedge
	<i>Baumea juncea</i>	Bare Twig-sedge
	<i>Billardiera mutabilis</i>	Common Apple-berry
	<i>Bossiaea prostrata</i>	Creeping Bossiaea
	<i>Bothriochloa macra</i>	Red-leg Grass
	<i>Bursaria spinosa</i>	Sweet Bursaria
P	<i>Caladenia catenata</i> s.l.	Pink Fingers/White Fingers
P	<i>Caladenia parva</i>	Small Spider-orchid
	<i>Carex appressa</i>	Tall Sedge

Status	Scientific Name	Common Name
Indigenous species		
	<i>Carex breviculmis</i>	Common Grass-sedge
	<i>Carpobrotus rossii</i>	Karkalla
P	<i>Cassinia aculeata</i> subsp. <i>aculeata</i>	Common Cassinia
	<i>Cassytha glabella</i>	Slender Dodder-laurel
	<i>Cassytha pubescens</i>	Downy Dodder-laurel
	<i>Cassytha</i> spp.	Dodder Laurel
	<i>Centella cordifolia</i>	Centella
	<i>Centrolepis aristata</i>	Pointed Centrolepis
	<i>Chloris</i> spp.	Windmill Grass
	<i>Clematis microphylla</i> var. <i>microphylla</i> spp. agg.	Small-leaved Clematis
	<i>Coprosma quadrifida</i>	Prickly Currant-bush
P	<i>Correa reflexa</i>	Common Correa
	<i>Crassula helmsii</i>	Swamp Crassula
P	<i>Cryptostylis subulata</i>	Large Tongue-orchid
	<i>Cyperus</i> spp.	Flat Sedge
	<i>Daucus glochidiatus</i>	Australian Carrot
	<i>Daviesia latifolia</i>	Hop Bitter-pea
	<i>Deyeuxia quadriseta</i>	Reed Bent-grass
	<i>Dianella revoluta</i>	Black-anther Flax-lily
	<i>Dichondra repens</i>	Kidney-weed
	<i>Dillwynia cinerascens</i>	Grey Parrot-pea
	<i>Dillwynia</i> spp.	Parrot Pea
	<i>Disphyma crassifolium</i> subsp. <i>clavellatum</i>	Rounded Noon-flower
	<i>Distichlis distichophylla</i>	Australian Salt-grass
	<i>Drosera aberrans</i>	Scented Sundew
	<i>Drosera auriculata</i>	Tall Sundew
	<i>Drosera pygmaea</i>	Tiny Sundew
	<i>Eleocharis sphacelata</i>	Tall Spike-rush
	<i>Eleocharis</i> spp.	Spike Sedge
P	<i>Epacris impressa</i>	Common Heath
	<i>Epilobium billardioreanum</i> subsp. <i>billardioreanum</i>	Smooth Willow-herb
	<i>Eragrostis brownii</i>	Common Love-grass
	<i>Eryngium vesiculosum</i>	Prickfoot
I	<i>Eucalyptus camaldulensis</i>	River Red-gum
	<i>Eucalyptus camphora</i> subsp. <i>humeana</i>	Mountain Swamp-gum
	<i>Eucalyptus ovata</i>	Swamp Gum
	<i>Eucalyptus pauciflora</i>	Snow Gum
	<i>Eucalyptus radiata</i> subsp. <i>radiata</i>	Narrow-leaf Peppermint
VU v L P	<i>Eucalyptus strzeleckii</i> (Monarc record, not accepted)	Strzelecki Gum

Status	Scientific Name	Common Name
Indigenous species		
	<i>Eucalyptus viminalis</i> subsp. <i>pryoriana</i>	Coast Manna-gum
P	<i>Euchiton japonicus</i> s.l.	Clustered/Creeping Cudweed
	<i>Exocarpos cupressiformis</i>	Cherry Ballart
	<i>Exocarpos strictus</i>	Pale-fruit Ballart
	<i>Ficinia nodosa</i>	Knobby Club-sedge
	<i>Gahnia filum</i>	Chaffy Saw-sedge
	<i>Gahnia radula</i>	Thatch Saw-sedge
	<i>Gahnia sieberiana</i>	Red-fruit Saw-sedge
	<i>Gahnia</i> spp.	Saw Sedge
P	<i>Glossodia major</i>	Wax-lip Orchid
	<i>Gonocarpus tetragynus</i>	Common Raspwort
	<i>Goodenia humilis</i>	Swamp Goodenia
	<i>Goodenia ovata</i>	Hop Goodenia
	<i>Hakea ulicina</i>	Furze Hakea
	<i>Hemichroa pentandra</i>	Trailing Hemichroa
	<i>Hydrocotyle</i> spp.	Pennywort
	<i>Hypericum gramineum</i>	Small St John's Wort
	<i>Imperata cylindrica</i>	Blady Grass
	<i>Isolepis inundata</i>	Swamp Club-sedge
	<i>Isolepis</i> spp.	Club Sedge
	<i>Isopogon ceratophyllus</i>	Horny Cone-bush
	<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Sea Rush
	<i>Juncus pallidus</i>	Pale Rush
	<i>Juncus planifolius</i>	Broad-leaf Rush
	<i>Juncus procerus</i>	Tall Rush
	<i>Juncus revolutus</i>	Creeping Rush
	<i>Juncus</i> spp.	Rush
	<i>Juncus subsecundus</i>	Finger Rush
	<i>Kennedia prostrata</i>	Running Postman
	<i>Kunzea leptospermoides</i>	Burgan
P	<i>Lagenophora gracilis</i>	Slender Bottle-daisy
P	<i>Laphangium luteoalbum</i>	Jersey Cudweed
	<i>Lepidosperma curtisiae</i>	Little Sword-sedge
	<i>Lepidosperma elatius</i>	Tall Sword-sedge
	<i>Lepidosperma laterale</i>	Variable Sword-sedge
	<i>Lepidosperma longitudinale</i>	Pithy Sword-sedge
	<i>Lepidosperma neesii</i>	Stiff Rapier-sedge
P	<i>Leptorhynchos tenuifolius</i>	Wiry Buttons
	<i>Leptospermum continentale</i>	Prickly Tea-tree

Status	Scientific Name	Common Name
Indigenous species		
	<i>Leptospermum laevigatum</i>	Coast Tea-tree
P	<i>Leucopogon</i> spp.	Beard Heath
	<i>Lobelia anceps</i>	Angled Lobelia
	<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	Wattle Mat-rush
	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
	<i>Lythrum hyssopifolia</i>	Small Loosestrife
	<i>Melaleuca ericifolia</i>	Swamp Paperbark
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
P	<i>Microtis</i> spp.	Onion Orchid
	<i>Myoporum insulare</i>	Common Boobialla
P	<i>Olearia lirata</i>	Snowy Daisy-bush
P	<i>Olearia ramulosa</i>	Twiggy Daisy-bush
	<i>Opercularia ovata</i>	Broad-leaf Stinkweed
	<i>Oxalis corniculata</i> s.l.	Yellow Wood-sorrel
P	<i>Ozothamnus ferrugineus</i>	Tree Everlasting
	<i>Patersonia occidentalis</i> var. <i>occidentalis</i>	Long Purple-flag
	<i>Pentapogon quadrifidus</i> subsp. <i>quadrifidus</i>	Five-awned Spear-grass
	<i>Persicaria decipiens</i>	Slender Knotweed
	<i>Phragmites australis</i>	Common Reed
	<i>Pimelea humilis</i>	Common Rice-flower
	<i>Pimelea</i> spp.	Rice Flower
	<i>Platylobium obtusangulum</i>	Common Flat-pea
	<i>Poa labillardierei</i>	Common Tussock-grass
	<i>Poa sieberiana</i>	Grey Tussock-grass
	<i>Poa</i> spp.	Tussock Grass
	<i>Poranthera microphylla</i> s.l.	Small Poranthera
	<i>Pteridium esculentum</i> subsp. <i>esculentum</i>	Austral Bracken
P	<i>Pterostylis</i> spp.	Greenhood
	<i>Puccinellia stricta</i> s.s.	Australian Saltmarsh-grass
	<i>Ranunculus</i> spp.	Buttercup
	<i>Rhagodia candolleana</i> subsp. <i>candolleana</i>	Seaberry Saltbush
	<i>Rubus parvifolius</i>	Small-leaf Bramble
	<i>Rumex</i> spp.	Dock
	<i>Rytidosperma caespitosum</i>	Common Wallaby-grass
	<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	Slender Wallaby-grass
	<i>Rytidosperma semiannulare</i>	Wetland Wallaby-grass
	<i>Rytidosperma setaceum</i> subsp. <i>setaceum</i>	Bristly Wallaby-grass
	<i>Rytidosperma</i> spp.	Wallaby Grass
	<i>Samolus repens</i> var. <i>repens</i>	Creeping Brookweed

Status	Scientific Name	Common Name
Indigenous species		
	<i>Sarcocornia quinqueflora</i>	Beaded Glasswort
	<i>Schoenus apogon</i>	Common Bog-sedge
	<i>Schoenus brevifolius</i>	Zig-zag Bog-sedge
	<i>Schoenus nitens</i>	Shiny Bog-sedge
	<i>Schoenus tesquorum</i>	Soft Bog-sedge
	<i>Selliera radicans</i>	Shiny Swamp-mat
P	<i>Senecio quadridentatus</i>	Cotton Fireweed
P	<i>Senecio</i> spp.	Groundsel
	<i>Solanum aviculare</i>	Kangaroo Apple
	<i>Tecticornia arbuscula</i>	Shrubby Glasswort
P	<i>Thelymitra antennifera</i>	Rabbit Ears
P	<i>Thelymitra arenaria</i>	Forest Sun-orchid
P	<i>Thelymitra brevifolia</i>	Peppertop Sun-orchid
P	<i>Thelymitra carnea</i>	Pink Sun-orchid
P	<i>Thelymitra flexuosa</i>	Twisted Sun-orchid
P	<i>Thelymitra holmesii</i>	Blue-star Sun-orchid
P	<i>Thelymitra ixioides</i>	Spotted Sun-orchid
P	<i>Thelymitra pallidiflora</i>	Pallid Sun-orchid
P	<i>Thelymitra pauciflora</i>	Slender Sun-orchid
P	<i>Thelymitra reflexa</i>	Gaping Sun-orchid
P	<i>Thelymitra rubra</i>	Salmon Sun-orchid
P	<i>Thelymitra</i> spp.	Sun Orchid
P	<i>Thelymitra</i> X <i>merraniae</i>	Merran's Sun-orchid
	<i>Themeda triandra</i>	Kangaroo Grass
P	<i>Thysanotus patersonii</i>	Twining Fringe-lily
P	<i>Thysanotus tuberosus</i>	Common Fringe-lily
	<i>Tricoryne elatior</i>	Yellow Rush-lily
	<i>Triglochin</i> spp.	Arrowgrass
	<i>Typha domingensis</i>	Narrow-leaf Cumbungi
	<i>Typha orientalis</i>	Broad-leaf Cumbungi
	<i>Typha</i> spp.	Bulrush
	<i>Viminaria juncea</i>	Golden Spray
	<i>Viola hederacea</i>	Ivy-leaf Violet
	<i>Wahlenbergia gracilis</i>	Sprawling Bluebell
P	<i>Xanthorrhoea minor</i> subsp. <i>lutea</i>	Small Grass-tree
Introduced species		
	<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sallow Wattle
	<i>Acetosella vulgaris</i>	Sheep Sorrel
	<i>Agapanthus praecox</i> subsp. <i>orientalis</i>	Agapanthus

Status	Scientific Name	Common Name
Indigenous species		
	<i>Agrostis capillaris</i>	Brown-top Bent
R	<i>Allium triquetrum</i>	Angled Onion
	<i>Amaranthus</i> spp.	Amaranth
	<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
	<i>Arctotheca calendula</i>	Cape weed
R	<i>Asparagus asparagoides</i>	Bridal Creeper
	<i>Avena</i> spp.	Oat
	<i>Betula</i> spp.	Birch
	<i>Billardiera heterophylla</i>	Bluebell Creeper
	<i>Briza maxima</i>	Large Quaking-grass
	<i>Bromus catharticus</i>	Prairie Grass
	<i>Bromus diandrus</i>	Great Brome
	<i>Cenchrus clandestinus</i>	Kikuyu
	<i>Centaureum erythraea</i>	Common Centaury
	<i>Cerastium glomeratum</i> s.l.	Common Mouse-ear Chickweed
	<i>Chenopodium album</i>	Fat Hen
RC	<i>Chrysanthemoides monilifera</i>	Boneseed
RC	<i>Cirsium vulgare</i>	Spear Thistle
	<i>Coprosma repens</i>	Mirror Bush
	<i>Cordyline australis</i>	New Zealand Cabbage-tree
	<i>Cortaderia selloana</i>	Pampas Grass
	<i>Corymbia citriodora</i> subsp. <i>citriodora</i>	Lemon-scented Gum
#	<i>Corymbia maculata</i>	Spotted Gum
	<i>Cotoneaster pannosus</i>	Velvet Cotoneaster
	<i>Cotula coronopifolia</i>	Water Buttons
RC	<i>Crataegus monogyna</i>	Hawthorn
	<i>Cynodon dactylon</i>	Couch
RC	<i>Cytisus scoparius</i>	English Broom
	<i>Dactylis glomerata</i>	Cocksfoot
	<i>Daucus carota</i>	Carrot
	<i>Ehrharta erecta</i>	Panic Veldt-grass
	<i>Ehrharta longiflora</i>	Annual Veldt-grass
	<i>Erica lusitanica</i>	Spanish Heath
	<i>Erigeron bonariense</i>	Flaxleaf Fleabane
#	<i>Eucalyptus botryoides</i>	Southern Mahogany
	<i>Eucalyptus cladocalyx</i>	Sugar Gum
#	<i>Eucalyptus globulus</i>	Southern Blue-gum
#	<i>Eucalyptus leucoxylon</i>	Yellow Gum
r	<i>Eucalyptus sideroxylon</i> subsp. <i>sideroxylon</i> (planted)	Mugga

Status	Scientific Name	Common Name
Indigenous species		
	<i>Freesia leichtlinii</i>	Freesia
RC	<i>Genista linifolia</i>	Flax-leaf Broom
RC	<i>Genista monspessulana</i>	Montpellier Broom
	<i>Gladiolus</i> spp.	Gladiolus
	<i>Gladiolus undulatus</i>	Wild Gladiolus
	<i>Hakea drupacea</i>	Sweet Hakea
	<i>Hedera helix</i>	English Ivy
	<i>Helminthotheca echioides</i>	Ox-tongue
	<i>Holcus lanatus</i>	Yorkshire Fog
	<i>Hordeum leporinum</i>	Barley-grass
	<i>Hypochaeris radicata</i>	Flatweed
	<i>Hypochaeris</i> spp.	Cat's Ear
	<i>Lolium</i> spp.	Rye Grass
RC	<i>Lycium ferocissimum</i>	African Box-thorn
	<i>Malus</i> spp.	Apple
#	<i>Melaleuca armillaris</i>	Giant Honey-myrtle
R	<i>Oxalis pes-caprae</i>	Soursob
	<i>Oxalis purpurea</i>	Large-flower Wood-sorrel
	<i>Paspalum dilatatum</i>	Paspalum
	<i>Phalaris aquatica</i>	Toowoomba Canary-grass
	<i>Phytolacca octandra</i>	Red-ink Weed
	<i>Pinus radiata</i>	Radiata Pine
	<i>Pittosporum undulatum</i>	Sweet Pittosporum
	<i>Plantago coronopus</i>	Buck's-horn Plantain
	<i>Plantago lanceolata</i>	Ribwort
	<i>Polygala myrtifolia</i>	Myrtle-leaf Milkwort
	<i>Polygonum arenastrum</i>	Wireweed
	<i>Polygonum aviculare</i> s.l.	Prostrate Knotweed
	<i>Populus</i> spp.	Poplar
	<i>Romulea rosea</i>	Onion Grass
RC	<i>Rosa rubiginosa</i>	Sweet Briar
RC	<i>Rubus anglocandicans</i>	Blackberry
R	<i>Salix</i> spp.	Willow
	<i>Setaria parviflora</i>	Slender Pigeon-grass
	<i>Solanum nigrum</i> s.l.	Black Nightshade
	<i>Sonchus oleraceus</i>	Common Sow-thistle
	<i>Sporobolus africanus</i>	Rat-tail Grass
	<i>Trifolium angustifolium</i> var. <i>angustifolium</i>	Narrow-leaf Clover
RC	<i>Ulex europaeus</i>	Gorse

Status	Scientific Name	Common Name
Indigenous species		
	<i>Urtica dioica</i>	Giant Nettle
	<i>Vellereophyton dealbatum</i>	White Cudweed
	<i>Vicia sativa</i>	Common Vetch
	<i>Vulpia</i> spp.	Fescue
RC	<i>Watsonia meriana</i> var. <i>bulbillifera</i>	Bulbil Watsonia
RC	<i>Xanthium spinosum</i>	Bathurst Burr
	<i>Zantedeschia aethiopica</i>	White Arum-lily

A1.1 Listed flora species

The following table includes the listed flora species that have potential to occur within the study area. The list of species is sourced from the Victorian Biodiversity Atlas and the Protected Matters Search Tool.

Table A1.2 Listed flora species recorded / predicted to occur within 5 kilometres of the study area

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG				Gas import Jetty	Pipeline	
EPBC Act listed threatened species										
<i>Eucalyptus strzeleckii</i>	Strzelecki Gum	VU	v	L		2018	Ridges, slopes and along the banks of streams on deep, fertile loam soils that are seasonally waterlogged; less commonly found on undulating or flat terrain.	Negligible	Negligible	Single tree recorded by Monarc Environmental (2018), subsequently considered likely Mountain Swamp-gum (Dell Botany 2019).
<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass	VU		I	2013	PMST	Swampy areas, mainly along the Murray River between Wodonga and Echuca with scattered records from southern Victoria.	Low	Recorded	Recorded by Biosis (2019)
<i>Caladenia orientalis</i>	Eastern Spider-orchid	EN	e	L		PMST	Heath and heathy woodlands in coastal areas between the Mornington Peninsula and Wilsons Promontory.	Negligible	Negligible	No nearby records and limited suitable habitat.
<i>Dianella amoena</i>	Matted Flax-lily	EN	e	L	2014	PMST	Lowland grassland and grassy woodland, on well-drained to seasonally waterlogged fertile sandy loam soils to heavy cracking clays.	Low	Low	Nearby records but no suitable habitat.

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG				Gas import Jetty	Pipeline	
<i>Eucalyptus crenulata</i>	Buxton Gum	EN	e	L	2007		Alluvial soils in seasonally inundated depressions along river flats; records away from Buxton and Yering in the northeast are likely to be introductions.	Negligible	Negligible	Not indigenous to the area
<i>Glycine latrobeana</i>	Clover Glycine	VU	v	L		PMST	Grasslands and grassy woodlands, particularly those dominated by Kangaroo Grass.	Low	Low	No suitable habitat nearby to records.
<i>Limonium australe</i> var. <i>baudinii</i>	Tasmanian Sea-lavender	VU	x		1904		Presumed extinct in Victoria.	Negligible	Negligible	No recent records
<i>Pomaderris vacciniifolia</i>	Round-leaf Pomaderris	CR	e	L		PMST	Endemic in Victoria. Largely confined to moist forest and scrubs in the upper catchment of the Yarra, Plenty and Yea Rivers in an area bounded by Healesville, Marysville and Whittlesea, but also in the Tyers-Walhalla areas.	Negligible	Negligible	No suitable habitat nearby to records.
<i>Prasophyllum frenchii</i>	Maroon Leek-orchid	EN	e	L	2016	PMST	Grassland and grassy woodland environments on sandy or black clay loam soils that are generally damp but well drained.	Low	Low	No suitable habitat. Known from grassland within a rail reserve nearby to study area
<i>Prasophyllum spicatum</i>	Dense Leek-orchid	VU	e		2009	PMST	Heath and heathy woodlands.	Low	Low	Revised from moderate as was not observed during targeted surveys in suitable habitat

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG				Gas import Jetty	Pipeline	
<i>Pterostylis chlorogramma</i>	Green-striped Greenhood	VU	v	L		PMST	Heathy woodland; more specific habitat requirements are poorly known.	Negligible	Negligible	No suitable habitat or nearby records.
<i>Pterostylis cucullata</i>	Leafy Greenhood	VU		L		PMST	Sand dune scrubs in coastal areas, and inland on slopes and river flats in moist foothill and montane forests.	Low	Low	Marginal suitable habitat and no nearby records.
<i>Senecio psilocarpus</i>	Swamp Fireweed	VU	v		2005	PMST	Seasonally inundated herb-rich swamps, growing on peaty soils or volcanic clays.	Negligible	Low	Not observed during targeted surveys in suitable habitat
<i>Thelymitra epipactoides</i>	Metallic Sun-orchid	EN	e	L		PMST	Moist or dry sandy loams or loamy sands, primarily in coastal heaths, grasslands and woodlands, but also in similar communities at drier inland sites.	Negligible	Negligible	No suitable habitat or nearby records.
<i>Xerochrysum palustre</i>	Swamp Everlasting	VU	v	L	2005	PMST	Sedge-swamps and shallow freshwater marshes and swamps in lowlands, on black cracking clay soils.	Negligible	Low	Not observed during targeted surveys in suitable habitat.
FFG Act listed threatened species										
<i>Adiantum diaphanum</i>	Filmy Maidenhair		e	L	1972		Wet rock faces or exposed sections of rock along streams in shaded fern gullies of wet sclerophyll forest.	Negligible	Negligible	No suitable habitat, no recent records.
<i>Craspedia canens</i>	Grey Billy-buttons		e	L	2001		Low altitude grasslands between Cranbourne and Traralgon.	Negligible	Low	No suitable habitat.
<i>Diuris punctata</i>	Purple Diuris		v	L	1998		Fertile, loamy soils and periodically wet areas in lowland grasslands, grassy woodlands,	Negligible	Low	Nearby record from 1998 within intact habitat. Limited suitable habitat

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG				Gas import Jetty	Pipeline	
							heathy woodlands and open heathlands.			within the study area.
<i>Lachnagrostis punicea</i> subsp. <i>filifolia</i>	Purple Blown-grass		r	L	1994		Wet marshes and slightly saline swamps and depressions, on heavy soils away from the coast.	Negligible	Negligible	No recent nearby records. No suitable habitat.
<i>Thelymitra X merraniae</i>	Merran's Sun-orchid		e	L	1999		Heathlands, woodlands and open forests, commonly in depressions or low-lying areas around swamps.	Moderate	Recorded	Recorded alongside Woolleys Road by Biosis (2019).
DELWP Advisory listed rare or threatened species										
<i>Atriplex paludosa</i> subsp. <i>paludosa</i>	Marsh Saltbush		r		2012		Boggy, saline soils on coastal or near-coastal saltmarshes and tidal-flats.	Low	Low	Some suitable habitat within study area but not observed during assessments. Moderate chance of being present within Watson Creek. Not observed at the Crib Point Jetty facility
<i>Austrostipa rudis</i> subsp. <i>australis</i>	Veined Spear-grass		r		2009		Cooler areas of moderate altitude, in open-forest on sandy or sandstone derived soils.	Low	Low	No suitable habitat. Nearby records generally in higher elevations.
<i>Avicennia marina</i> subsp. <i>australasica</i>	Grey Mangrove		r		2012		Low energy coastlines in the inter-tidal zone.	Low	Low	Recorded adjacent to the study area at Crib Point (Biosis 2019). Not observed within the study area. Possibly present at Watson Creek.

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG				Gas import Jetty	Pipeline	
<i>Coronidium gunnianum</i>	Pale Swamp Everlasting		v		1994		Widespread and sometimes locally common, particularly in high-rainfall areas of Victoria; often in moist sites in open forests and woodlands.	Negligible	Low	No suitable habitat nearby to recent records. Vegetation adjacent to records is modified with introduced pasture.
<i>Dianella</i> sp. aff. <i>longifolia</i> (Benambra)	Arching Flax-lily		v		2013		Occurs in lowland plains grassland and grassy woodlands as well as around rocky outcrops at higher altitudes.	Negligible	Low	Adjacent records in intact habitat but habitat within study area is too degraded.
<i>Eucalyptus fulgens</i>	Green Scentbark		r		2013		Forests and woodlands of the Gippsland Plain and adjacent foothills.	Negligible	Low	Nearby records in the Pakenham East Train Stabling Yard however not observed during Monarc Environmental's assessment.
<i>Eucalyptus willisii</i> s.s.	Promontory Peppermint		r		1943		Apparently restricted to sandy areas and granite hills in Wilsons Promontory.	Low	Low	Not recorded during assessments. Nearby record on Quail Island.
<i>Eucalyptus X studleyensis</i>	Studley Park Gum		e		2010		A morphologically variable hybrid between <i>Eucalyptus Camaldulensis</i> subsp. <i>camaldulensis</i> and <i>E. ovata</i> subsp. <i>ovata</i> from the lower Yarra River north-east of Melbourne (Kew, Viewbank, Watsonia).	Negligible	Negligible	No suitable habitat and not found naturally in the Project Area.

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG				Gas import Jetty	Pipeline	
<i>Euryomyrtus ramosissima</i> subsp. <i>prostrata</i>	Nodding Baeckea		r		1989		Confined to heath and heathy woodlands in coastal environments, with disjunct occurrences in the Grampians.	Low	Low	One record from Stony Point rom 1989. No other nearby or recent records. No suitable habitat.
<i>Exocarpos syrticola</i>	Coast Ballart		r		1988		Calcareous sands of coastal dunes and cliffs. Semi-parasitic on the roots of nearby plants.	Negligible	Low	One nearby record from 1988 in Warrigine Park. Not observed during assessment. No other suitable habitat.
<i>Geranium solanderi</i> var. <i>solanderi</i> s.s.	Austral Crane's-bill		v		2002		Grasslands or grassy woodlands where hydrology is not a limiting factor.	Negligible	Moderate	Some suitable habitat, however not within its normal range. One record from 2002.
<i>Juncus revolutus</i>	Creeping Rush		r		2008		Saltmarshes and other similarly saline inland habitats.	Low	Moderate	Some suitable habitat within Warrigine Park. Suitable habitat near Watson Creek but not within study area.
<i>Lachnagrostis punicea</i> subsp. <i>punicea</i>	Purple Blown-grass		r		2005		Wet marshes and slightly saline swamps and depressions in plains communities.	Negligible	Low	Very near and recent record in adjacent intact habitat. No suitable habitat within study area. Not observed during field assessments.

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG				Gas import Jetty	Pipeline	
<i>Lachnagrostis robusta</i>	Salt Blown-grass		r		2008		Confined to saline swamps and lake edges but widespread across the Victorian Volcanic Plain and occasionally in the southern Wimmera	Negligible	Negligible	No suitable habitat.
<i>Lawrenzia spicata</i>	Salt Lawrenzia		r		2006		Fringe habitats of coastal saltmarsh communities.	Low	Low	No suitable habitat and not observed. May persist at Watson Creek outside of study area.
<i>Limonium australe</i> var. <i>australe</i>	Yellow Sea-lavender		r		2008		Confined to mangrove and saltmarsh communities in central and west Gippsland	Low	Low	No suitable habitat and not observed. May persist at Watson Creek outside of study area.
<i>Microseris scapigera</i> s.s.	Plains Yam-daisy		v		1994		Damp depressions in grasslands, woodlands, stream banks, alpine herbfields and around the margins of saline lakes and flats.	Low	Low	Some suitable habitat but no nearby recent records.
<i>Prasophyllum lindleyanum</i>	Green Leek-orchid		v	I	2009		Fertile soils in woodland or scrubby heath.	Moderate	Low	Abundant records at Stony Point to the south. Suitable habitat adjacent to the south of Crib Point Jetty facility.
<i>Pterostylis grandiflora</i>	Cobra Greenhood		r		2007		Moist, shady slopes in open-forest, on well-drained soil	Negligible	Negligible	No suitable habitat.

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG				Gas import Jetty	Pipeline	
<i>Pterostylis X toveyana</i>	Mentone Greenhood		v		1969		Coastal scrub and moist areas of open-forest.	Negligible	Negligible	No nearby recent records or suitable habitat.
<i>Senecio glomeratus</i> subsp. <i>longifructus</i>	Annual Fireweed		r		2006		Areas adjacent to streams, swamps and saline flats.	Low	Low	No suitable habitat nearby to 2006 record.
<i>Thelymitra longiloba</i>	Marsh Sun-orchid		e	I	1988		Grows in coastal and near-coastal heathland and heathy woodland in low-lying moist areas or drier sites on sandy, clay, or peaty loams	Moderate	Moderate	Nearby record and suitable habitat at Crib Point adjacent to Woolleys Beach Reserve.
<i>Thelymitra orientalis</i>	Hoary Sun-orchid		v		2003		Grows in damp heathy flats and seepage areas usually in peaty white sands.	Low	Low	No nearby records.
<i>Thelymitra pallidiflora</i>	Pallid Sun-orchid		e	I	2005		Apparently endemic to south-central Victoria in grassy and heathy woodlands on sandy soils.	Moderate	Recorded	Nearby record and suitable habitat at Crib Point adjacent to Woolleys Beach Reserve. Located within the study area on existing easement between KP 1.13 and KP 1.7.
<i>Thelymitra reflexa</i>	Gaping Sun-orchid		e		2006		Near-coastal heathy woodland on seasonally damp sandy soil. Currently known only from Western Port at Crib Point and French Island.	Moderate	Recorded	Nearby record and suitable habitat at Crib Point adjacent to Woolleys Beach Reserve. Located within the study area on existing

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG				Gas import Jetty	Pipeline	
										easement between KP 1.13 and KP 1.7.
<i>Thelymitra X irregularis</i>	Crested Sun-orchid		r		1999		Believed to be a natural hybrid between <i>Thelymitra</i> <i>ixiodes</i> and either <i>T. carnea</i> or <i>T. rubra</i> . Sporadically occurring where the parent species grow intermingled.	Moderate	Moderate	Suitable habitat alongside Woolleys Road where both parent plants persist.
<i>Thelymitra X macmillanii</i>	Crimson Sun-orchid		v		2009		The habitat requirements of this species are poorly known.	Moderate	Moderate	Possible habitat alongside Woolleys Beach Reserve next to Crib Point.
<i>Triglochin minutissima</i>	Tiny Arrowgrass		r		1991		Scattered occurrences on damp saline soils near salt-lakes, and forming part of herbfields in coastal saltmarshes.	Low	Low	No nearby recent records.

Appendix 2 Fauna

Notes to tables:

EPBC Act: EX - Extinct CR - Critically Endangered EN - Endangered VU - Vulnerable CD - Conservation dependent	DSE 2009, DSE 2013: ex - extinct cr - critically endangered en - endangered vu - vulnerable nt - near threatened dd - data deficient rx - regionally extinct
FFG Act: L - listed as threatened under FFG Act N - nominated for listing as threatened I - determined ineligible for listing	Introduced species PS - pest species listed under the CaLP Act * - introduced species

Most recent database records are from the Victorian Biodiversity Atlas unless otherwise specified as follows

PMST – Protected Matters Search Tool

BA – Birds Australia

Species with bold type were recorded by Biosis

A2.1 Fauna species recorded

Table A2.1 Vertebrate fauna recorded by Monarc Environmental (2018) and Biosis during field assessments undertaken for the Project (in taxonomic order).

Status	Species name	Common name
Birds		
	<i>Phaps chalcoptera</i>	Common Bronzewing
	<i>Phaps elegans</i>	Brush Bronzewing
	<i>Ocyphaps lophotes</i>	Crested Pigeon
vu L	<i>Lewinia pectoralis</i>	Lewin's Rail
	<i>Hypotaenidia philippensis</i>	Buff-banded Rail
	<i>Gallinula tenebrosa</i>	Dusky Moorhen
	<i>Porphyrio melanotus</i>	Australasian Swamphen
	<i>Fulica atra</i>	Eurasian Coot
	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe
	<i>Poliocephalus poliocephalus</i>	Hoary-headed Grebe
	<i>Phalacrocorax carbo</i>	Great Cormorant
	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant
nt	<i>Phalacrocorax fuscescens</i>	Black-faced Cormorant
nt	<i>Phalacrocorax varius</i>	Pied Cormorant
	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant
	<i>Anhinga novaehollandiae</i>	Australasian Darter
	<i>Pelecanus conspicillatus</i>	Australian Pelican
nt	<i>Gallinago hardwickii</i>	Latham's Snipe
	<i>Threskiornis molucca</i>	Australian White Ibis
	<i>Threskiornis spinicollis</i>	Straw-necked Ibis
nt	<i>Platalea regia</i>	Royal Spoonbill
en L	<i>Egretta garzetta nigripes</i>	Little Egret
vu L	<i>Ardea alba modesta</i>	Eastern Great Egret
	<i>Bubulcus coromandus</i>	Eastern Cattle Egret
	<i>Egretta novaehollandiae</i>	White-faced Heron
	<i>Cereopsis novaehollandiae</i>	Cape Barren Goose
	<i>Chenonetta jubata</i>	Australian Wood Duck
	<i>Cygnus atratus</i>	Black Swan
	<i>Anas superciliosa</i>	Pacific Black Duck
	<i>Anas castanea</i>	Chestnut Teal
	<i>Anas gracilis</i>	Grey Teal
vu	<i>Spatula rhynchotis</i>	Australasian Shoveler
vu	<i>Aythya australis</i>	Hardhead
en L	<i>Oxyura australis</i>	Blue-billed Duck
	<i>Accipiter fasciatus</i>	Brown Goshawk

Status	Species name	Common name
	<i>Aquila audax</i>	Wedge-tailed Eagle
	<i>Haliastur sphenurus</i>	Whistling Kite
	<i>Elanus axillaris</i>	Black-shouldered Kite
	<i>Falco berigora</i>	Brown Falcon
	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Trichoglossus molucannus</i>	Rainbow Lorikeet
	<i>Glossopsitta concinna</i>	Musk Lorikeet
	<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-Cockatoo
	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo
	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
	<i>Cacatua tenuirostris</i>	Long-billed Corella
	<i>Eolophus roseicapilla</i>	Galah
	<i>Alisterus scapularis</i>	Australian King-Parrot
	<i>Platycercus elegans</i>	Crimson Rosella
	<i>Platycercus eximius</i>	Eastern Rosella
	<i>Dacelo novaeguineae</i>	Laughing Kookaburra
	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo
	<i>Columba livia</i>	Domestic Pigeon
	<i>Spilopelia chinensis</i>	Spotted Dove
nt L	<i>Hydroprogne caspia</i>	Caspian Tern
	<i>Thalasseus bergii</i>	Crested Tern
	<i>Chroicocephalus novaehollandiae</i>	Silver Gull
	<i>Haematopus longirostris</i>	Pied Oystercatcher
	<i>Erythronyx cinctus</i>	Red-kneed Dotterel
	<i>Vanellus miles</i>	Masked Lapwing
	<i>Elseyornis melanops</i>	Black-fronted Dotterel
CR vu L	<i>Numenius madagascariensis</i>	Eastern Curlew
	<i>Calidris ruficollis</i>	Red-necked Stint
nt	<i>Larus pacificus</i>	Pacific Gull
	<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Petrochelidon nigricans</i>	Tree Martin
	<i>Rhipidura albiscapa</i>	Grey Fantail
	<i>Rhipidura leucophrys</i>	Willie Wagtail
	<i>Petroica phoenicea</i>	Flame Robin
	<i>Eopsaltria australis</i>	Eastern Yellow Robin
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush
	<i>Grallina cyanoleuca</i>	Magpie-lark
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike
	<i>Epthianura albifrons</i>	White-fronted Chat
	<i>Acanthiza pusilla</i>	Brown Thornbill

Status	Species name	Common name
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
	<i>Sericornis frontalis</i>	White-browed Scrubwren
	<i>Acrocephalus australis</i>	Reed-Warbler
	<i>Cisticola exilis</i>	Golden-headed Cisticola
	<i>Malurus cyaneus</i>	Superb Fairy-wren
	<i>Artamus cyanopterus</i>	Dusky Woodswallow
	<i>Pardalotus punctatus</i>	Spotted Pardalote
	<i>Zosterops lateralis</i>	Silvereye
	<i>Melithreptus lunatus</i>	White-naped Honeyeater
	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater
	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill
	<i>Caligavis chrysops</i>	Yellow-faced Honeyeater
	<i>Nesoptilotis leucotis</i>	White-eared Honeyeater
	<i>Ptilotula penicillata</i>	White-plumed Honeyeater
	<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater
	<i>Manorina melanocephala</i>	Noisy Miner
	<i>Anthochaera chrysoptera</i>	Little Wattlebird
	<i>Anthochaera carunculata</i>	Red Wattlebird
	<i>Anthus australis</i>	Australian Pipit
nt L	<i>Stagonopleura guttata</i>	Diamond Firetail
	<i>Strepera graculina</i>	Pied Currawong
	<i>Cracticus torquatus</i>	Grey Butcherbird
	<i>Gymnorhina tibicen</i>	Australian Magpie
	<i>Corvus coronoides</i>	Australian Raven
	<i>Corvus mellori</i>	Little Raven
	<i>Pardalotus striatus</i>	Striated Pardalote
	<i>Turdus merula</i>	Common Blackbird
	<i>Alauda arvensis</i>	Eurasian Skylark
	<i>Passer domesticus</i>	House Sparrow
	<i>Acridotheres tristis</i>	Common Myna
	<i>Sturnus vulgaris</i>	Common Starling
	<i>Carduelis carduelis</i>	European Goldfinch
Mammals		
	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
	<i>Antechinus agilis</i>	Agile Antechinus
	<i>Trichosurus vulpecula</i>	Common Brush-tailed Possum
	<i>Pseudocheirus peregrinus</i>	Eastern Ring-tailed Possum
	<i>Petaurus breviceps</i>	Sugar Glider
	<i>Wallabia bicolor</i>	Black-tailed Wallaby
	<i>Rattus lutreolus</i>	Swamp Rat

Status	Species name	Common name
	<i>Rattus rattus</i>	Black Rat
	<i>Mus musculus</i>	House Mouse
	<i>Canis lupus familiaris</i>	Dog (feral)
EN nt L	<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot
	<i>Tadarida australis</i>	White-striped Freetail Bat
Reptiles		
	<i>Lampropholis guichenoti</i>	Pale-flecked Garden Sunskink
	<i>Tiliqua nigrolutea</i>	Blotched Blue-tongued Lizard
vu	<i>Pseudemoia rawlinsoni</i>	Glossy Grass Skink
	<i>Austrelaps superbus</i>	Lowland Copperhead
	<i>Liopholis whitii</i>	White's Skink
Amphibians		
	<i>Limnodynastes dumerilii</i>	Southern Bullfrog
	<i>Limnodynastes peronii</i>	Striped Marsh Frog
	<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog
vu	<i>Pseudophryne semimarmorata</i>	Southern Toadlet
	<i>Crinia signifera</i>	Common Froglet
	<i>Litoria ewingii</i>	Southern Brown Tree Frog
	<i>Litoria peronii</i>	Peron's Tree Frog
VU en L	<i>Litoria raniformis</i>	Growling Grass Frog
	<i>Litoria verreauxii verreauxii</i>	Verreaux's Tree Frog
Fishes		
	<i>Anguilla australis</i>	Southern Shortfin Eel
	<i>Galaxias maculatus</i>	Common Galaxias
	<i>Nannoperca australis</i>	Southern Pygmy Perch
	<i>Pseudaphritis urvillii</i>	Tupong
	<i>Hypseleotris galii</i>	Firetail Gudgeon
	<i>Philypnodon grandiceps</i>	Flatheaded Gudgeon
	<i>Tetractenos spp.</i>	Toadfish
Decapod crustacea		
	<i>Paratya australiensis</i>	Common Freshwater Shrimp
	<i>Lepidurus apus viridis</i>	Tadpole Shrimp

A2.2 Listed fauna species

The following table includes a list of the listed fauna species that have potential to occur within the study area. The list of species is sourced from the Victorian Biodiversity Atlas and the Protected Matters Search Tool.

Table A2.2 Listed fauna species recorded, or predicted to occur, within 5 kilometres of the study area

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking	
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline		
EPBC Act listed threatened species												
<i>Rostratula australis</i>	Australian Painted-snipe	EN	e	L			PMST	Shallows of well-vegetated freshwater wetlands.	Low	Low	No recent records. Limited suitable habitat.	
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	e	L		2007	PMST	Shallow freshwater and brackish wetlands with abundant emergent aquatic vegetation.	Low	Low	Limited suitable habitat.	
<i>Neophema chrysogaster</i>	Orange-bellied Parrot	CR	e	L		1987	PMST	Coastal vegetation including saltmarshes, dunes, pastures, shrublands, sewage plants, saltworks, islands, and beaches.	Low	Low	No recent records. Suitable habitat available in Western Port, but species is now very rare east of Bellarine Peninsula.	
<i>Lathamus discolor</i>	Swift Parrot	CR	e	L		1980	PMST	A range of forests and woodlands, especially those supporting nectar-producing tree species. Also well-treed urban areas.	Low	Moderate	May forage within eucalypts while on mainland over winter, but unlikely to make regular use of habitat present.	
<i>Hirundapus caudacutus</i>	White-throated Needletail	VU	v	L	Mi	2010	PMST	An almost exclusively aerial species within Australia, occurring over most types of habitat, particularly wooded areas.	Moderate	Moderate	May forage above woodlands, farmland, heathland and mudflats.	

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Fregetta tropica</i>	White-bellied Storm-Petrel	VU					PMST	Breeds from October to April on Subantarctic islands and moves northward from May to September to subtropical waters of the Atlantic Ocean	Negligible	Negligible	No suitable habitat. No records within Western Port.
<i>Pterodroma leucoptera</i>	Gould's Petrel	EN					PMST	A marine pelagic that spends the majority of its time at sea. Breeding colonies on Cabbage Tree Island and Boondelbah Island.	Negligible	Negligible	No suitable habitat. No records within Western Port.
<i>Pachyptila turtur</i>	Fairy Prion (southern)	VU	v			1979	PMST	Open ocean over continental shelves and slopes, and rarely coming close to shore except at breeding islands and during rough weather.	Low	Negligible	No suitable habitat. Occasionally recorded within Western Port.
<i>Diomedea exulans</i>	Wandering Albatross	VU	e	L	Mi	1960	PMST	Observed over continental shelves often in areas of continental upwellings. Regularly recorded feeding in sheltered harbours, often gathering at sewerage outfalls.	Low	Negligible	No suitable habitat and no recent records.
<i>Thalassarche melanophris</i>	Black-browed Albatross	VU	v		Mi	1981	PMST	Subantarctic and subtropical waters. Breeds on rocky islets and stacks.	Low	Negligible	No suitable habitat and no recent records.
<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	EN	v	L	Mi		PMST	Breeds on antarctic and subantarctic islands. Forages over the open oceans, with a small number of records over	Low	Negligible	No suitable habitat and no recent records.

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
								inshore and offshore areas along the Victorian coast.			
<i>Thalassarche cauta</i>	Shy Albatross	VU	v	L	Mi	1981	PMST	A marine pelagic species inhabiting Subantarctic and subtropical waters, spending the majority of their time at sea. Occasionally observed in continental shelf waters in bays and harbours.	Low	Negligible	No suitable habitat and no recent records.
<i>Phoebetria fusca</i>	Sooty Albatross	VU		L	Mi		PMST	Subantarctic and subtropical marine waters.	Negligible	Negligible	No suitable habitat and no recent records.
<i>Macronectes giganteus</i>	Southern Giant-Petrel	EN	v	L	Mi	1988	PMST	Adults of this species are present all year round at Antarctic breeding colonies, from where immature birds disperse, some as far north as subtropical areas.	Low	Negligible	No suitable habitat and no recent records.
<i>Thalassarche bulleri</i>	Buller's Albatross	VU		L	Mi		PMST	Breeds in New Zealand and is a seasonal visitor to Victorian coastal waters where it occurs in pelagic and inshore waters.	Low	Negligible	No suitable habitat and no recent records.
<i>Macronectes halli</i>	Northern Giant-Petrel	VU	nt	L	Mi		PMST	Breeds on subantarctic islands. Occasionally observed along temperate coastal areas of Australia. Often seen around sewer outfalls or at seal and penguin colonies.	Low	Negligible	No suitable habitat and no recent records.
<i>Diomedea epomophora</i>	Southern Royal Albatross	VU	v	L	Mi		PMST	Range extends throughout the oceans of the Southern	Negligible	Negligible	No suitable habitat and no recent records.

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area			Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty		Pipeline	
								Hemisphere. Nests almost exclusively on the Chatham Islands, east of New Zealand.				
<i>Diomedea sanfordi</i>	Northern Royal Albatross	EN			Mi		PMST	Subantarctic, subtropical, and occasionally Antarctic waters. Commonly nest on Campbell Island and the Auckland Islands.	Negligible		Negligible	No suitable habitat and no recent records.
<i>Diomedea antipodensis</i>	New Zealand Wandering Albatross	VU			Mi		PMST	A marine, pelagic species that ranges widely throughout the Pacific region of the Southern Ocean. It visits off-shore waters of southern Australia.	Negligible		Negligible	No suitable habitat and no recent records.
<i>Thalassarche salvini</i>	Salvin's Albatross	VU			Mi		PMST	A marine species occurring in subantarctic and subtropical waters.	Low		Negligible	No suitable habitat and no recent records.
<i>Sternula nereis</i>	Fairy Tern	VU	e	L		1992	PMST	Coastal environments including intertidal mudflats, sand flats and beaches. Nests above high-water mark on sandy shell-grit beaches.	High		Low	Suitable habitat and recent nearby records.
<i>Thinornis cucullatus</i>	Hooded Plover	VU	v	L		1974		Sandy ocean beaches, estuaries and inland lakes.	Low		Negligible	Some suitable beach habitat present, but no nearby records.
<i>Charadrius mongolus</i>	Lesser Sand Plover	EN	e		Mi	1981	PMST	Intertidal mudflats and sandbanks of sheltered bays and estuaries.	Moderate		Negligible	Suitable habitat and nearby records.
<i>Charadrius</i>	Greater Sand	VU	e		Mi		PMST	Intertidal mudflats and	Moderate		Negligible	Suitable habitat and

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area			Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty		Pipeline	
<i>Ieschenaultii</i>	Plover							sandbanks of sheltered bays and estuaries.				nearby records.
<i>Numenius madagascariensis</i>	Eastern Curlew	CR	v		Mi	2016	PMST	Large intertidal sandflats, banks, mudflats, estuaries, inlets, sewage farms, saltworks, harbours, coastal lagoons and bays.	High	Low		Suitable habitat and nearby records.
<i>Limosa lapponica</i>	Bar-tailed Godwit	VU			Mi	2007		Estuarine mudflats, beaches and mangroves. Common in coastal areas around Australia.	High	Low		Suitable habitat and nearby records.
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR	e		Mi	2002	PMST	Large intertidal sandflats, banks, mudflats, estuaries, inlets, sewage farms, saltworks, harbours, coastal lagoons and bays.	High	Low		Suitable habitat and nearby records.
<i>Calidris canutus</i>	Red Knot	EN	e		Mi	2002	PMST	Large intertidal sandflats, banks, mudflats, estuaries, inlets, sewage farms, saltworks, harbours, coastal lagoons and bays.	High	Low		Suitable habitat and nearby records.
<i>Calidris tenuirostris</i>	Great Knot	CR	e	L	Mi	2002	PMST	Large intertidal sandflats, banks, mudflats, estuaries, inlets, sewage farms, saltworks, harbours, coastal lagoons and bays.	High	Low		Suitable habitat and nearby records.

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area			Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline		
<i>Grantiella picta</i>	Painted Honeyeater	VU	v	L			PMST	Dry open woodlands and forests. Typically forages for fruit and nectar in mistletoes and in tree canopies.	Negligible	Negligible		Limited suitable habitat and no nearby recent records
<i>Anthochaera phrygia</i>	Regent Honeyeater	CR	e	L			PMST	A range of dry woodlands and forests dominated by nectar-producing tree species.	Negligible	Negligible		Outside of known range
<i>Dasyurus maculatus maculatus</i>	Spot-tailed Quoll	EN	e	L			PMST	Rainforest and wet and dry sclerophyll forests and woodlands.	Negligible	Negligible		No suitable habitat and no nearby recent records
<i>Antechinus minimus maritimus</i>	Swamp Antechinus	VU	nt	L			PMST	Dense wet heath and heathy woodland, sedgeland and dense tussock grassland.	Negligible	Negligible		No suitable habitat and no nearby recent records
<i>Petauroides volans</i>	Southern Greater Glider	VU	v	L			PMST	Wet and damp sclerophyll forest with large hollow-bearing trees.	Negligible	Negligible		No suitable habitat and no nearby recent records
<i>Potorous tridactylus trisulcatus</i>	Long-nosed Potoroo	VU	nt	L		1978	PMST	Forest, heathy woodlands and heathlands.	Negligible	Negligible		No suitable habitat and no nearby recent records
<i>Mastacomys fuscus mordicus</i>	Broad-toothed Rat	VU	e	L			PMST	Sub-alpine Woodland, Heathland, Sedgeland, and sedge-dominated areas within forest.	Negligible	Negligible		No suitable habitat and no nearby recent records
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	VU	v	L		1972		Coastal heathland, heathy woodland and dry sclerophyll forest.	Negligible	Negligible		Suitable habitat present, but no recent records, indicating species is likely to extinct from the region

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Pseudomys fumeus</i>	Smoky Mouse	EN	e	L			PMST	Coastal heath and heathy woodland, wet forest, sub-alpine heath and dry sclerophyll forest.	Negligible	Negligible	No suitable habitat and no nearby recent records
<i>Eubalaena australis</i>	Southern Right Whale	EN	e	L	Mi	2009	PMST	Found along the Victorian coastline during winter migration. The coast 8 km east of Warrnambool is a locally important calving and nursing site until early November.	Moderate	Negligible	Recorded occasionally in Western Port. Not considered further within this terrestrial and freshwater biodiversity report.
<i>Megaptera novaeangliae</i>	Humpback Whale	VU	v	L	Mi	2013	PMST	Increasingly recorded along the Victorian coast during migration, occasionally entering Port Phillip and Western Port.	Moderate	Negligible	Recorded occasionally in Western Port. Not considered further within this terrestrial and freshwater biodiversity report.
<i>Isodon obesulus</i>	Southern Brown Bandicoot	EN	nt	L		2017	PMST	Heathland, shrubland, sedgeland, heathy open forest and woodland; also exotic vegetation, such as blackberry thickets and rank grasses where native vegetation has been removed.	Low	Recorded	Recorded at eight locations by Monarc Environmental (2018)
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	VU	v	L		1982	PMST	Rainforest, wet and dry sclerophyll forest, woodland and urban areas.	Low	Moderate	Foraging habitat present in the region, but species unlikely to make significant use of habitat present

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area			Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline		
<i>Chelonia mydas</i>	Green Turtle	VU			Mi		PMST	Marine species with a pan-tropical distribution throughout the world. More abundant along the tropical coasts of Australia and the Great Barrier Reef.	Low	Negligible	No recent records	
<i>Dermochelys coriacea</i>	Leathery Turtle	EN	e	L	Mi	2017	PMST	Marine species usually sighted along the eastern seaboard often in bays, estuaries and rivers. No major nesting events have been recorded in Australia.	Low	Negligible	Occasionally recorded in the local area; unlikely to make regular use of habitat within study area	
<i>Caretta caretta</i>	Loggerhead Turtle	EN			Mi		PMST	Waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. Nesting occurs in coastal environments of northern WA, NT and QLD.	Low	Negligible	No recent records	
<i>Litoria aurea</i>	Green and Golden Bell Frog	VU	v	I		1962		Still or slow-flowing waterbodies and surrounding terrestrial vegetation.	Negligible	Negligible	No suitable habitat and no recent records	
<i>Litoria raniformis</i>	Growing Grass Frog	VU	e	L		2016	PMST	Still or slow-flowing waterbodies and surrounding terrestrial vegetation.	Negligible	Recorded	Recorded at KP 28.2 and Cardinia Creek by Monarc Environmental (2018)	
<i>Carcharodon carcharias</i>	Great White Shark	VU	v	L	Mi		PMST	Near coastal and offshore waters.	Low	Negligible	No recent records	
<i>Prototroctes maraena</i>	Australian Grayling	VU	v	L		2001	PMST	Adults inhabit cool, clear, freshwater streams.	Moderate	High	Suitable habitat within waterways and estuaries. Further consideration	

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
											given to this species within the Pipeline Works study area only.
<i>Galaxiella pusilla</i>	Dwarf Galaxis	VU	e	L		1964	PMST	Slow-flowing or still freshwater wetlands such as swamps, drains and backwaters of streams.	Negligible	High	Suitable habitat within freshwater waterways
<i>Maccullochella peelii</i>	Murray Cod	VU	v	L		1971	PMST	A diverse range of stream habitats in the Murray-Darling basin; principally the main channels of rivers and their major tributaries.	Negligible	Negligible	No suitable habitat; records are from introduced populations.
<i>Macquaria australasica</i>	Macquarie Perch	EN	e	L		1977		Streams with clear water and deep, rocky holes with abundant cover.	Negligible	Negligible	No suitable habitat; records are from introduced populations.
<i>Synemon plana</i>	Golden Sun Moth	CR	e	L			PMST	Natural temperate grassland, grassy woodland and pasture supporting spear grasses and wallaby grasses and exotic grassland dominated by Chilean needle grass.	Negligible	Negligible	No suitable habitat and no nearby recent records
<i>Thalassarche impavida</i>	Campbell Albatross	VU			Mi		PMST	Subantarctic and subtropical waters from pelagic to shelf-break water habitats.	Negligible	Negligible	No suitable habitat and no nearby recent records

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking	
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline		
FFG Act listed												
<i>Synoicus chinensis</i>	King Quail		e	L		1981		Predominately wet heath environments; less commonly coastal heath. The current range of this species in Victoria is not known but it is likely to be severely restricted.	Negligible	Negligible	No suitable habitat; widely believed to be restricted to French Island in Victoria.	
<i>Lewinia pectoralis</i>	Lewin's Rail		v	L		2011		Swamps, dense riparian vegetation and saltmarsh.	Low	Recorded	Recorded by Monarc Environmental (2018).	
<i>Porzana pusilla</i>	Baillon's Crane		v	L		2003		Well-vegetated permanent and temporary fresh and brackish wetlands.	Low	Moderate	Suitable habitat present in and adjacent to waterbodies	
<i>Egretta garzetta</i>	Little Egret		e	L		2016		Swamps, billabongs, floodplain pools, mudflats, mangroves and channels; breeds in trees standing in water.	High	High	Suitable habitat present	
<i>Ardea intermedia plumifera</i>	Intermediate Egret		e	L		2013		Densely-vegetated freshwater wetlands including lakes, swamps and billabongs. Breeds in trees standing in water.	High	High	Suitable habitat present	
<i>Ardea alba modesta</i>	Eastern Great Egret		v	L		2014	PMST	Prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.	High	Recorded	Recorded by Biosis and Monarc Environmental (2018)	
<i>Ixobrychus dubius</i>	Australian Little Bittern		e	L		2006		Freshwater swamps, lakes and rivers with dense reed beds, saltmarsh and coastal lagoons.	Low	Moderate	Suitable habitat present	

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Anseranas semipalmata</i>	Magpie Goose		nt	L		1994		Swamps, lakes, sewage ponds, flooded pasture, dams.	Low	Low	Limited suitable habitat
<i>Stictonetta naevosa</i>	Freckled Duck		e	L		1980		Large freshwater wetlands, generally with dense vegetation.	Negligible	Low	Limited suitable habitat. No recent records.
<i>Oxyura australis</i>	Blue-billed Duck		e	L		2009		Open or densely vegetated wetlands.	Low	Recorded	Recorded by Monarc Environmental (2018)
<i>Accipiter novaehollandiae</i>	Grey Goshawk		v	L		1979		Rainforest, gallery forest, tall wet forest and woodland. Also partially cleared agricultural land.	Low	Low	Limited suitable habitat and no nearby recent records
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		v	L		2017	PMST	Coastal areas such as beaches and estuaries, inland wetlands and major inland streams.	High	High	Recent records and suitable habitat.
<i>Ninox connivens</i>	Barking Owl		e	L		1978		Open woodland and forest habitats often where forests adjoin open land. North East Victoria is the remaining stronghold area for this species in the state.	Negligible	Negligible	No recent records.
<i>Ninox strenua</i>	Powerful Owl		v	L		2013		Eucalypt forests and woodlands, well-treed urban areas.	Moderate	Moderate	Suitable woodland habitat along coastal zone
<i>Neophema pulchella</i>	Turquoise Parrot		nt	L		1982		Woodlands and associated grasslands.	Negligible	Negligible	No suitable habitat and no nearby recent records
<i>Gelochelidon nilotica macrotarsa</i>	Gull-billed Tern		e	L		2007		Floodplains, saltmarsh, claypans and flooded pasture.	Low	Low	Limited suitable habitat and no nearby recent records

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Hydroprogne caspia</i>	Caspian Tern		nt	L	Mi	2013		Estuaries, inlets, bays, lagoons, inland lakes, flooded pasture, sewage ponds.	Recorded	Low	Recorded at Hastings Bight (Biosis 2019).
<i>Sternula albifrons</i>	Little Tern		v	L	Mi	2002	PMST	Sheltered coastal environments, including bays, lagoons and estuaries. Nests on sandy substrates containing shell-grit,	Moderate	Negligible	Potential habitat present
<i>Tringa brevipes</i>	Grey-tailed Tattler		e	L	Mi	1992	PMST	Large intertidal sandflats, banks, mudflats, estuaries, inlets, sewage farms, saltworks, harbours, coastal lagoons and bays.	Moderate	Negligible	Suitable habitat and no nearby recent records
<i>Xenus cinereus</i>	Terek Sandpiper		e	L	Mi	1981	PMST	Large intertidal sandflats, banks, mudflats, estuaries, inlets, sewage farms, saltworks, harbours, coastal lagoons and bays.	Low	Negligible	Limited suitable habitat and no nearby recent records
<i>Melanodryas cucullata</i>	Hooded Robin		nt	L		1980		Woodlands of eucalypt, mallee, semi-cleared farmland.	Negligible	Negligible	No nearby recent records, unlikely to occur in Sth Victoria
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler		e	L		2000		Open forests and woodlands.	Negligible	Negligible	Local population extinct
<i>Calamanthus pyrrhopygius</i>	Chestnut-rumped Heathwren		v	L		2008		Woodland habitat with a dense, shrubby understorey.	High	High	Suitable woodland habitat along coastal zone

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Chthonicola sagittatus</i>	Speckled Warbler		v	L		1909		Eucalypt woodland with rocky gullies, ridges, tussock grasses and a sparse shrub understorey.	Low	Low	No suitable habitat or no nearby recent records
<i>Stagonopleura guttata</i>	Diamond Firetail		nt	L		1908		Open forests and woodlands with a grassy ground layer.	Low	Low	No suitable habitat or no nearby recent records
<i>Sminthopsis leucopus</i>	White-footed Dunnart		nt	L		1970		Lowland heathy woodland and forest, coastal scrub and coastal grasslands.	Low	Low	No recent records.
<i>Lissolepis coventryi</i>	Swamp Skink		v	L		2010		Densely vegetated swamps and associated watercourses, and adjacent wet heaths, sedgeland and saltmarshes.	High	High	Suitable habitat within areas at Warrigine Park or Hastings Reserve
<i>Mugilogobius platynotus</i>	Flatback Mangrove Goby		v	L		2009		Tidal mangrove forests of estuaries.	High	Recorded	Recorded at Watson Creek
<i>Michelea microphylla</i>	Small-gilled Ghost Shrimp		v	L		1965		Western Port endemic	Low	Negligible	No suitable habitat and no nearby recent records
<i>Pseudocalliax tooradin</i>	Ghost shrimp		v	L		1965		Western Port endemic	Low	Negligible	No suitable habitat and no nearby recent records
DELWP Advisory listed threatened											
<i>Spatula rhynchotis</i>	Australasian Shoveler		v			2011		Prefers large, permanent lakes and swamps with deep water, stable conditions and abundant aquatic vegetation.	Negligible	Recorded	Recorded by Monarc Environmental (2018)

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Aythya australis</i>	Hardhead		v			2013		Freshwater wetlands with abundant aquatic vegetation, including slow moving areas of rivers. Also occurs in brackish wetlands such as saltpans, coastal lagoons and sheltered inshore waters.	Moderate	Recorded	Recorded by Monarc Environmental (2018)
<i>Biziura lobata</i>	Musk Duck		v			2007		Large, permanent swamps, lakes and estuaries with abundant aquatic vegetation.	High	High	Limited suitable habitat, Recorded nearby at Jacks Beach.
<i>Falco subniger</i>	Black Falcon		v	N		2011		Woodlands, open country and around terrestrial wetlands areas. Primarily occurs in arid and semi-arid zones in the north, north-west and west of Victoria.	Low	Low	Limited suitable habitat, but some nearby records. Generally outside of usual range.
<i>Hirundapus caudacutus</i>	White-throated Needletail		v		Mi	2010	PMST	An almost exclusively aerial species within Australia, occurring over most types of habitat, particularly wooded areas.	Moderate	Moderate	May forage above woodlands, farmland, heathland and mudflats.
<i>Arenaria interpres</i>	Ruddy Turnstone		v		Mi	1996	PMST	Mainly found on coastal beaches, exposed reefs, and rock platforms.	Moderate	Low	Some suitable beach and rocky platform habitat nearby. No recent records
<i>Pluvialis</i>	Grey Plover		e		Mi	1981	PMST	Mudflats, saltmarsh, tidal reefs	Low	Negligible	Suitable habitat and no

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area			Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline		
<i>squatarola</i>								and estuaries.				nearby recent records
<i>Pluvialis fulva</i>	Pacific Golden Plover		v		Mi	1990	PMST	A range of coastal habitats including mudflats, sandflats rocky shores and saltmarsh.	Low	Low		Suitable habitat and no nearby recent records
<i>Numenius phaeopus</i>	Whimbrel		v		Mi	2010	PMST	Coastal environments on mudflats, sandy shores and the crevices of rock platforms. The species is rarely recorded inland.	Moderate	Negligible		Suitable habitat and no nearby recent records
<i>Tringa glareola</i>	Wood Sandpiper		v		Mi		PMST	Well-vegetated shallow freshwater wetlands with emergent aquatic plants and dense fringing vegetation.	Low	Low		Limited suitable habitat and no nearby recent records
<i>Actitis hypoleucos</i>	Common Sandpiper		v		Mi	2012	PMST	Migrates to Australia from Eurasia in August where it inhabits a wide variety of coastal and inland wetlands with muddy margins before departing north in March.	High	Low		Suitable habitat and nearby recent records
<i>Tringa nebularia</i>	Common Greenshank		v		Mi	2013	PMST	A variety of ephemeral and permanent inland wetlands and sheltered coastal wetlands.	High	Low		Suitable habitat and nearby recent records
<i>Tringa stagnatilis</i>	Marsh Sandpiper		v		Mi	1992	PMST	Permanent or ephemeral wetlands, mudflats and saltmarshes in coastal and inland environments.	High	Low		Suitable habitat and nearby recent records
<i>Arctophoca forsteri</i>	New Zealand Fur Seal		v			1977	PMST	Breeds on islands off the southern Australian coast.	Low	Negligible		No recent records.

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Pseudemoia rawlinsoni</i>	Glossy Grass Skink		v			2010		Damp environments like drainage lines, soaks and the margins of creeks, particularly in dense vegetation including rank grass, reeds and sedges. Also the fringes of coastal saltmarshes.	High	High	Suitable habitat within areas at Warrigine Park or Hastings Reserve
<i>Pseudophryne semimarmorata</i>	Southern Toadlet		v			2016		A variety of habitats such as open forests, lowland woodlands and heathlands where adults shelter beneath leaf litter and other debris in moist soaks and depressions.	Low	Recorded	Recorded at KP 2.2 calling under leaf litter by Monarc Environmental (2018), outside of impact area.
<i>Engaeus victoriensis</i>	Foothill Burrowing Crayfish		e			1911		Grey, clay dominated soils of wet sclerophyll foothill forests and the low-lying parts of creek systems in north-west, west and southern foothills of the Dandenong Ranges (with a disjunct population occurring on the Mornington Peninsula between Panton Hill and Flinders).	Negligible	Negligible	No suitable habitat and no nearby recent records
Migratory species											
<i>Gallinago megala</i>	Swinhoe's Snipe				Mi			Shallow freshwater wetlands of various kinds including paddy fields and sewage farms, with bare mud or shallow water for feeding, with nearby vegetation	Negligible	Negligible	No suitable habitat and no nearby recent records

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Gallinago stenura</i>	Pin-tailed Snipe				Mi			cover. Birds in their non-breeding range use a variety of shallow freshwater wetlands including more open wetlands in arid areas.	Negligible	Negligible	No local records and no suitable habitat
<i>Gallinago hardwickii</i>	Latham's Snipe		nt		Mi	2013	PMST	A migrant to Australia from July to April occurring in a wide variety of permanent and ephemeral wetlands. Prefers open freshwater wetlands with nearby cover, but also recorded on the edges of creeks and rivers, river-pools and floodplains.	Negligible	Recorded	Recorded by Biosis and Monarc Environmental (2018)
<i>Calidris melanotos</i>	Pectoral Sandpiper		nt		Mi	1998	PMST	A variety of wetland habitats with fringing mudflats including bays, coastal lagoons, lakes, swamps, creeks, inundated grasslands, saltmarshes and artificial wetlands.	Moderate	Low	Potential habitat present
<i>Limicola falcinellus</i>	Broad-billed Sandpiper				Mi			Sheltered parts of the coast, favouring estuarine mudflats but also occasionally occur on saltmarshes, shallow freshwater lagoons, saltworks and sewage farms, and in areas with large soft intertidal mudflats.	Moderate	Negligible	No nearby records, however potentially suitable habitat present

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area			Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline		
<i>Chlidonias leucopterus</i>	White-winged Black Tern		nt		Mi	1960	PMST	A seasonal migrant that occurs in coastal, subcoastal and terrestrial wetlands including bays, estuaries, swamps and floodplains.	Low	Low	Limited suitable habitat and no nearby recent records	
<i>Pandion cristatus</i>	Osprey				Mi			Littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands.	Negligible	Negligible	Rarely recorded on Victorian coastline; unlikely to make regular use of study area	
<i>Apus pacificus</i>	Fork-tailed Swift				Mi	1986		This is an aerial species, occurring over a wide range of environments, predominately over open countryside but sometimes over forests and urban landscapes.	Moderate	Moderate	May fly over and forage above study area, but unlikely to utilise terrestrial habitat	
<i>Motacilla flava</i>	Western Yellow Wagtail				Mi			Inhabits open country near water, such as wet meadows.	Negligible	Negligible	No nearby records; rarely recorded in southern Australia	
<i>Puffinus tenuirostris</i>	Short-tailed Shearwater				Mi	1985		Usually found on headlands and islands covered with tussocks and succulent vegetation	Low	Negligible	Breeding population present on Phillip Island, but species unlikely to utilise habitat within the study area.	
<i>Puffinus carneipes</i>	Flesh-footed Shearwater				Mi			Mainly occurs in the subtropics over continental shelves, slopes, and occasionally inshore waters.	Negligible	Negligible	No nearby records and no suitable habitat	

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area			Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline		
<i>Stercorarius parasiticus</i>	Arctic Jaeger				Mi	1981		Coastal and oceanic waters, including estuaries and harbours. Breeds on Arctic tundra.	Moderate	Low		Several local records, but unlikely to make regular use of study area
<i>Thalassarche steadi</i>	White-capped Albatross				Mi			Occurs in subantarctic and subtropical waters. Birds nest on slopes vegetated with tussock and succulents on Auckland Island.	Negligible	Negligible		No nearby records and no suitable habitat
<i>Thalasseus bergii</i>	Crested Tern				Mi	2014		Coastal environments in sheltered embayments such as bays, inlets, estuaries and lagoons. Breeds on offshore islands.	High	Low		Known to occur locally and may utilise habitat within the study area
<i>Charadrius bicinctus</i>	Double-banded Plover				Mi	2011		Found on coastal beaches, mudflats, sewage farms, river banks, fields, dunes, upland tussock grasses and shingle.	High	High		Known to occur locally and suitable habitat present
<i>Numenius minutus</i>	Little Curlew				Mi			Coastal and inland grasslands and black soil plains in northern Australia, near swamps and flooded areas.	Negligible	Negligible		Not commonly recorded in southern Australia
<i>Tringa incana</i>	Wandering Tattler				Mi			Generally found on rocky coasts with reefs and platforms, points, spits, piers, offshore islands and shingle beaches or beds.	Negligible	Negligible		Uncommon in Australia

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Calidris ruficollis</i>	Red-necked Stint				Mi	2011		Sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores.	High	Low	Known to occur locally and suitable habitat present
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper				Mi	2006		Prefers muddy edges of shallow fresh or brackish wetlands with inundated or emergent low vegetation. Occasionally use flooded paddocks and other ephemeral wetlands.	High	Low	Known to occur locally and suitable habitat present
<i>Philomachus pugnax</i>	Ruff				Mi	1960		Found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges	Low	Negligible	Few local records; unlikely to make regular use of study area
<i>Rhipidura rufifrons</i>	Rufous Fantail				Mi	2013		Inhabits wet sclerophyll forests, often in gullies dominated by eucalypts	Moderate	Moderate	Nearby recent records
<i>Myiagra cyanoleuca</i>	Satin Flycatcher				Mi	2008		Densely vegetated areas of forest gullies and tall woodlands. During migration, the species may occur in more open environments and coastal areas.	Moderate	Moderate	Nearby recent records
<i>Monarcha melanopsis</i>	Black-faced Monarch				Mi			Rainforest, particularly in damp gullies, eucalypt forests and woodlands, and coastal scrub environments. During migration, the species may be found in more open woodland areas.	Negligible	Negligible	No suitable habitat and no nearby recent records

Scientific name	Common name	Conservation status				Most recent database record	Other records	Habitat description	Likely occurrence in study area		Rationale for likelihood ranking
		EPBC	VIC	FFG	Mi				Gas Import Jetty	Pipeline	
<i>Lagenorhynchus obscurus</i>	Dusky Dolphin				Mi			Coastal waters in the Southern Hemisphere.	Negligible	Negligible	No suitable habitat and no nearby recent records
<i>Lamna nasus</i>	Porbeagle				Mi			Inhabits temperate, subarctic and subantarctic waters of the North Atlantic and Southern Hemisphere	Negligible	Negligible	No suitable habitat and no nearby recent records
<i>Tursiops aduncus</i>	Indian Ocean Bottlenose Dolphin							Found in a range of coastal environments such as bays, gulfs, lagoons and estuaries	Negligible	Negligible	No suitable habitat and no nearby recent records
<i>Caperea marginata</i>	Pygmy Right Whale				Mi			Pygmy right whales live in a pelagic aquatic habitat, in the cool to cold ocean waters surrounding Antarctica.	Low	Negligible	No nearby recent records

A2.3 Migratory species (EPBC Act listed)

Table A2.3 Migratory fauna species recorded or predicted to occur within 5 kilometres of the study area

Scientific name	Common name	Most recent record
Migratory species		
<i>Gallinago megala</i>	Swinhoe's Snipe	PMST
<i>Gallinago stenura</i>	Pin-tailed Snipe	PMST
<i>Limicola falcinellus</i>	Broad-billed Sandpiper	PMST
<i>Gallinago hardwickii</i>	Latham's Snipe	2013
<i>Pandion cristatus</i>	Osprey	PMST
<i>Hirundapus caudacutus</i>	White-throated Needletail	2010
<i>Apus pacificus</i>	Fork-tailed Swift	1986
<i>Motacilla flava</i>	Western Yellow Wagtail	PMST
<i>Thalassarche impavida</i>	Campbell Albatross	PMST
<i>Puffinus tenuirostris</i>	Short-tailed Shearwater	1985
<i>Puffinus carneipes</i>	Flesh-footed Shearwater	PMST
<i>Diomedea exulans</i>	Wandering Albatross	1960
<i>Thalassarche melanophris</i>	Black-browed Albatross	1981
<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	PMST
<i>Thalassarche cauta</i>	Shy Albatross	1981
<i>Phoebastria fusca</i>	Sooty Albatross	PMST
<i>Stercorarius parasiticus</i>	Arctic Jaeger	1981
<i>Macronectes giganteus</i>	Southern Giant-Petrel	1988
<i>Thalassarche bulleri</i>	Buller's Albatross	PMST
<i>Macronectes halli</i>	Northern Giant-Petrel	PMST
<i>Diomedea epomophora</i>	Southern Royal Albatross	PMST
<i>Diomedea sanfordi</i>	Northern Royal Albatross	PMST
<i>Diomedea antipodensis</i>	New Zealand Wandering Albatross	PMST
<i>Thalassarche salvini</i>	Salvin's Albatross	PMST
<i>Thalassarche steadi</i>	White-capped Albatross	PMST
<i>Chlidonias leucopterus</i>	White-winged Black Tern	1960
<i>Hydroprogne caspia</i>	Caspian Tern	2013
<i>Thalasseus bergii</i>	Crested Tern	2014
<i>Sternula albifrons</i>	Little Tern	PMST
<i>Arenaria interpres</i>	Ruddy Turnstone	1996
<i>Pluvialis squatarola</i>	Grey Plover	1981
<i>Pluvialis fulva</i>	Pacific Golden Plover	1990
<i>Charadrius mongolus</i>	Lesser Sand Plover	1981
<i>Charadrius bicinctus</i>	Double-banded Plover	2011
<i>Charadrius leschenaultii</i>	Greater Sand Plover	PMST
<i>Numenius madagascariensis</i>	Eastern Curlew	2016
<i>Numenius phaeopus</i>	Whimbrel	2010

Scientific name	Common name	Most recent record
<i>Numenius minutus</i>	Little Curlew	PMST
<i>Limosa lapponica</i>	Bar-tailed Godwit	2007
<i>Tringa glareola</i>	Wood Sandpiper	PMST
<i>Tringa brevipes</i>	Grey-tailed Tattler	1992
<i>Tringa incana</i>	Wandering Tattler	PMST
<i>Actitis hypoleucos</i>	Common Sandpiper	2012
<i>Tringa nebularia</i>	Common Greenshank	2013
<i>Tringa stagnatilis</i>	Marsh Sandpiper	1992
<i>Xenus cinereus</i>	Terek Sandpiper	1981
<i>Calidris ferruginea</i>	Curlew Sandpiper	2002
<i>Calidris ruficollis</i>	Red-necked Stint	2011
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	2006
<i>Calidris canutus</i>	Red Knot	2002
<i>Calidris tenuirostris</i>	Great Knot	2002
<i>Philomachus pugnax</i>	Ruff	1960
<i>Calidris melanotos</i>	Pectoral Sandpiper	1998
<i>Rhipidura rufifrons</i>	Rufous Fantail	2013
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	2008
<i>Monarcha melanopsis</i>	Black-faced Monarch	PMST
<i>Lamna nasus</i>	Humpback Whale	PMST
<i>Lagenorhynchus obscurus</i>	Dusky Dolphin	PMST
<i>Eubalaena australis</i>	Southern Right Whale	PMST
<i>Caperea marginata</i>	Pygmy Right Whale	PMST
<i>Megaptera novaeangliae australis</i>	Southern Humpback Whale	PMST
<i>Chelonia mydas</i>	Green Turtle	PMST
<i>Dermochelys coriacea</i>	Leathery Turtle	PMST
<i>Caretta caretta</i>	Loggerhead Turtle	PMST
<i>Carcharodon carcharias</i>	Great White Shark	PMST

Appendix 3 Vegetation quality assessment results

Table A3.1 Habitat hectares of native vegetation patches entirely or partly within the impact area

Site ID	KOJH1	KOJH2	KOJH3	KOJH4	KOJH5	KOJH10	KOJH13	KOJH14	KOJH15	KOJH16
EVC #: Name	GipP0793	GipP0793	GipP0793	GipP048	GipP0048	GipP0053	GipP0053	GipP0053	GipP0053	GipP0083
	Score	Score	Score	Score*	Score	Score	Score	Score	Score	Score
Max Score										
Site Condition	Large Trees	0	0	7		0	N/A	N/A	N/A	2
	Canopy Cover	0	0	4		0	N/A	4	N/A	2
	Lack of Weeds	6	6	9		7	9	9	9	7
	Understorey	5	5	15		5	15	20	15	10
	Recruitment	5	5	10		1	6	3	6	10
	Organic Matter	5	5	5		5	5	5	5	5
	Logs	5	0	5		0	N/A	N/A	N/A	2
	Total site score	26	21	55		18	27	35		
	EVC standardiser	N/A	N/A	N/A		N/A	1.25	1.25	1.25	N/A
	Adjusted site score	26	21	55		18	34	44	44	38
Landscape Value	Patch Size	1	1	8		8	8	8	8	8
	Neighbourhood	1	1	1		1	2	3	3	3
	Distance to Core	4	3	4		4	4	4	4	4
	Total Landscape Score	6	5	13		13	14	15	15	15
Habitat points	100	32	26	68	26	31	48	66	59	53
CONDITION SCORE	1	0.32	0.26	0.68	0.26	0.31	0.48	0.66	0.59	0.53
Habitat Zone area (ha)		0.009	0.054	0.143	0.131	0.056	0.887	0.710	1.814	0.386
Habitat Hectares (Hha)		0.003	0.014	0.097	0.034	0.017	0.426	0.469	1.070	0.205

* Component values not available

Site ID											KOJH16	KOJH16	
EVC #: Name												GipP0083	GipP0083
	Max Score	KOJH21	KOJH23	KOJH28	KOJH30	CCCT4	CCCT10	KOJH42	KOJH43	KOJH43	KOJH43		
		GipP0175	GipP0175	GipP0053	GipP0053	GipP0083	GipP0053	GipP0053	GipP0053	GipP0053	GipP0083		
		Score	Score	Score	Score	Score	Score	Score	Score	Score	Score		
Site Condition	Large Trees	2	9	N/A	N/A	0	N/A	N/A	N/A	N/A	2		
	Canopy Cover	4	4	2	0	2	0	0	0	0	2		
	Lack of Weeds	6	7	4	0	4	6	0	0	0	7		
	Understorey	15	15	15	5	5	5	5	5	5	10		
	Recruitment	10	6	6	5	1	3	6	6	6	10		
	Organic Matter	5	3	4	5	2	2	3	5	5	5		
	Logs	5	4	2	N/A	0	N/A	N/A	N/A	N/A	2		
	Total site score	44	47	32	13	14	16	14	16	16	38		
	EVC standardiser	N/A	N/A	1.25	1.25	N/A	1.25	1.25	1.25	1.25	N/A		
	Adjusted site score	44	47	40	16	14	20	18	20	20	38		
Landscape Value	Patch Size	8	8	1	2	1	1	1	1	1	8		
	Neighbourhood	2	1	0	0	0	0	0	0	0	3		
	Distance to Core	4	4	1	0	1	0	1	3	4	4		
	Total Landscape Score	14	13	5	2	2	1	2	4	4	15		
Habitat points	100	58	60	45	18	16	21	20	24	53	53		
CONDITION SCORE	1	0.58	0.6	0.45	0.18	0.16	0.21	0.20	0.24	0.53	0.53		
Habitat Zone area (ha)		0.423	0.065	0.369	0.064	0.158	0.051	0.066	0.276	0.386	0.386		
Habitat Hectares (Hha)		0.245	0.039	0.166	0.011	0.025	0.011	0.013	0.066	0.205	0.205		

Site ID	JHCC1 JHCC2 CCCT52 CCCT53 JHCC49 JHCC50 JHCC57 JHCC58 JHCC60 JHCC64										
EVC #: Name	GipP0053 GipP0053 GipP0083 GipP0083 GipP0053 GipP0053 GipP0048 GipP0048 GipP0053 GipP0048 GipP0048										
	Max Score	Score	Score	Score	Score	Score	Score	Score*	Score	Score	Score
Site Condition	Large Trees	10	N/A	0	0	N/A	N/A	9	3	0	0
	Canopy Cover	5	3	0	0	0	0	4	2	4	4
	Lack of Weeds	15	2	4	6	9	2	6	7	9	9
	Understorey	25	5	5	10	5	5	20	20	5	5
	Recruitment	10	3	1	3	1	1	6	3	0	0
	Organic Matter	5	2	2	2	2	2	5	2	4	4
	Logs	5	N/A	N/A	5	4	N/A	5	5	0	0
	Total site score		15	12	26	21	10	55	43	22	22
	EVC standardiser		1.25	1.25	N/A	N/A	1.25	N/A	N/A	N/A	N/A
	Adjusted site score		19	15	26	21	13	55	43	22	22
Landscape Value	Patch Size	10	2	1	1	1	1	8	8	8	8
	Neighbourhood	10	0	0	0	0	1	2	2	2	2
	Distance to Core	5	1	1	0	0	4	4	4	4	4
	Total Landscape Score		3	2	1	1	6	14	14	14	14
Habitat points		100	22	17	27	22	19	69	57	51	36
CONDITION SCORE		1	0.22	0.17	0.27	0.22	0.19	0.69	0.57	0.51	0.36
Habitat Zone area (ha)			0.318	0.453	0.041	0.017	0.025	0.733	2.109	0.374	0.062
Habitat Hectares (Hha)			0.070	0.077	0.011	0.004	0.005	0.506	1.202	0.191	0.022

* Component values not available

Site ID																				JHCC55	JHCC56	JHCC57	JHCC62	JHCC67	JHCC68	JHCC69	JHCC70	JHCC72
EVC #: Name																				GipP0048	GipP0083	GipP0048	GipP0793	GipP0175	GipP0175	GipP0048	GipP0053	GipP0048
		Max Score	Score		Score		Score		Score		Score		Score		Score		Score		Score*									
Site Condition	Large Trees	10	5	9	9	7	0	7	9	N/A																		
	Canopy Cover	5	2	4	4	2	4	4	4	0																		
	Lack of Weeds	15	4	7	6	6	9	9	7	6																		
	Understorey	25	15	15	20	5	5	5	5	5																		
	Recruitment	10	6	3	6	1	0	0	0	1																		
	Organic Matter	5	2	3	5	2	3	3	2	2																		
	Logs	5	3	5	5	0	2	3	5	N/A																		
	Total site score		37	46	55	23	23	31	32	14																		
	EVC standardiser		N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.25																		
	Adjusted site score		37	46	55	23	23	31	32	18																		
Landscape Value	Patch Size	10	8	8	8	8	1	1	1	1																		
	Neighbourhood	10	2	2	2	2	1	1	2	0																		
	Distance to Core	5	4	4	4	4	3	3	4	0																		
	Total Landscape Score		14	14	14	14	5	5	7	1																		
Habitat points		100	51	60	69	37	28	36	39	19								41										
CONDITION SCORE		1	0.51	0.6	0.69	0.37	0.28	0.36	0.39	0.19								0.41										
Habitat Zone area (ha)			0.509	0.109	0.733	0.088	0.036	0.081	0.046	0.023								0.707										
Habitat Hectares (Hha)			0.260	0.065	0.506	0.033	0.010	0.029	0.018	0.004								0.290										

* Component values not available

Site ID	JHCC79		JHCC80	JHCC81	JHMV2	JHMV3
EVC #: Name	GipP0048		GipP0053	GipP0053	GipP0053	GipP0048
	Max Score	Score	Score	Score	Score*	Score
Site Condition	Large Trees	10	9	N/A	N/A	2
	Canopy Cover	5	2	0	0	2
	Lack of Weeds	15	6	6	4	4
	Understorey	25	5	5	5	15
	Recruitment	10	1	6	1	5
	Organic Matter	5	3	0	1	5
	Logs	5	2	N/A	N/A	4
	Total site score		28	17	11	37
	EVC standardiser		N/A	1.25	1.25	N/A
Adjusted site score			28	21	14	37
Landscape Value	Patch Size	10	1	1	1	10
	Neighbourhood	10	1	1	1	2
	Distance to Core	5	1	1	1	4
	Total Landscape Score		3	3	3	16
Habitat points		100	31	24	17	53
CONDITION SCORE		1	0.31	0.24	0.17	0.53
Habitat Zone area (ha)			0.140	0.029	0.034	0.950
Habitat Hectares (Hha)			0.043	0.007	0.006	0.504

* Component values not available

Site ID														
EVC #: Name														
	Max Score	HZ1	HZ2	HZ3	HZ4	HZ8*	HZ9	HZ10	HZ11	HZ14	HZ15			
		GipP0009	GipP0003	GipP0053	GipP0048	GipP0793	GipP0053	GipP0175	GipP0175	GipP0821	GipP0053	Score	Score	Score
Site Condition	Large Trees	N/A	0	N/A	10	3	N/A	2	0	N/A	N/A			
	Canopy Cover	N/A	0	0	3	2	3	0	0	N/A	5			
	Lack of Weeds	11	6	7	2	9	9	6	7	9	9			
	Understorey	10	5	5	5	20	5	5	0	5	5			
	Recruitment	0	0	10	5	6	10	0	0	3	0			
	Organic Matter	3	2	3	5	5	5	3	3	0	3			
	Logs	N/A	0	N/A	0	0	N/A	0	0	N/A	N/A			
	Total site score	24	13	25	30	45	32	16	10	17	22			
	EVC standardiser	1.36	N/A	1.25	N/A	N/A	1.25	N/A	N/A	1.36	1.25			
	Adjusted site score	33	13	31	30	45	40	16	10	23	28			
Landscape Value	Patch Size	1	1	1	6	8	1	1	1	1	1			
	Neighbourhood	1	0	0	1	2	0	0	0	0	0			
	Distance to Core	3	1	1	4	4	3	1	1	1	1			
	Total Landscape Score	5	2	2	11	14	4	2	2	2	2			
Habitat points	100	38	15	33	41	59	44	18	12	25	30			
CONDITION SCORE	1	0.38	0.15	0.33	0.41	0.59	0.44	0.18	0.12	0.25	0.30			
Habitat Zone area (ha)		0.134	0.038	0.006	0.089	4.162	0.091	0.025	0.044	0.016	0.039			
Habitat Hectares (Hha)		0.051	0.006	0.002	0.036	2.455	0.040	0.004	0.005	0.004	0.012			

* Component values and condition score from Monarc Environmental (2018)

Site ID	HZ16 HZ18 HZ19 HZ20 HZ21 HZ22 HZ23 HZ24 HZ26									
EVC #: Name	GipP0821 GipP0175 GipP0175 GipP0175 GipP0175 GipP0053 GipP0083 GipP0821 GipP0048									
	Max Score	Score	Score	Score	Score	Score	Score	Score	Score*	
Site Condition	Large Trees	10	N/A	10	0	0	0	N/A	0	N/A
	Canopy Cover	5	N/A	3	3	5	5	0	5	N/A
	Lack of Weeds	15	4	4	2	4	4	0	0	6
	Understorey	25	5	5	5	5	5	5	5	15
	Recruitment	10	3	0	1	6	6	10	10	5
	Organic Matter	5	5	3	0	5	5	5	3	5
	Logs	5	N/A	0	0	4	4	N/A	0	N/A
	Total site score		17	25	11	29	29	20	23	31
	EVC standardiser		1.36	N/A	N/A	N/A	N/A	1.25	N/A	1.36
	Adjusted site score		23	25	11	29	29	25	23	42
Landscape Value	Patch Size	10	1	1	1	1	6	6	6	6
	Neighbourhood	10	0	0	0	0	0	0	0	0
	Distance to Core	5	1	1	1	1	1	1	1	1
	Total Landscape Score		2	2	2	2	7	7	7	7
Habitat points		100	25	27	13	31	36	32	30	49
CONDITION SCORE		1	0.25	0.27	0.13	0.31	0.36	0.32	0.30	0.49
Habitat Zone area (ha)			0.047	0.029	0.013	0.309	0.653	0.295	0.717	0.246
Habitat Hectares (Hha)			0.012	0.008	0.002	0.096	0.235	0.094	0.215	0.121

* Component values not available

Habitat Zone ID		HZ32	HZ33	HZ34	HZ35	HZ36	HZ37	HZ38	HZ39	HZ40
EVC #: Name		GipP0048	GipP0048	GipP0053	GipP0048	GipP0048	GipP0048	GipP0048	GipP0053	GipP0053
	Max Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Trees	0	0	N/A	10	10	10	10	N/A	N/A
	Canopy Cover	0	0	5	5	5	5	5	3	5
	Lack of Weeds	0	0	0	0	0	0	0	0	0
	Understorey	5	5	5	5	5	0	5	0	5
	Recruitment	5	0	5	3	3	0	0	5	5
	Organic Litter	5	2	5	5	5	5	5	5	5
	Logs	0	0	N/A	5	5	5	0	N/A	N/A
	Total Site Score	15	7	20	33	33	25	25	13	20
	EVC standardiser	N/A	N/A	1.25	N/A	N/A	N/A	N/A	1.25	1.25
	Adjusted Site Score	15	7	25	33	33	25	25	16	25
Landscape Value	Patch Size	2	1	1	8	8	1	1	1	1
	Neighbourhood	4	4	1	1	1	0	0	0	0
	Distance to Core	3	3	3	4	4	3	3	3	3
	Total Landscape Score	9	8	5	13	13	4	4	4	4
Habitat points		24	15	30	46	46	29	29	20	29
CONDITION SCORE		0.24	0.15	0.30	0.46	0.46	0.29	0.29	0.20	0.29
Habitat Zone area (ha)		0.139	0.040	0.060	0.024	0.005	0.014	0.025	0.022	0.136
Habitat Hectares (Hha)		0.033	0.006	0.018	0.011	0.001	0.004	0.007	0.004	0.039

Habitat Zone ID		HZ41	HZ42	HZ43	HZ44	HZ45	HZ46	HZ47	HZ48	HZ49
EVC #: Name		GipP0053	GipP00653	GipP0937	GipP0937	GipP0937	GipP0053	GipP0048	GipP0053	GipP0048
	Max Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Trees	N/A	N/A	0	0	0	N/A	0	N/A	3
	Canopy Cover	3	N/A	5	0	5	5	0	5	3
	Lack of Weeds	0	7	0	0	0	0	4	4	7
	Understorey	5	5	5	5	5	5	5	5	5
	Recruitment	5	3	10	5	5	5	5	5	3
	Organic Litter	5	5	3	3	5	5	3	5	5
	Logs	N/A	N/A	0	0	0	N/A	2	N/A	4
	Total Site Score	18	20	23	13	20	20	19	24	27
	EVC standardiser	1.25	1.36	N/A	N/A	N/A	1.25	N/A	1.25	N/A
	Adjusted Site Score	23	27	23	13	20	25	19	30	27
Landscape Value	Patch Size	1	1	1	8	8	8	8	8	8
	Neighbourhood	0	0	0	1	1	0	0	0	0
	Distance to Core	3	3	3	1	1	4	4	4	4
	Total Landscape Score	4	4	4	10	10	12	12	12	12
Habitat points		27	31	27	23	30	37	31	42	39
CONDITION SCORE		0.27	0.31	0.27	0.23	0.30	0.37	0.31	0.42	0.39
Habitat Zone area (ha)		0.163	0.067	0.031	0.057	0.003	0.035	0.069	0.028	0.260
Habitat Hectares (Hha)		0.044	0.021	0.008	0.013	0.001	0.013	0.021	0.012	0.101

Habitat Zone ID		HZ50	HZ51	HZ52	HZ53	HZ54	HZ56	HZ55	HZ59
EVC #: Name		GipP0053	GipP0053	GipP0048	GipP0048	GipP0048	GipP0048	GipP0048	GipP0937
	Max Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Trees	N/A	N/A	3	0	0	6	9	10
	Canopy Cover	5	5	3	0	0	0	5	5
	Lack of Weeds	15	7	7	4	0	4	4	0
	Understorey	25	5	5	5	5	5	5	5
	Recruitment	10	5	3	0	0	0	0	3
	Organic Litter	5	3	3	3	3	3	5	3
	Logs	5	N/A	3	0	0	0	0	5
	Total Site Score	22	25	27	12	8	12	19	31
	EVC standardiser	1.25	1.25	N/A	N/A	N/A	N/A	N/A	N/A
	Adjusted Site Score	28	31	27	12	8	12	19	31
Landscape Value	Patch Size	10	8	8	1	1	1	1	1
	Neighbourhood	10	1	1	1	0	0	0	0
	Distance to Core	5	4	4	3	1	1	1	0
	Total Landscape Score	5	13	13	5	2	2	2	1
Habitat points	100	33	44	40	17	10	14	21	32
CONDITION SCORE	1	0.33	0.44	0.40	0.17	0.10	0.14	0.21	0.32
Habitat Zone area (ha)		0.044	0.028	0.121	0.166	0.020	0.233	0.017	0.058
Habitat Hectares (Hha)		0.015	0.013	0.048	0.028	0.002	0.033	0.004	0.018

Habitat Zone ID		HZ60	HZ61	HZ62	HZ63
EVC #: Name		GipP0937	GipP0937	GipP0793	GipP0048
	Max Score	Score	Score	Score	Score
Site Condition	Large Trees	0	0	0	0
	Canopy Cover	0	0	5	5
	Lack of Weeds	7	7	0	0
	Understorey	5	5	5	5
	Recruitment	3	0	5	0
	Organic Litter	3	3	3	3
	Logs	0	0	5	5
	Total Site Score	23	18	15	18
	EVC standardiser	N/A	N/A	N/A	N/A
	Adjusted Site Score	23	18	15	18
Landscape Value	Patch Size	8	2	1	1
	Neighbourhood	5	3	0	0
	Distance to Core	3	3	0	0
	Total Landscape Score	1	16	8	1
Habitat points		24	34	23	19
CONDITION SCORE		0.24	0.34	0.23	0.19
Habitat Zone area (ha)		0.033	0.008	0.330	0.032
Habitat Hectares (Hha)		0.008	0.001	0.112	0.007

Appendix 4 Tree data

Table A4.1 Large trees in patches within the impact area considered lost (>10% encroachment into tree protection zone)

Tree #	Species	DBH	Size	EVC attribution
42	<i>Eucalyptus viminalis</i>	67	Large	GipP0048
270	Stag inside footprint	77	Large	GipP0175
316	<i>Eucalyptus ovata</i>	96	Large	GipP0175
389	<i>Eucalyptus ovata</i>	70	Large	GipP0175
391	Stag inside footprint	77	Large	GipP0175
441	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	73	Large	GipP0048
444	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	51	Large	GipP0048
445	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	70	Large	GipP0048
642	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	57	Large	GipP0048
643	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	62	Large	GipP0048
644	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	67	Large	GipP0048
645	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	82	Large	GipP0048
646	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	53	Large	GipP0048
647	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	76	Large	GipP0048
648	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	81	Large	GipP0048
649	<i>Eucalyptus viminalis</i> subsp. <i>pyroriana</i>	61	Large	GipP0048
650	Consultant addition	<Null>	Large	GipP0048
651	Consultant addition	<Null>	Large	GipP0048
652	Consultant addition	<Null>	Large	GipP0048
653	Consultant addition	<Null>	Large	GipP0048
654	Consultant addition	<Null>	Large	GipP0048
656	<i>Eucalyptus viminalis</i>	70	Large	GipP0175

Tree #	Species	DBH	Size	EVC attribution
662	<i>Eucalyptus viminalis</i>	70	Large	GipP0083
667	<i>Eucalyptus viminalis</i>	103	Large	GipP0175
703	<i>Eucalyptus ovata</i>	70	Large	<Null>
704	<i>Eucalyptus ovata</i>	71	Large	<Null>

Table A4.2 Scattered trees within the impact area considered lost (>10% encroachment into tree protection zone)

Tree #	Species	DBH	Size	EVC attribution
1	<i>Eucalyptus viminalis</i>	115	Large	GipP0175
2	<i>Eucalyptus ovata</i>	60	Small	GipP0937
3	<i>Eucalyptus ovata</i>	60	Small	GipP0937
4	<i>Eucalyptus ovata</i>	60	Small	GipP0937
6	<i>Eucalyptus ovata</i>	60	Small	GipP0053
9	<i>Eucalyptus ovata</i>	79	Large	GipP0053
15	<i>Eucalyptus ovata</i>	50	Small	GipP0053
22	Stag in road reserve	64	Small	GipP0053
25	Stag in road reserve	66	Small	GipP0053
27	<i>Eucalyptus ovata</i>	65	Small	GipP0053
28	<i>Eucalyptus ovata</i>	89	Large	GipP0053
29	<i>Eucalyptus ovata</i>	84	Large	GipP0053
30	<i>Eucalyptus radiata</i>	53	Large	GipP0937
31	<i>Eucalyptus radiata</i>	0	Small	GipP0937
32	<i>Eucalyptus radiata</i>	0	Small	GipP0937
35	<i>Eucalyptus</i> sp.	30	Small	GipP0048
36	<i>Eucalyptus</i> sp.	91	Large	GipP0048
39	Stag	37	Small	GipP0048
64	<i>Eucalyptus ovata</i>	65	Small	GipP0053
65	<i>Eucalyptus ovata</i>	50	Small	GipP0053
67	<i>Eucalyptus ovata</i>	29	Small	GipP0053
100	<i>Eucalyptus radiata</i>	0	Small	GipP0175
105	<i>Eucalyptus ovata</i>	71	Large	GipP0003
109	<i>Eucalyptus</i> sp.	81	Large	GipP0003
112	<i>Eucalyptus ovata</i>	70	Large	GipP0003
117	<i>Eucalyptus viminalis</i>	5	Small	GipP0053

Tree #	Species	DBH	Size	EVC attribution
121	<i>Eucalyptus viminalis</i>	5	Small	GipP0053
122	<i>Eucalyptus viminalis</i>	8	Small	GipP0053
123	<i>Eucalyptus viminalis</i>	35	Small	GipP0053
124	<i>Eucalyptus ovata</i>	34	Small	GipP0053
230	<i>Eucalyptus viminalis</i>	86	Large	GipP0048
232	Stag with hollows	49	Large	GipP0048
233	<i>Eucalyptus ovata</i>	51	Large	GipP0048
234	Stag with hollows	50	Large	GipP0048
235	Stag with hollows	40	Large	GipP0048
236	<i>Eucalyptus viminalis</i>	60	Large	GipP0048
253	<i>Eucalyptus viminalis</i>	63	Large	GipP0048
255	<i>Eucalyptus viminalis</i>	10	Small	GipP0048
257	<i>Eucalyptus viminalis</i>	83	Large	GipP0048
258	<i>Eucalyptus viminalis</i>	51	Large	GipP0048
260	<i>Eucalyptus viminalis</i> subsp <i>pryoriana</i>	56	Large	GipP0048
261	<i>Eucalyptus viminalis</i> subsp <i>pryoriana</i>	42	Small	GipP0048
262	<i>Eucalyptus viminalis</i> subsp <i>pryoriana</i>	66	Large	GipP0048
276	<i>Eucalyptus radiata</i>	54	Small	GipP0175
308	<Null>	57	Large	GipP0175
309	<i>Eucalyptus radiata</i> s.l.	46	Small	GipP0175
310	<i>Eucalyptus ovata</i>	72	Large	GipP0175
311	<i>Eucalyptus ovata</i>	63	Small	GipP0175
312	<i>Eucalyptus radiata</i> s.l.	40	Small	GipP0175
332	<i>Eucalyptus ovata</i>	63	Small	GipP0175
333	<i>Eucalyptus viminalis</i>	67	Small	GipP0175
334	<i>Eucalyptus</i> sp.	45	Small	GipP0175
337	Stag inside footprint	57	Large	GipP0175

Tree #	Species	DBH	Size	EVC attribution
388	<Null>	<Null>	Large	GipP0175
603	<i>Eucalyptus ovata</i>	60	Small	GipP0175
604	<i>Eucalyptus ovata</i>	20	Small	GipP0053
311	<i>Eucalyptus ovata</i>	63	Small	GipP0175
605	<i>Eucalyptus ovata</i>	25	Small	GipP0053
606	<i>Eucalyptus ovata</i>	15	Small	GipP0053
607	<i>Eucalyptus ovata</i>	35	Small	GipP0053
608	<i>Eucalyptus ovata</i>	20	Small	GipP0053
609	<i>Eucalyptus ovata</i>	15	Small	GipP0053
610	<i>Eucalyptus ovata</i>	15	Small	GipP0053
615	<i>Eucalyptus viminalis</i>	20	Small	GipP0048
622	<i>Eucalyptus ovata</i>	36	Small	GipP0003
623	<i>Eucalyptus ovata</i>	59	Small	GipP0003
624	<i>Eucalyptus ovata</i>	53	Small	GipP0003
625	<i>Eucalyptus ovata</i>	55	Small	GipP0003
626	<i>Eucalyptus ovata</i>	27	Small	GipP0003
627	<i>Eucalyptus ovata</i>	59	Small	GipP0003
631	<Null>	69	Large	GipP0048
632	<i>Eucalyptus viminalis</i> subsp. <i>pryoriana</i>	26	Small	GipP0048
633	<i>Eucalyptus viminalis</i> subsp. <i>viminalis</i>	61	Large	GipP0048
634	<Null>	65	Large	GipP0048
637	<i>Eucalyptus viminalis</i> subsp. <i>pryoriana</i>	83	Large	GipP0048
638	<i>Eucalyptus viminalis</i> subsp. <i>pryoriana</i>	27	Small	GipP0048
655	<i>Eucalyptus ovata</i>	62	Small	GipP0053
661	<i>Eucalyptus ovata</i>	64	Small	GipP0053

Appendix 5 Native Vegetation Removal Reports

Native vegetation removal report

This report provides information to support an application to remove, destroy or lop native vegetation in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation*. The report **is not an assessment by DELWP** of the proposed native vegetation removal. Native vegetation information and offset requirements have been determined using spatial data provided by the applicant or their consultant.

Date of issue: 02/06/2020

Time of issue: 7:01 pm

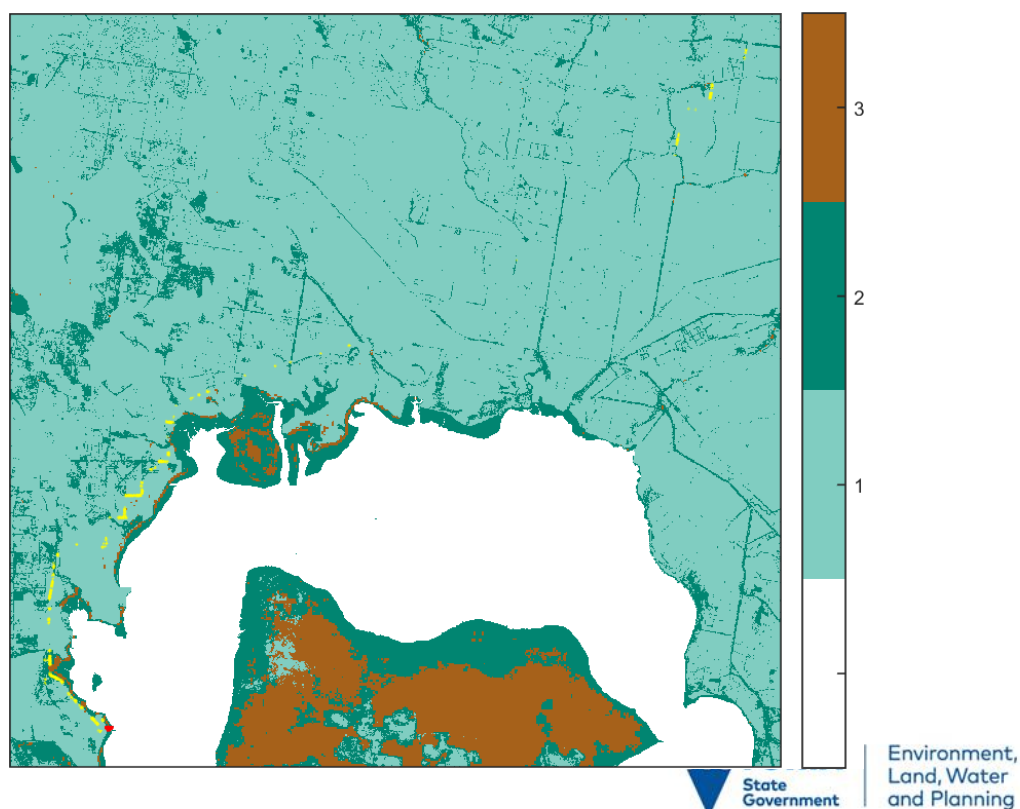
Report ID: BIO_2020_040

Project ID 28957_VegClearingPS1

Assessment pathway

Assessment pathway	Detailed Assessment Pathway
Extent including past and proposed	16.955 ha
Extent of past removal	1.603 ha
Extent of proposed removal	15.352 ha
No. Large trees proposed to be removed	77
Location category of proposed removal	<p>Location 3</p> <p>The native vegetation is in an area where the removal of less than 0.5 hectares could have a significant impact on habitat for one or more rare or threatened species. The native vegetation is also in an area mapped as an endangered Ecological Vegetation Class (as per the statewide EVC map); and a wetland designated under the Convention on Wetlands of International Importance (the Ramsar Convention); and an internationally important site for Migratory Shorebirds of the East Asian-Australasian Flyway.</p>

1. Location map



Offset requirements if a permit is granted

Any approval granted will include a condition to obtain an offset that meets the following requirements:

General offset amount¹	0.985 general habitat units
Vicinity	Port Phillip and Westernport Catchment Management Authority (CMA) or Cardinia Shire, Casey City, Mornington Peninsula Shire Council
Minimum strategic biodiversity value score ²	0.296
Large trees*	12 large trees
Species offset amount³	0.177 species units of habitat for Tiny Arrowgrass, <i>Triglochin minutissima</i> 7.400 species units of habitat for Coast Helmet-orchid, <i>Corybas despectans</i> 3.969 species units of habitat for Coast Twin-leaf, <i>Zygophyllum billardiarei</i> 4.549 species units of habitat for Coast Wirilda, <i>Acacia uncifolia</i> 3.859 species units of habitat for Coast Bitter-bush, <i>Adriana quadripartita</i>
Large trees*	65 trees
* The total number of large trees that the offset must protect	77 large trees to be protected in either the general, species or combination across all habitat units protected

NB: values within tables in this document may not add to the totals shown above due to rounding

Appendix 1 includes information about the native vegetation to be removed

Appendix 2 includes information about the rare or threatened species mapped at the site.

Appendix 3 includes maps showing native vegetation to be removed and extracts of relevant species habitat importance maps

¹ The general offset amount required is the sum of all general habitat units in Appendix 1.

² Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

³ The species offset amount(s) required is the sum of all species habitat units in Appendix 1.

Next steps

Any proposal to remove native vegetation must meet the application requirements of the Detailed Assessment Pathway and it will be assessed under the Detailed Assessment Pathway.

If you wish to remove the mapped native vegetation you are required to apply for a permit from your local council. Council will refer your application to DELWP for assessment, as required. **This report is not a referral assessment by DELWP.**

This *Native vegetation removal report* must be submitted with your application for a permit to remove, destroy or lop native vegetation.

Refer to the *Guidelines for the removal, destruction or lopping of native vegetation* (the Guidelines) for a full list of application requirements. This report provides information that meets the following application requirements:

- The assessment pathway and reason for the assessment pathway
- A description of the native vegetation to be removed (partly met)
- Maps showing the native vegetation and property (partly met)
- Information about the impacts on rare or threatened species.
- The offset requirements determined in accordance with section 5 of the Guidelines that apply if approval is granted to remove native vegetation.

Additional application requirements must be met including:

- Topographical and land information
- Recent dated photographs
- Details of past native vegetation removal
- An avoid and minimise statement
- A copy of any Property Vegetation Plan that applies
- A defensible space statement as applicable
- A statement about the Native Vegetation Precinct Plan as applicable
- A site assessment report including a habitat hectare assessment of any patches of native vegetation and details of trees
- An offset statement that explains that an offset has been identified and how it will be secured.

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Obtaining this publication does not guarantee that an application will meet the requirements of Clauses 52.16 or 52.17 of the Victoria Planning Provisions and Victorian planning schemes or that a permit to remove native vegetation will be granted.

Notwithstanding anything else contained in this publication, you must ensure that you comply with all relevant laws, legislation, awards or orders and that you obtain and comply with all permits, approvals and the like that affect, are applicable or are necessary to undertake any action to remove, lop or destroy or otherwise deal with any native vegetation or that apply to matters within the scope of Clauses 52.16 or 52.17 of the Victoria Planning Provisions and Victorian planning schemes.

Appendix 1: Description of native vegetation to be removed

The species-general offset test was applied to your proposal. This test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the species offset threshold. The threshold is set at 0.005 per cent of the mapped habitat value for a species. When the proportional impact is above the species offset threshold a species offset is required. This test is done for all species mapped at the site. Multiple species offsets will be required if the species offset threshold is exceeded for multiple species.

Where a zone requires species offset(s), the species habitat units for each species in that zone is calculated by the following equation in accordance with the Guidelines:

$$\text{Species habitat units} = \text{extent} \times \text{condition} \times \text{species landscape factor} \times 2, \text{ where the species landscape factor} = 0.5 + (\text{habitat importance score}/2)$$

The species offset amount(s) required is the sum of all species habitat units per zone

Where a zone does not require a species offset, the general habitat units in that zone is calculated by the following equation in accordance with the Guidelines:

$$\text{General habitat units} = \text{extent} \times \text{condition} \times \text{general landscape factor} \times 1.5, \text{ where the general landscape factor} = 0.5 + (\text{strategic biodiversity value score}/2)$$

The general offset amount required is the sum of all general habitat units per zone.

Native vegetation to be removed

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
1-P	Patch	gipp0048	Least Concern	0	no	0.150	0.040	0.040	0.570	0.193	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.193	0.007	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.193	0.007	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.193	0.007	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
2-P	Patch	gipp0048	Least Concern	0	no	0.240	0.162	0.162	0.400	0.190	0.046	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.190	0.046	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.190	0.046	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.190	0.046	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
3-P	Patch	gipp0793	Vulnerable	1	no	0.370	0.103	0.103	0.740	0.349	0.051	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.349	0.051	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.349	0.051	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.349	0.051	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
4-P	Patch	gipp0793	Vulnerable	0	no	0.590	0.026	0.026	0.850	0.720	0.026	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.720	0.026	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.720	0.026	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.720	0.026	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
5-P	Patch	gipp0793	Vulnerable	0	no	0.590	0.040	0.040	0.850	0.717	0.040	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.717	0.040	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.717	0.040	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.717	0.040	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
7-P	Patch	gipp0793	Vulnerable	3	no	0.590	0.340	0.340	0.845	0.558	0.313	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.558	0.313	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.558	0.313	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.558	0.313	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
8-P	Patch	gipp0048	Least Concern	0	no	0.320	0.006	0.006	0.660	0.630	0.003	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.630	0.003	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.630	0.003	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.630	0.003	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
9-P	Patch	gipp0048	Least Concern	0	no	0.310	0.018	0.018	0.990	0.720	0.010	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.720	0.010	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.720	0.010	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.720	0.010	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
10-P	Patch	gipp0048	Least Concern	0	no	0.260	0.058	0.058	0.760	0.601	0.024	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.601	0.024	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.601	0.024	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.601	0.024	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
11-P	Patch	gipp0048	Least Concern	0	no	0.260	0.029	0.029	0.760	0.660	0.013	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.660	0.013	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.660	0.013	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.660	0.013	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
12-P	Patch	gipp0048	Least Concern	4	no	0.680	0.045	0.045	0.767	0.682	0.052	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.682	0.052	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.682	0.052	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.682	0.052	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
13-P	Patch	gipp0053	Endangered	0	no	0.480	0.266	0.266	0.691	0.553	0.198	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.553	0.198	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.553	0.198	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.553	0.198	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
14-P	Patch	gipp0053	Endangered	0	no	0.480	0.040	0.040	0.720	0.540	0.030	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.540	0.030	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.540	0.030	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.540	0.030	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
15-P	Patch	gipp0053	Endangered	0	no	0.480	0.055	0.055	0.240	0.616	0.043	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.616	0.043	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.616	0.043	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.616	0.043	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
16-P	Patch	gipp0053	Endangered	0	no	0.480	0.181	0.181	0.340	0.628	0.142	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.628	0.142	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.628	0.142	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.628	0.142	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
17-P	Patch	gipp0053	Endangered	0	no	0.580	0.090	0.090	0.760	0.665	0.087	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.665	0.087	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.665	0.087	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.539	0.087	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
18-P	Patch	gipp0053	Endangered	0	no	0.580	0.080	0.080	0.758	0.640	0.076	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.640	0.076	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.640	0.076	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.640	0.076	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
19-P	Patch	gipp0053	Endangered	0	no	0.580	0.391	0.391	0.760	0.652	0.375	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.652	0.375	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.652	0.375	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.644	0.375	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
20-P	Patch	gipp0053	Endangered	0	no	0.580	0.019	0.019	0.760	0.600	0.018	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.600	0.018	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.600	0.018	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.600	0.018	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
21-P	Patch	gipp0053	Endangered	0	no	0.660	0.264	0.264	0.794	0.686	0.294	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.686	0.294	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.686	0.294	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.682	0.294	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
22-P	Patch	gipp0053	Endangered	0	no	0.440	0.045	0.045	0.730	0.580	0.031	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.374	0.030	504210 Coast Wirilda <i>Acacia uncifolia</i>
23-P	Patch	gipp0053	Endangered	0	no	0.590	0.088	0.088	0.789	0.779	0.092	503446 Tiny Arrowgrass <i>Triglochin minutissima</i>
										0.779	0.092	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.779	0.092	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.639	0.092	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
24-P	Patch	gipp0053	Endangered	0	no	0.590	0.233	0.233	0.768	0.739	0.239	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.739	0.239	504210 Coast Wirilda <i>Acacia uncifolia</i>
25-P	Patch	gipp0053	Endangered	0	no	0.590	0.081	0.081	0.790	0.780	0.085	503446 Tiny Arrowgrass <i>Triglochin minutissima</i>
										0.780	0.085	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.780	0.085	504210 Coast Wirilda <i>Acacia uncifolia</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.527	0.085	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
26-P	Patch	gipp0053	Endangered	0	no	0.590	0.012	0.012	0.755	0.727	0.012	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.727	0.012	504210 Coast Wirilda <i>Acacia uncifolia</i>
27-P	Patch	gipp0053	Endangered	0	no	0.590	0.004	0.004	0.690	0.690	0.004	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.690	0.004	504210 Coast Wirilda <i>Acacia uncifolia</i>
28-P	Patch	gipp0053	Endangered	0	no	0.590	0.011	0.011	0.756	0.734	0.011	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.734	0.011	504210 Coast Wirilda <i>Acacia uncifolia</i>
29-P	Patch	gipp0175	Endangered	1	no	0.600	0.024	0.024	0.438	0.514	0.022	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.021	0.024	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.021	0.024	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.021	0.024	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
30-P	Patch	gipp0053	Endangered	0	no	0.590	0.053	0.053	0.737	0.610	0.050	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.684	0.052	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.684	0.052	504210 Coast Wirilda <i>Acacia uncifolia</i>
31-P	Patch	gipp0083	Endangered	1	no	0.530	0.086	0.086	0.869	0.643	0.075	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.665	0.076	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.665	0.076	504210 Coast Wirilda <i>Acacia uncifolia</i>
32-P	Patch	gipp0083	Endangered	1	no	0.530	0.002	0.002	0.800	0.743	0.002	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.743	0.002	504210 Coast Wirilda <i>Acacia uncifolia</i>
33-P	Patch	gipp0083	Endangered	1	no	0.530	0.081	0.081	0.800	0.749	0.075	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.749	0.075	504210 Coast Wirilda <i>Acacia uncifolia</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
34-P	Patch	gipp0175	Endangered	1	no	0.580	0.311	0.311	0.250	0.565	0.282	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.355	0.284	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.015	0.307	504210 Coast Wirlida <i>Acacia uncifolia</i>
										0.007	0.303	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
35-P	Patch	gipp0175	Endangered	0	no	0.120	0.044	0.044	0.150		0.005	General
36-P	Patch	gipp0175	Endangered	1	no	0.180	0.025	0.025	0.150		0.004	General
37-P	Patch	gipp0821	Least Concern	0	no	0.490	0.249	0.249	0.227		0.112	General
38-P	Patch	gipp0083	Endangered	0	no	0.300	0.163	0.163	0.584		0.058	General
39-P	Patch	gipp0053	Endangered	0	no	0.320	0.239	0.239	0.271		0.073	General
40-P	Patch	gipp0175	Endangered	1	no	0.360	0.432	0.432	0.217		0.142	General
41-P	Patch	gipp0175	Endangered	0	no	0.340	0.258	0.258	0.240		0.082	General
42-P	Patch	gipp0175	Endangered	0	no	0.130	0.012	0.012	0.170		0.001	General
43-P	Patch	gipp0175	Endangered	1	no	0.270	0.029	0.029	0.375		0.008	General
44-P	Patch	gipp0821	Least Concern	0	no	0.250	0.021	0.021	0.380	0.380	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.298	0.007	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
45-P	Patch	gipp0053	Endangered	0	no	0.300	0.037	0.037	0.380	0.380	0.015	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.380	0.015	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
46-P	Patch	gipp0821	Least Concern	0	no	0.250	0.008	0.008	0.380	0.380	0.003	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.380	0.003	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
47-P	Patch	gipp0053	Endangered	0	no	0.330	0.008	0.008	0.470	0.420	0.004	500836 Coast Helmet-orchid <i>Corybas despectans</i>

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Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.420	0.004	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
48-P	Patch	gipp0003	Vulnerable	0	no	0.150	0.038	0.038	0.747	0.520	0.009	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.087	0.008	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
49-P	Patch	gipp0053	Endangered	0	no	0.170	0.020	0.020	0.370	0.230	0.004	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.230	0.004	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.230	0.004	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
50-P	Patch	gipp0048	Least Concern	0	no	0.310	0.098	0.098	0.540	0.450	0.044	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.450	0.044	504210 Coast Wirilda <i>Acacia uncifolia</i>
51-P	Patch	gipp0053	Endangered	0	no	0.240	0.017	0.017	0.540	0.450	0.006	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.450	0.006	504210 Coast Wirilda <i>Acacia uncifolia</i>
52-P	Patch	gipp0053	Endangered	0	no	0.510	0.026	0.026	0.750	0.640	0.022	500836 Coast Helmet-orchid <i>Corybas despectans</i>
186-P	Patch	gipp0048	Least Concern	0	no	0.570	0.854	0.854	0.745	0.708	0.832	500836 Coast Helmet-orchid <i>Corybas despectans</i>
54-P	Patch	gipp0048	Least Concern	5	no	0.510	0.370	0.370	0.716	0.685	0.318	500836 Coast Helmet-orchid <i>Corybas despectans</i>
55-P	Patch	gipp0083	Endangered	5	no	0.600	0.108	0.108	0.700	0.709	0.111	500836 Coast Helmet-orchid <i>Corybas despectans</i>
56-P	Patch	gipp0053	Endangered	0	no	0.240	0.088	0.088	0.410	0.534	0.032	500836 Coast Helmet-orchid <i>Corybas despectans</i>
57-P	Patch	gipp0053	Endangered	0	no	0.240	0.036	0.036	0.410	0.555	0.013	500836 Coast Helmet-orchid <i>Corybas despectans</i>
58-P	Patch	gipp0053	Endangered	0	no	0.370	0.026	0.026	0.410	0.508	0.015	500836 Coast Helmet-orchid <i>Corybas despectans</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
62-P	Patch	gipp0053	Endangered	0	no	0.330	0.044	0.044	0.790	0.717	0.025	500836 Coast Helmet-orchid <i>Corybas despectans</i>
68-P	Patch	gipp0937	Endangered	0	no	0.270	0.018	0.018	0.410	0.390	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
69-P	Patch	gipp0653	Endangered	0	no	0.310	0.105	0.105	0.590	0.537	0.050	500836 Coast Helmet-orchid <i>Corybas despectans</i>
70-P	Patch	gipp0175	Endangered	1	no	0.360	0.075	0.075	0.380	0.091	0.030	500836 Coast Helmet-orchid <i>Corybas despectans</i>
71-P	Patch	gipp0175	Endangered	0	no	0.280	0.030	0.030	0.360	0.090	0.009	500836 Coast Helmet-orchid <i>Corybas despectans</i>
72-P	Patch	gipp0048	Least Concern	3	no	0.600	0.626	0.626	0.657	0.339	0.503	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.008	0.507	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.232	0.489	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
73-P	Patch	gipp0048	Least Concern	2	no	0.460	0.047	0.047	0.620	0.390	0.030	500836 Coast Helmet-orchid <i>Corybas despectans</i>
74-P	Patch	gipp0048	Least Concern	0	no	0.190	0.008	0.008	0.620	0.290	0.002	500836 Coast Helmet-orchid <i>Corybas despectans</i>
75-P	Patch	gipp0048	Least Concern	1	no	0.290	0.020	0.020	0.620	0.290	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
76-P	Patch	gipp0048	Least Concern	0	no	0.290	0.033	0.033	0.620	0.315	0.013	500836 Coast Helmet-orchid <i>Corybas despectans</i>
100-P	Patch	gipp0053	Endangered	0	no	0.200	0.035	0.035	0.561	0.327	0.009	500836 Coast Helmet-orchid <i>Corybas despectans</i>
77-P	Patch	gipp0053	Endangered	0	no	0.290	0.169	0.169	0.443	0.325	0.065	500836 Coast Helmet-orchid <i>Corybas despectans</i>
78-P	Patch	gipp0053	Endangered	0	no	0.270	0.179	0.179	0.457	0.329	0.064	500836 Coast Helmet-orchid <i>Corybas despectans</i>
79-P	Patch	gipp0048	Least Concern	1	no	0.390	0.013	0.013	0.670	0.430	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.430	0.007	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.430	0.007	504210 Coast Wirilda <i>Acacia uncifolia</i>
80-P	Patch	gipp0009	Least Concern	0	no	0.380	0.134	0.134	0.230	0.595	0.081	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.381	0.081	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.381	0.081	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.381	0.081	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
81-P	Patch	gipp0953	Least Concern	0	no	0.450	0.164	0.164	0.230	0.457	0.108	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.353	0.108	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.353	0.108	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.019	0.104	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
82-P	Patch	gipp0053	Endangered	0	no	0.300	0.078	0.078	0.230		0.022	General
83-P	Patch	gipp0053	Endangered	0	no	0.190	0.021	0.021	0.470	0.170	0.005	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.170	0.005	504210 Coast Wirilda <i>Acacia uncifolia</i>
84-P	Patch	gipp0053	Endangered	0	no	0.210	0.008	0.008	0.740	0.500	0.003	500836 Coast Helmet-orchid <i>Corybas despectans</i>
85-P	Patch	gipp0048	Least Concern	3	no	0.390	0.019	0.019	0.400	0.300	0.010	500836 Coast Helmet-orchid <i>Corybas despectans</i>
86-P	Patch	gipp0048	Least Concern	3	no	0.390	0.015	0.015	0.400	0.300	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
87-P	Patch	gipp0053	Endangered	0	no	0.200	0.037	0.037	0.690	0.400	0.010	500836 Coast Helmet-orchid <i>Corybas despectans</i>
88-P	Patch	gipp0053	Endangered	0	no	0.190	0.006	0.006	0.460		0.001	General
89-P	Patch	gipp0083	Endangered	0	no	0.160	0.016	0.016	0.460		0.003	General

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Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
90-P	Patch	gipp0053	Endangered	0	no	0.210	0.011	0.011	0.450		0.003	General
91-P	Patch	gipp0083	Endangered	0	no	0.220	0.021	0.021	0.450		0.005	General
92-P	Patch	gipp0083	Endangered	0	no	0.270	0.037	0.037	0.450		0.011	General
93-P	Patch	gipp0053	Endangered	0	no	0.180	0.003	0.003	0.390		0.001	General
94-P	Patch	gipp0053	Endangered	0	no	0.180	0.003	0.003	0.390		0.000	General
95-P	Patch	gipp0053	Endangered	0	no	0.170	0.438	0.438	0.414		0.079	General
96-P	Patch	gipp0053	Endangered	0	no	0.220	0.140	0.140	0.760		0.041	General
97-P	Patch	gipp0053	Endangered	0	no	0.220	0.148	0.148	0.760		0.043	General
98-P	Patch	gipp0053	Endangered	0	no	0.220	0.177	0.177	0.665		0.049	General
102-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.015	0.734	0.639	0.005	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.639	0.005	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.639	0.005	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.639	0.005	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
103-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.029	0.730	0.640	0.010	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.640	0.010	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.640	0.010	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.640	0.010	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
104-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.028	0.746	0.636	0.009	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.636	0.009	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.636	0.009	504210 Coast Wirilda <i>Acacia uncifolia</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.636	0.009	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
105-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.069	0.779	0.626	0.022	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.626	0.022	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.626	0.022	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.626	0.022	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
106-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.070	0.420	0.470	0.021	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.470	0.021	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.470	0.021	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.470	0.021	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
107-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.070	0.463	0.597	0.022	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.597	0.022	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.597	0.022	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.597	0.022	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
108-ST	Scattered Tree	gipp0175	Endangered	1	no	0.200	0.070	0.070	0.630	0.540	0.022	500836 Coast Helmet-orchid <i>Corybas despectans</i>
109-ST	Scattered Tree	gipp0175	Endangered	1	no	0.200	0.070	0.056	0.150		0.010	General
110-ST	Scattered Tree	gipp0175	Endangered	1	no	0.200	0.070	0.056	0.150		0.010	General
111-ST	Scattered Tree	gipp0175	Endangered	0	no	0.200	0.031	0.031	0.135		0.005	General
112-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.031	0.690	0.650	0.010	500836 Coast Helmet-orchid <i>Corybas despectans</i>

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Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.650	0.010	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.650	0.010	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.650	0.010	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
113-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.031	0.690	0.640	0.010	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.640	0.010	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.640	0.010	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.640	0.010	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
114-ST	Scattered Tree	gipp0175	Endangered	1	no	0.200	0.070	0.064	0.150		0.011	General
115-ST	Scattered Tree	gipp0175	Endangered	0	no	0.200	0.031	0.027	0.170		0.005	General
116-ST	Scattered Tree	gipp0175	Endangered	0	no	0.200	0.031	0.031	0.170		0.005	General
117-ST	Scattered Tree	gipp0175	Endangered	1	no	0.200	0.070	0.070	0.170		0.012	General
118-ST	Scattered Tree	gipp0175	Endangered	1	no	0.200	0.070	0.070	0.170		0.012	General
99-P	Patch	gipp0937	Endangered	0	no	0.230	0.040	0.040	0.470	0.570	0.014	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.570	0.014	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.570	0.014	504210 Coast Wirilda <i>Acacia uncifolia</i>
119-ST	Scattered Tree	gipp0175	Endangered	0	no	0.200	0.031	0.031	0.950	0.540	0.010	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.540	0.010	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
120-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.031	0.470	0.460	0.009	500836 Coast Helmet-orchid <i>Corybas despectans</i>

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Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.460	0.009	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.460	0.009	504210 Coast Wirilda <i>Acacia uncifolia</i>
121-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.021	0.470	0.577	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.577	0.007	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.577	0.007	504210 Coast Wirilda <i>Acacia uncifolia</i>
122-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.021	0.470	0.580	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.580	0.007	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.580	0.007	504210 Coast Wirilda <i>Acacia uncifolia</i>
123-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.027	0.470	0.580	0.009	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.580	0.009	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.580	0.009	504210 Coast Wirilda <i>Acacia uncifolia</i>
124-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.019	0.470	0.580	0.006	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.580	0.006	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.580	0.006	504210 Coast Wirilda <i>Acacia uncifolia</i>
125-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.026	0.470	0.580	0.008	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.580	0.008	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.580	0.008	504210 Coast Wirilda <i>Acacia uncifolia</i>
126-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.019	0.470	0.580	0.006	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.580	0.006	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.580	0.006	504210 Coast Wirilda <i>Acacia uncifolia</i>
127-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.016	0.470	0.419	0.005	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.386	0.005	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
128-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.021	0.470	0.420	0.006	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.417	0.006	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
129-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.020	0.470	0.416	0.006	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.268	0.006	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
130-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.013	0.470	0.412	0.004	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.099	0.004	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
131-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.024	0.674	0.477	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.134	0.007	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
132-ST	Scattered Tree	gipp0003	Vulnerable	1	no	0.200	0.070	0.070	0.538	0.435	0.020	500836 Coast Helmet-orchid <i>Corybas despectans</i>
133-ST	Scattered Tree	gipp0003	Vulnerable	0	no	0.200	0.031	0.031	0.410	0.298	0.008	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.298	0.008	504210 Coast Wirilda <i>Acacia uncifolia</i>
134-ST	Scattered Tree	gipp0003	Vulnerable	0	no	0.200	0.031	0.031	0.410	0.280	0.008	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.280	0.008	504210 Coast Wirilda <i>Acacia uncifolia</i>
135-ST	Scattered Tree	gipp0003	Vulnerable	0	no	0.200	0.031	0.019	0.370	0.241	0.005	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.192	0.005	504210 Coast Wirilda <i>Acacia uncifolia</i>

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Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
136-ST	Scattered Tree	gipp0003	Vulnerable	0	no	0.200	0.031	0.023	0.370	0.170	0.005	500836 Coast Helmet-orchid <i>Corybas despectans</i>
137-ST	Scattered Tree	gipp0003	Vulnerable	0	no	0.200	0.031	0.024	0.370	0.250	0.006	500836 Coast Helmet-orchid <i>Corybas despectans</i>
138-ST										0.216	0.006	504210 Coast Wirilda <i>Acacia uncifolia</i>
	Scattered Tree	gipp0003	Vulnerable	0	no	0.200	0.031	0.031	0.370	0.205	0.008	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.095	0.008	504210 Coast Wirilda <i>Acacia uncifolia</i>
139-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.070	0.540	0.200	0.017	500836 Coast Helmet-orchid <i>Corybas despectans</i>
140-ST	Scattered Tree	gipp0003	Vulnerable	1	no	0.200	0.070	0.070	0.350	0.169	0.016	500836 Coast Helmet-orchid <i>Corybas despectans</i>
141-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.053	0.700	0.610	0.017	500836 Coast Helmet-orchid <i>Corybas despectans</i>
142-ST	Scattered Tree	gipp0048	Least Concern	0	no	0.200	0.031	0.017	0.700	0.610	0.006	500836 Coast Helmet-orchid <i>Corybas despectans</i>
143-ST	Scattered Tree	gipp0048	Least Concern	0	no	0.200	0.031	0.030	0.590	0.530	0.009	500836 Coast Helmet-orchid <i>Corybas despectans</i>
144-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.070	0.210	0.416	0.020	500836 Coast Helmet-orchid <i>Corybas despectans</i>
145-ST	Scattered Tree	gipp0048	Least Concern	0	no	0.200	0.031	0.002	0.210	0.410	0.000	500836 Coast Helmet-orchid <i>Corybas despectans</i>
146-ST	Scattered Tree	gipp0048	Least Concern	0	no	0.200	0.031	0.017	0.210	0.410	0.005	500836 Coast Helmet-orchid <i>Corybas despectans</i>
147-ST	Scattered Tree	gipp0048	Least Concern	0	no	0.200	0.031	0.028	0.210	0.416	0.008	500836 Coast Helmet-orchid <i>Corybas despectans</i>
148-ST	Scattered Tree	gipp0175	Endangered	0	no	0.200	0.031	0.019	0.360	0.082	0.004	500836 Coast Helmet-orchid <i>Corybas despectans</i>

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Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
149-ST	Scattered Tree	gipp0175	Endangered	1	no	0.200	0.070	0.068	0.360	0.090	0.015	500836 Coast Helmet-orchid <i>Corybas despectans</i>
150-ST	Scattered Tree	gipp0175	Endangered	0	no	0.200	0.031	0.028	0.400	0.210	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
151-ST	Scattered Tree	gipp0175	Endangered	0	no	0.200	0.031	0.028	0.400	0.141	0.006	500836 Coast Helmet-orchid <i>Corybas despectans</i>
152-ST	Scattered Tree	gipp0048	Least Concern	0	no	0.200	0.031	0.014	0.140	0.080	0.003	500836 Coast Helmet-orchid <i>Corybas despectans</i>
153-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.070	0.400	0.232	0.017	500836 Coast Helmet-orchid <i>Corybas despectans</i>
154-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.050	0.140	0.080	0.011	500836 Coast Helmet-orchid <i>Corybas despectans</i>
155-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.050	0.140	0.080	0.011	500836 Coast Helmet-orchid <i>Corybas despectans</i>
156-ST	Scattered Tree	gipp0048	Least Concern	0	no	0.200	0.031	0.002	0.690	0.340	0.000	500836 Coast Helmet-orchid <i>Corybas despectans</i>
157-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.070	0.690	0.340	0.019	500836 Coast Helmet-orchid <i>Corybas despectans</i>
158-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.070	0.360	0.200	0.017	500836 Coast Helmet-orchid <i>Corybas despectans</i>
159-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.070	0.496	0.340	0.019	500836 Coast Helmet-orchid <i>Corybas despectans</i>
160-ST	Scattered Tree	gipp0048	Least Concern	0	no	0.200	0.031	0.031	0.650	0.430	0.009	500836 Coast Helmet-orchid <i>Corybas despectans</i>
161-ST	Scattered Tree	gipp0048	Least Concern	0	no	0.200	0.031	0.031	0.440	0.210	0.008	500836 Coast Helmet-orchid <i>Corybas despectans</i>
162-ST	Scattered Tree	gipp0048	Least Concern	1	no	0.200	0.070	0.070	0.440	0.210	0.017	500836 Coast Helmet-orchid <i>Corybas despectans</i>
163-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.031	0.460		0.007	General

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
164-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.031	0.450		0.007	General
165-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.031	0.450		0.007	General
166-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.031	0.299		0.006	General
167-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.001	0.450		0.000	General
168-ST	Scattered Tree	gipp0053	Endangered	1	no	0.200	0.070	0.069	0.450		0.015	General
169-ST	Scattered Tree	gipp0053	Endangered	1	no	0.200	0.070	0.069	0.450		0.015	General
170-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.027	0.390		0.006	General
171-ST	Scattered Tree	gipp0053	Endangered	1	no	0.200	0.070	0.070	0.390		0.015	General
172-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.031	0.400		0.007	General
173-ST	Scattered Tree	gipp0053	Endangered	0	no	0.200	0.031	0.031	0.390		0.007	General
174-ST	Scattered Tree	gipp0937	Endangered	0	no	0.200	0.031	0.031	0.450		0.007	General
175-ST	Scattered Tree	gipp0937	Endangered	0	no	0.200	0.031	0.031	0.450		0.007	General
176-ST	Scattered Tree	gipp0937	Endangered	0	no	0.200	0.031	0.031	0.450		0.007	General
177-ST	Scattered Tree	gipp0937	Endangered	0	no	0.200	0.031	0.030	0.440		0.006	General
178-ST	Scattered Tree	gipp0937	Endangered	0	no	0.200	0.031	0.030	0.440		0.006	General

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
179-ST	Scattered Tree	gipp0937	Endangered	0	no	0.200	0.031	0.031	0.440		0.007	General
180-ST	Scattered Tree	gipp0937	Endangered	1	no	0.200	0.070	0.070	0.440		0.015	General
181-P	Patch	gipp0937	Endangered	0	no	0.300	0.003	0.003	0.950	0.540	0.002	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.540	0.002	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
59-P	Patch	gipp0048	Least Concern	0	no	0.310	0.081	0.081	0.414	0.374	0.035	500836 Coast Helmet-orchid <i>Corybas despectans</i>
60-P	Patch	gipp0053	Endangered	0	no	0.420	0.034	0.034	0.430	0.300	0.019	500836 Coast Helmet-orchid <i>Corybas despectans</i>
61-P	Patch	gipp0048	Least Concern	2	no	0.390	0.344	0.344	0.601	0.559	0.209	500836 Coast Helmet-orchid <i>Corybas despectans</i>
63-P	Patch	gipp0053	Endangered	0	no	0.440	0.033	0.033	0.790	0.719	0.025	500836 Coast Helmet-orchid <i>Corybas despectans</i>
64-P	Patch	gipp0048	Least Concern	1	no	0.400	0.164	0.164	0.760	0.705	0.112	500836 Coast Helmet-orchid <i>Corybas despectans</i>
65-P	Patch	gipp0048	Least Concern	0	no	0.170	0.102	0.102	0.759	0.705	0.030	500836 Coast Helmet-orchid <i>Corybas despectans</i>
66-P	Patch	gipp0048	Least Concern	0	no	0.100	0.022	0.022	0.700	0.627	0.004	500836 Coast Helmet-orchid <i>Corybas despectans</i>
101-P	Patch	gipp0048	Least Concern	3	no	0.210	0.021	0.021	0.700	0.610	0.007	500836 Coast Helmet-orchid <i>Corybas despectans</i>
67-P	Patch	gipp0048	Least Concern	2	no	0.140	0.299	0.299	0.664	0.582	0.066	500836 Coast Helmet-orchid <i>Corybas despectans</i>
182-P	Patch	gipp0083	Endangered	0	no	0.320	0.059	0.059	0.450		0.021	General
183-P	Patch	gipp0083	Endangered	0	no	0.240	0.032	0.032	0.450		0.008	General

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
184-P	Patch	gipp0953	Least Concern	0	no	0.450	0.088	0.088	0.230	0.410	0.056	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.100	0.056	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.100	0.056	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.100	0.056	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
53-P	Patch	gipp0048	Least Concern	0	no	0.690	0.557	0.557	0.664	0.738	0.668	500836 Coast Helmet-orchid <i>Corybas despectans</i>
185-P	Patch	gipp0048	Least Concern	0	no	0.570	0.162	0.162	0.630	0.769	0.164	500836 Coast Helmet-orchid <i>Corybas despectans</i>
188-P	Patch	gipp0793	Vulnerable	0	no	0.340	0.421	0.421	0.758	0.553	0.222	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.553	0.222	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.553	0.222	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.553	0.222	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
191-P	Patch	gipp0048	Least Concern	0	no	0.230	0.044	0.044	0.630	0.150	0.012	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.150	0.012	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.150	0.012	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.150	0.012	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
187-P	Patch	gipp0793	Vulnerable	0	no	0.340	0.016	0.016	0.850	0.577	0.009	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.577	0.009	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.577	0.009	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.577	0.009	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
192-P	Patch	gipp0793	Vulnerable	0	no	0.590	0.016	0.016	0.850	0.460	0.014	500836 Coast Helmet-orchid <i>Corybas despectans</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
										0.460	0.014	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.460	0.014	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.460	0.014	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
6-P	Patch	gipp0793	Vulnerable	0	no	0.590	0.397	0.397	0.828	0.745	0.409	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.745	0.409	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.745	0.409	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.745	0.409	504755 Coast Bitter-bush <i>Adriana quadripartita</i>

Appendix 2: Information about impacts to rare or threatened species' habitats on site

This table lists all rare or threatened species' habitats mapped at the site.

Species common name	Species scientific name	Species number	Conservation status	Group	Habitat impacted	% habitat value affected
Coast Helmet-orchid	<i>Corybas despectans</i>	500836	Vulnerable	Dispersed	Habitat importance map	0.0080
Coast Twin-leaf	<i>Zygophyllum billardierei</i>	503615	Rare	Dispersed	Habitat importance map	0.0078
Coast Wirilda	<i>Acacia uncifolia</i>	504210	Rare	Dispersed	Habitat importance map	0.0061
Tiny Arrowgrass	<i>Triglochin minutissima</i>	503446	Rare	Dispersed	Top ranking map	0.0061
Coast Bitter-bush	<i>Adriana quadripartita</i>	504755	Vulnerable	Dispersed	Habitat importance map	0.0052
King Quail	<i>Coturnix chinensis victorinae</i>	10012	Endangered	Dispersed	Habitat importance map	0.0049
Creeping Rush	<i>Juncus revolutus</i>	501839	Rare	Dispersed	Habitat importance map	0.0036
Dune Wood-sorrel	<i>Oxalis rubens</i>	502390	Rare	Dispersed	Habitat importance map	0.0036
Coast Fescue	<i>Poa billardierei</i>	501361	Rare	Dispersed	Habitat importance map	0.0034
Hoary Sun-orchid	<i>Thelymitra orientalis</i>	503380	Vulnerable	Highly Localised Habitat	Habitat importance map	0.0029
Dense Leek-orchid	<i>Prasophyllum spicatum</i>	504506	Endangered	Dispersed	Habitat importance map	0.0021
Tiny Arrowgrass	<i>Triglochin minutissima</i>	503446	Rare	Dispersed	Habitat importance map	0.0019
Marsh Saltbush	<i>Atriplex paludosa</i> subsp. <i>paludosa</i>	500326	Rare	Dispersed	Habitat importance map	0.0019
Veined Spear-grass	<i>Austrostipa rudis</i> subsp. <i>australis</i>	504940	Rare	Dispersed	Habitat importance map	0.0018
Glossy Grass Skink	<i>Pseudemoia rawlinsoni</i>	12683	Vulnerable	Dispersed	Habitat importance map	0.0016
Leafy Greenhood	<i>Pterostylis cucullata</i> subsp. <i>cucullata</i>	505911	Endangered	Dispersed	Habitat importance map	0.0011
Salt Lawrenceia	<i>Lawrencea spicata</i>	501888	Rare	Dispersed	Habitat importance map	0.0010
Dune Poa	<i>Poa poiformis</i> var. <i>ramifer</i>	504826	Rare	Dispersed	Habitat importance map	0.0010
Green Leek-orchid	<i>Prasophyllum lindleyanum</i>	502702	Vulnerable	Dispersed	Habitat importance map	0.0010

Grey Mangrove	<i>Avicennia marina subsp. australasica</i>	500345	Rare	Dispersed	Habitat importance map	0.0010
Swamp Skink	<i>Lissolepis coventryi</i>	12407	Vulnerable	Dispersed	Habitat importance map	0.0008
Leafy Twig-sedge	<i>Cladium procerum</i>	500786	Rare	Dispersed	Habitat importance map	0.0008
Purple Blown-grass	<i>Lachnagrostis punicea subsp. punicea</i>	504206	Rare	Dispersed	Habitat importance map	0.0008
Parsley Xanthosia	<i>Xanthosia leiophylla</i>	504562	Rare	Dispersed	Habitat importance map	0.0007
Lewin's Rail	<i>Lewinia pectoralis pectoralis</i>	10045	Vulnerable	Dispersed	Habitat importance map	0.0007
Annual Fireweed	<i>Senecio glomeratus subsp. longifructus</i>	507144	Rare	Dispersed	Habitat importance map	0.0007
Mauve-tuft Sun-orchid	<i>Thelymitra malvina</i>	503374	Vulnerable	Dispersed	Habitat importance map	0.0006
Australian Mudfish	<i>Neochanna cleaveri</i>	4703	Critically endangered	Dispersed	Habitat importance map	0.0005
Growing Grass Frog	<i>Litoria raniformis</i>	13207	Endangered	Dispersed	Habitat importance map	0.0005
Rough Blown-grass	<i>Lachnagrostis rudis subsp. rudis</i>	500159	Endangered	Dispersed	Habitat importance map	0.0005
Golden Cowslips	<i>Diuris behrii</i>	501061	Vulnerable	Dispersed	Habitat importance map	0.0004
Green-striped Greenhood	<i>Pterostylis chlorogramma</i>	504728	Vulnerable	Dispersed	Habitat importance map	0.0004
Grey Plover	<i>Pluvialis squatarola</i>	10136	Endangered	Dispersed	Habitat importance map	0.0003
Naked Sun-orchid	<i>Thelymitra circumsepta</i>	503383	Vulnerable	Dispersed	Habitat importance map	0.0003
Southern Toadlet	<i>Pseudophryne semimarmorata</i>	13125	Vulnerable	Dispersed	Habitat importance map	0.0003
Sticky Wattle	<i>Acacia howittii</i>	500044	Rare	Dispersed	Habitat importance map	0.0003
Pacific Golden Plover	<i>Pluvialis fulva</i>	10137	Vulnerable	Dispersed	Habitat importance map	0.0003
Coast Bush-pea	<i>Pultenaea canaliculata</i>	502839	Rare	Dispersed	Habitat importance map	0.0003
Clover Glycine	<i>Glycine latrobeana</i>	501456	Vulnerable	Dispersed	Habitat importance map	0.0003
Grey Goshawk	<i>Accipiter novaehollandiae novaehollandiae</i>	10220	Vulnerable	Dispersed	Habitat importance map	0.0002
Purple Diuris	<i>Diuris punctata</i>	501084	Vulnerable	Dispersed	Habitat importance map	0.0002
Green Scentbark	<i>Eucalyptus fulgens</i>	505175	Rare	Dispersed	Habitat importance map	0.0002

Cobra Greenhood	<i>Pterostylis grandiflora</i>	502798	Rare	Dispersed	Habitat importance map	0.0002
Lesser Sand Plover	<i>Charadrius mongolus</i>	10139	Critically endangered	Dispersed	Habitat importance map	0.0002
Hooded Plover	<i>Thinornis rubricollis rubricollis</i>	10138	Vulnerable	Dispersed	Habitat importance map	0.0002
Chestnut-rumped Heathwren	<i>Calamanthus pyrrhopygius</i>	10498	Vulnerable	Dispersed	Habitat importance map	0.0001
Common Bent-wing Bat (eastern ssp.)	<i>Miniopterus schreibersii oceanensis</i>	61342	Vulnerable	Dispersed	Habitat importance map	0.0001
Australasian Bittern	<i>Botaurus poiciloptilus</i>	10197	Endangered	Dispersed	Habitat importance map	0.0001
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	10226	Vulnerable	Dispersed	Habitat importance map	0.0001
Ruddy Turnstone	<i>Arenaria interpres</i>	10129	Vulnerable	Dispersed	Habitat importance map	0.0001
Blue-billed Duck	<i>Oxyura australis</i>	10216	Endangered	Dispersed	Habitat importance map	0.0001
Intermediate Egret	<i>Ardea intermedia</i>	10186	Endangered	Dispersed	Habitat importance map	0.0001
Elegant Parrot	<i>Neophema elegans</i>	10307	Vulnerable	Dispersed	Habitat importance map	0.0001
Eastern Great Egret	<i>Ardea modesta</i>	10187	Vulnerable	Dispersed	Habitat importance map	0.0001
Little Egret	<i>Egretta garzetta nigripes</i>	10185	Endangered	Dispersed	Habitat importance map	0.0001
Musk Duck	<i>Biziura lobata</i>	10217	Vulnerable	Dispersed	Habitat importance map	0.0001
Baillon's Crake	<i>Porzana pusilla palustris</i>	10050	Vulnerable	Dispersed	Habitat importance map	0.0001
Australasian Shoveler	<i>Anas rhynchos</i>	10212	Vulnerable	Dispersed	Habitat importance map	0.0001
Strzelecki Gum	<i>Eucalyptus strzeleckii</i>	504558	Vulnerable	Dispersed	Habitat importance map	0.0001
Eastern Curlew	<i>Numenius madagascariensis</i>	10149	Vulnerable	Dispersed	Habitat importance map	0.0001
Hardhead	<i>Aythya australis</i>	10215	Vulnerable	Dispersed	Habitat importance map	0.0001
Freckled Duck	<i>Stictonetta naevosa</i>	10214	Endangered	Dispersed	Habitat importance map	0.0001
White-throated Needletail	<i>Hirundapus caudacutus</i>	10334	Vulnerable	Dispersed	Habitat importance map	0.0001
Curlew Sandpiper	<i>Calidris ferruginea</i>	10161	Endangered	Dispersed	Habitat importance map	0.0001
Black Falcon	<i>Falco subniger</i>	10238	Vulnerable	Dispersed	Habitat importance map	0.0000

Grey Billy-buttons	<i>Craspedia canens</i>	504643	Endangered	Dispersed	Habitat importance map	0.0000
Yarra Gum	<i>Eucalyptus yarraensis</i>	501326	Rare	Dispersed	Habitat importance map	0.0000
Swamp Everlasting	<i>Xerochysum palustre</i>	503763	Vulnerable	Dispersed	Habitat importance map	0.0000
Maroon Leek-orchid	<i>Prasophyllum frenchii</i>	502709	Endangered	Dispersed	Habitat importance map	0.0000
Swamp Fireweed	<i>Senecio psilocarpus</i>	504659	Vulnerable	Dispersed	Habitat importance map	0.0000
Matted Flax-lily	<i>Dianella amoena</i>	505084	Endangered	Dispersed	Habitat importance map ; special site	0.0000
Floodplain Fireweed	<i>Senecio campylocarpus</i>	507136	Rare	Dispersed	Habitat importance map	0.0000
Plains Yam-daisy	<i>Microseris scapigera</i> s.s.	504657	Vulnerable	Dispersed	Habitat importance map	0.0000
Pale Swamp Everlasting	<i>Coronidium gunnianum</i>	504655	Vulnerable	Dispersed	Habitat importance map	0.0000
Winter Sun-orchid	<i>Thelymitra hiemalis</i>	505006	Endangered	Dispersed	Habitat importance map	0.0000
Purple Blown-grass	<i>Lachnagrostis punicea</i> subsp. <i>filifolia</i>	504222	Rare	Dispersed	Habitat importance map	0.0000
Spurred Helmet-orchid	<i>Corybas aconitiflorus</i>	500835	Rare	Dispersed	Habitat importance map	0.0000
Hoary Rapier-sedge	<i>Lepidosperma canescens</i>	501915	Rare	Dispersed	Habitat importance map	0.0000
Salt Blown-grass	<i>Lachnagrostis robusta</i>	504223	Rare	Dispersed	Habitat importance map	0.0000
Tufted Club-sedge	<i>Isolepis wakefieldiana</i>	501789	Rare	Dispersed	Habitat importance map	0.0000
Slender Stylewort	<i>Levenhookia sonderi</i>	501998	Rare	Dispersed	Habitat importance map	0.0000
Lace Monitor	<i>Varanus varius</i>	12283	Endangered	Dispersed	Habitat importance map	0.0000
Masked Owl	<i>Tyto novaehollandiae</i> <i>novaehollandiae</i>	10250	Endangered	Dispersed	Habitat importance map	0.0000
Powerful Owl	<i>Ninox strenua</i>	10248	Vulnerable	Dispersed	Habitat importance map	0.0000

Habitat group

- Highly localised habitat means there is 2000 hectares or less mapped habitat for the species
- Dispersed habitat means there is more than 2000 hectares of mapped habitat for the species

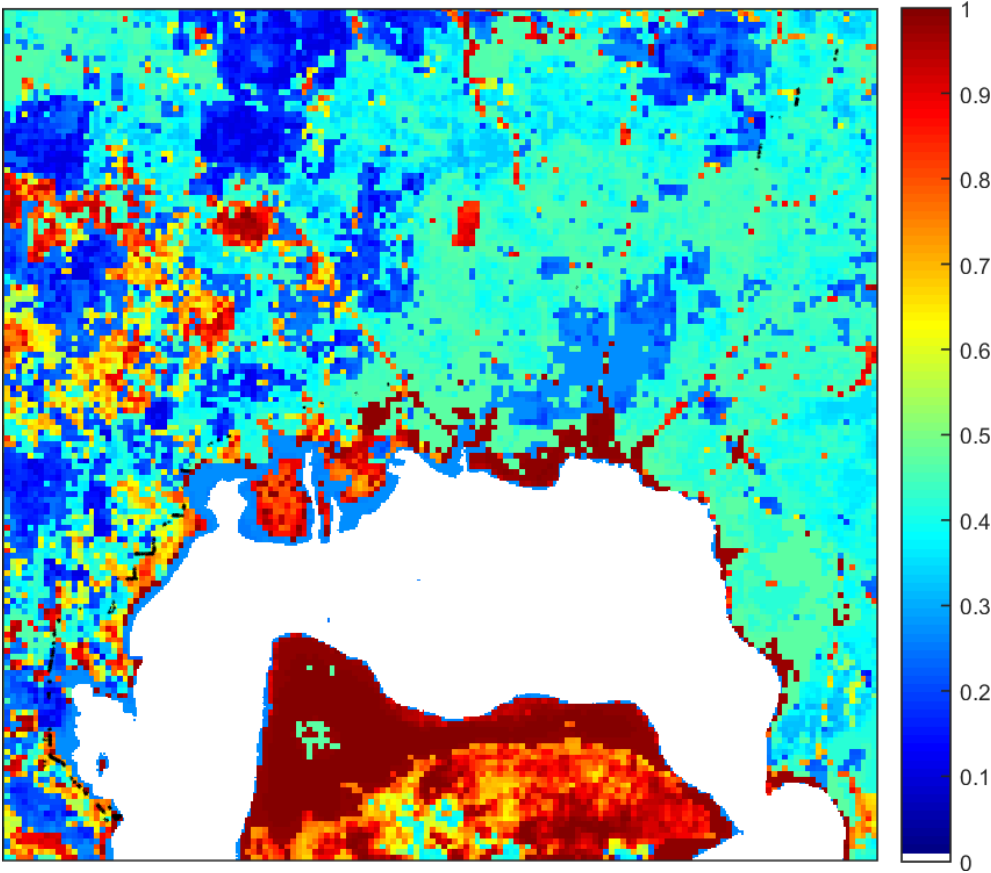
Habitat impacted

- Habitat importance maps are the maps defined in the Guidelines that include all the mapped habitat for a rare or threatened species
- Top ranking maps are the maps defined in the Guidelines that depict the important areas of a dispersed species habitat, developed from the highest habitat importance scores in dispersed species habitat maps and selected VBA records

- Selected VBA record is an area in Victoria that represents a large population, roosting or breeding site etc.

Appendix 3 – Images of mapped native vegetation

2. Strategic biodiversity values map



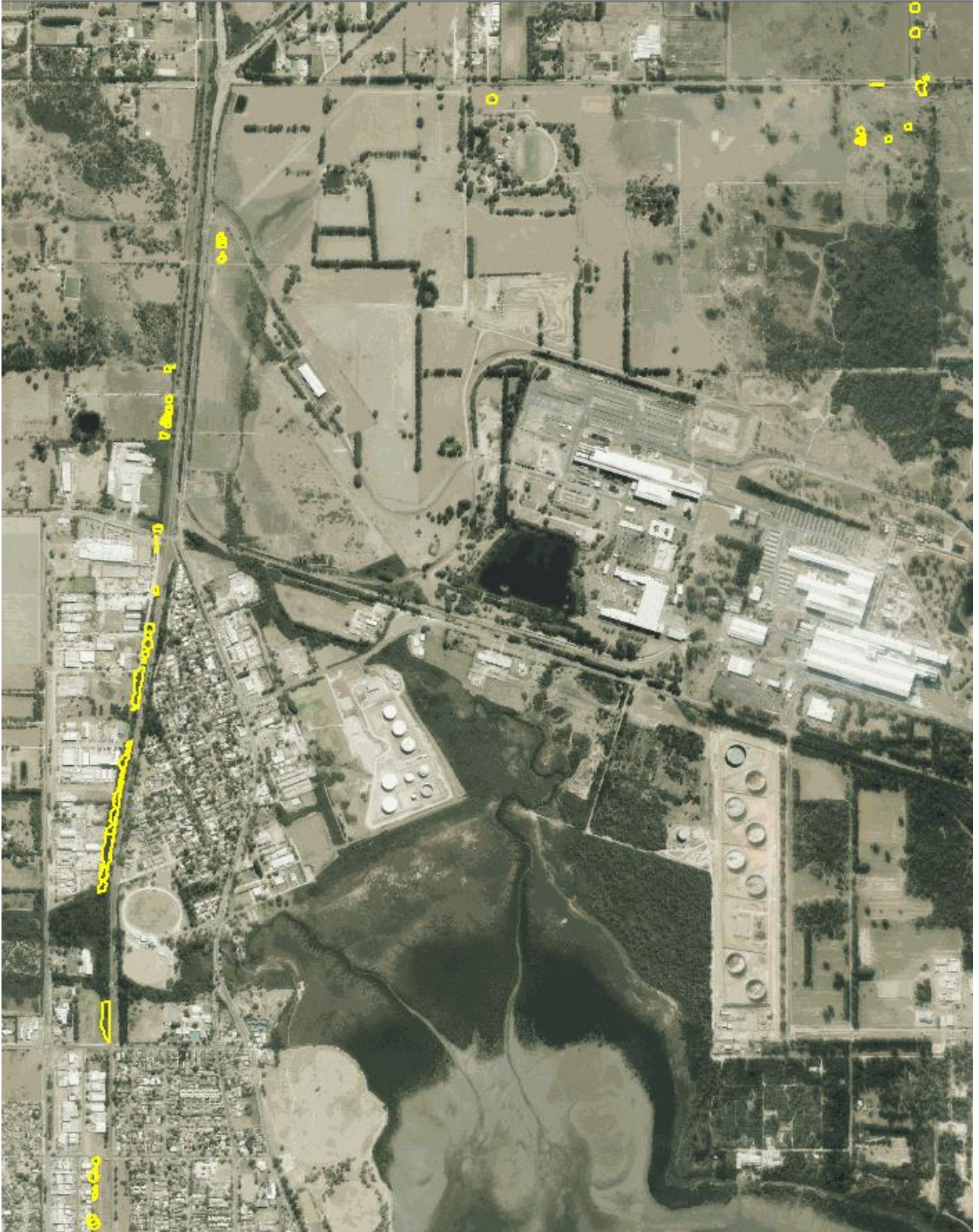
3. Aerial photograph showing mapped native vegetation



A



B



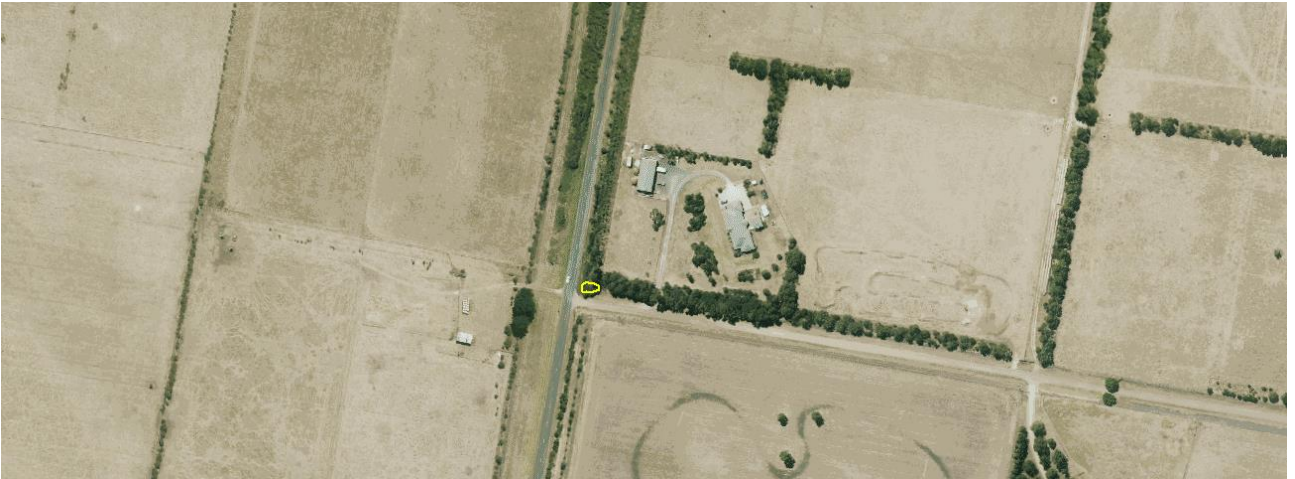
An aerial photograph of a coastal area, likely a wetland or marsh. The image shows a mix of green vegetation, brownish mudflats, and a large body of water on the right side. Several yellow lines are drawn on the image to delineate specific areas. A horizontal line runs across the middle, with a vertical line intersecting it from the left. Another vertical line is on the right side. A small rectangular area is outlined in the bottom left. Three labels are present: 'A' is near the top center, 'B' is near the center right, and 'C' is near the bottom left. The overall scene is a complex of natural and possibly managed land.

An aerial photograph of a rural landscape. A large, winding river or waterway occupies the lower right portion of the image. The surrounding area is a patchwork of agricultural fields, some of which are green, and others that are brown or tan. There are several buildings, including a large white industrial-style building on the left. A network of roads and paths is visible. Yellow circles and lines are overlaid on the image, marking specific locations of interest. These include a cluster of yellow circles in the lower left, a yellow line extending from the bottom left towards the center, and several yellow circles scattered across the upper right and center-right areas.

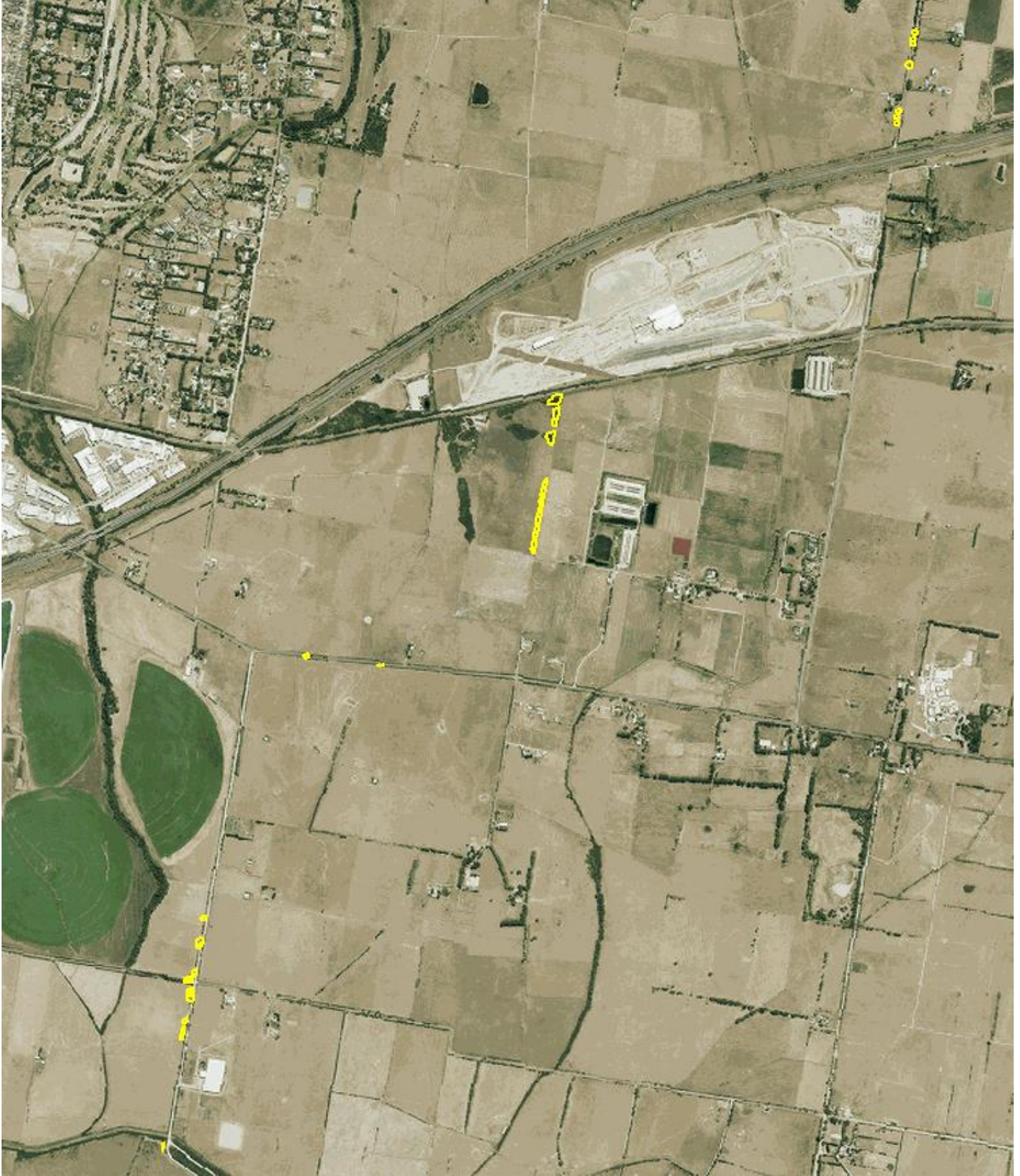
E



F



G



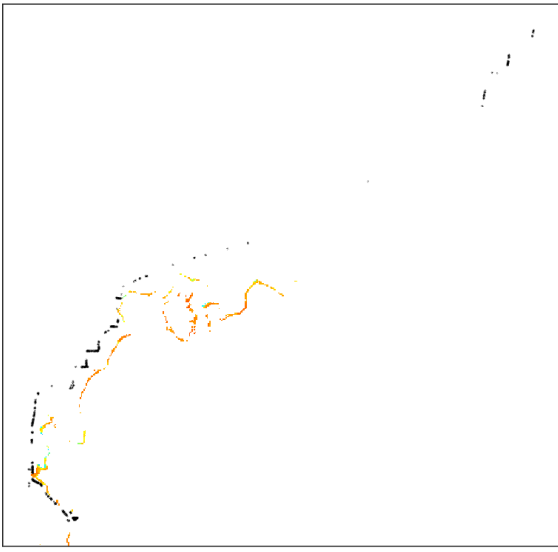
4. Map of the property in context



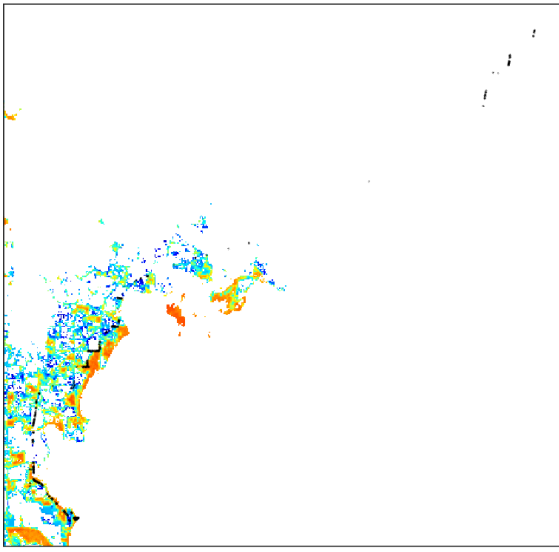
Yellow boundaries denote areas of proposed native vegetation removal.
Red boundaries denote areas of past removal.

4. Habitat importance maps

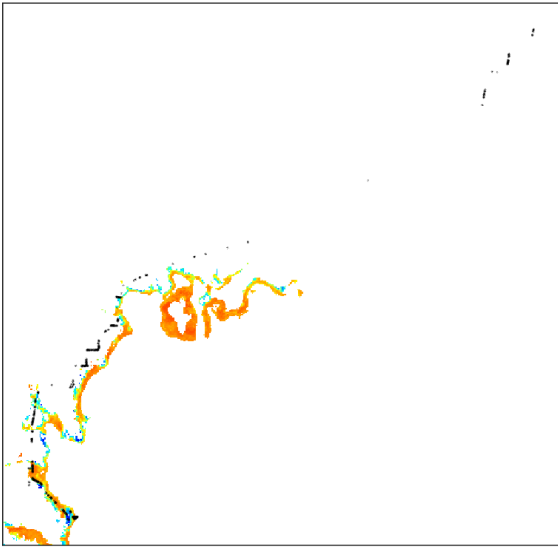
Tiny Arrowgrass
Triglochin minutissima
503446



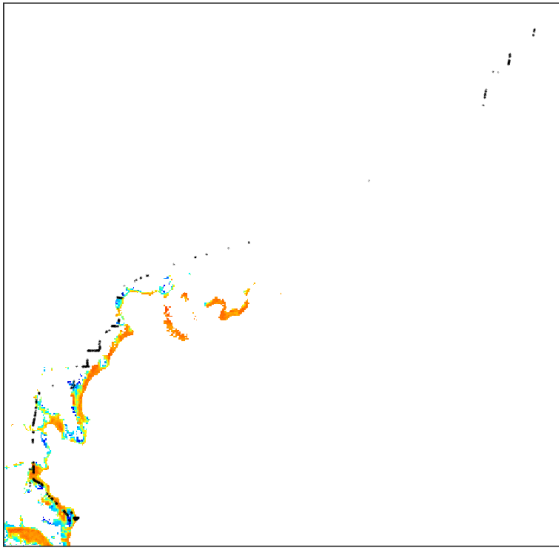
Coast Helmet-orchid
Corybas despectans
500836



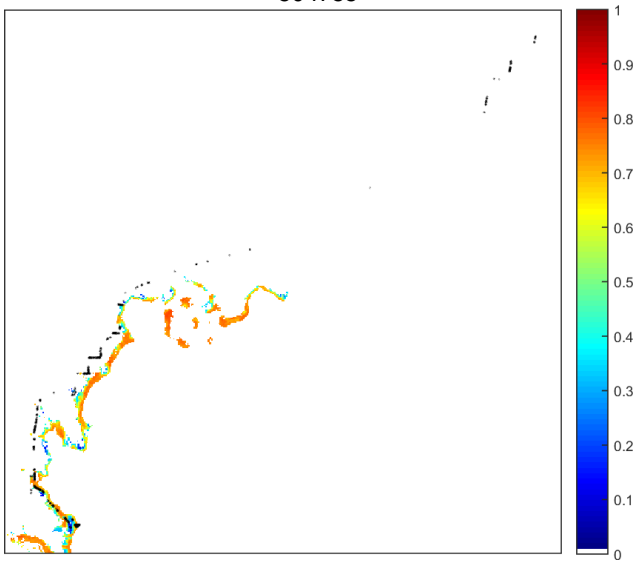
Coast Twin-leaf
Zygophyllum billardierei
503615



Coast Wirilda
Acacia uncifolia
504210



Coast Bitter-bush
Adriana quadripartita
504755



Native vegetation removal report

This report provides information to support an application to remove, destroy or lop native vegetation in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation*. The report **is not an assessment by DELWP** of the proposed native vegetation removal. Native vegetation information and offset requirements have been determined using spatial data provided by the applicant or their consultant.

Date of issue: 02/06/2020

Time of issue: 7:44 pm

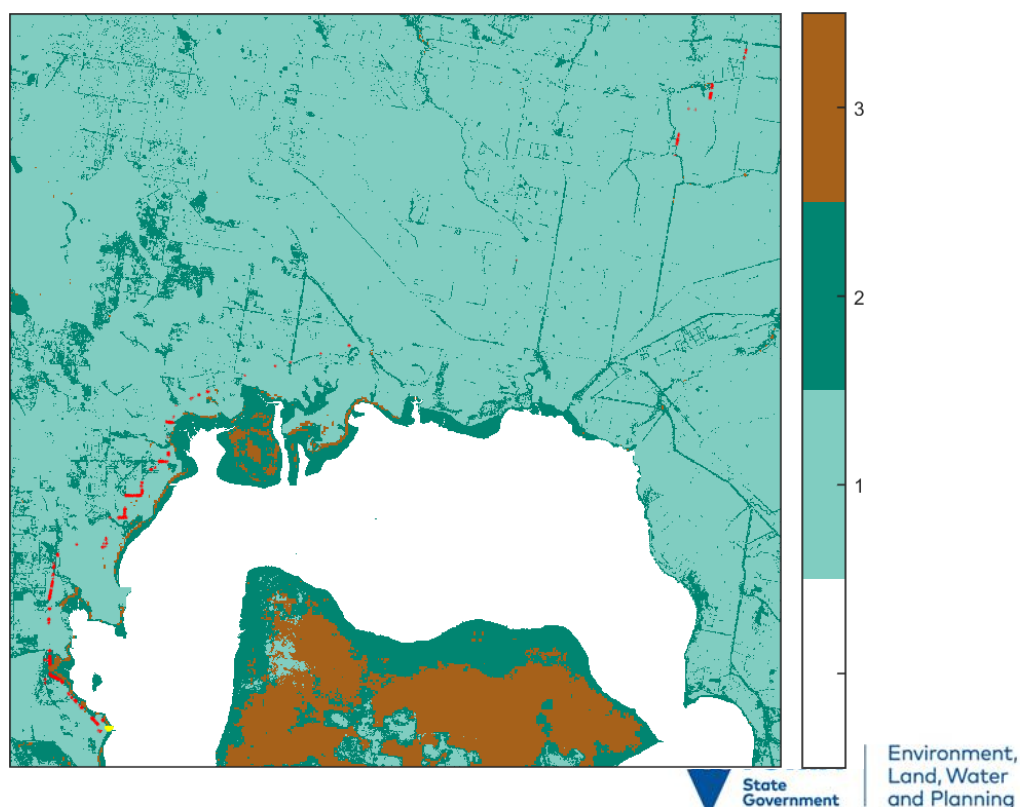
Report ID: BIO_2020_041

Project ID 28957_VegClearingPS2

Assessment pathway

Assessment pathway	Detailed Assessment Pathway
Extent including past and proposed	16.955 ha
Extent of past removal	15.352 ha
Extent of proposed removal	1.603 ha
No. Large trees proposed to be removed	2
Location category of proposed removal	<p>Location 2</p> <p>The native vegetation is in an area mapped as a wetland designated under the Convention on Wetlands of International Importance (the Ramsar Convention); and a wetland listed in the Directory of Important Wetlands of Australia; and an internationally important site for Migratory Shorebirds of the East Asian-Australasian Flyway. Removal of less than 0.5 hectares of native vegetation in this location will not have a significant impact on any habitat for a rare or threatened species.</p>

1. Location map



Offset requirements if a permit is granted

Any approval granted will include a condition to obtain an offset that meets the following requirements:

General offset amount¹	0.021 general habitat units
Vicinity	Port Phillip and Westernport Catchment Management Authority (CMA) or Mornington Peninsula Shire Council
Minimum strategic biodiversity value score ²	0.684
Large trees*	0 large trees
Species offset amount³	1.217 species units of habitat for Coast Helmet-orchid, <i>Corybas despectans</i> 1.217 species units of habitat for Coast Twin-leaf, <i>Zygophyllum billardieri</i> 1.217 species units of habitat for Coast Wirilda, <i>Acacia uncifolia</i> 1.217 species units of habitat for Coast Bitter-bush, <i>Adriana quadripartita</i>
Large trees*	2 trees
* The total number of large trees that the offset must protect	2 large trees to be protected in either the general, species or combination across all habitat units protected

NB: values within tables in this document may not add to the totals shown above due to rounding

Appendix 1 includes information about the native vegetation to be removed

Appendix 2 includes information about the rare or threatened species mapped at the site.

Appendix 3 includes maps showing native vegetation to be removed and extracts of relevant species habitat importance maps

¹ The general offset amount required is the sum of all general habitat units in Appendix 1.

² Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

³ The species offset amount(s) required is the sum of all species habitat units in Appendix 1.

Next steps

Any proposal to remove native vegetation must meet the application requirements of the Detailed Assessment Pathway and it will be assessed under the Detailed Assessment Pathway.

If you wish to remove the mapped native vegetation you are required to apply for a permit from your local council. Council will refer your application to DELWP for assessment, as required. **This report is not a referral assessment by DELWP.**

This *Native vegetation removal report* must be submitted with your application for a permit to remove, destroy or lop native vegetation.

Refer to the *Guidelines for the removal, destruction or lopping of native vegetation* (the Guidelines) for a full list of application requirements. This report provides information that meets the following application requirements:

- The assessment pathway and reason for the assessment pathway
- A description of the native vegetation to be removed (partly met)
- Maps showing the native vegetation and property (partly met)
- Information about the impacts on rare or threatened species.
- The offset requirements determined in accordance with section 5 of the Guidelines that apply if approval is granted to remove native vegetation.

Additional application requirements must be met including:

- Topographical and land information
- Recent dated photographs
- Details of past native vegetation removal
- An avoid and minimise statement
- A copy of any Property Vegetation Plan that applies
- A defensible space statement as applicable
- A statement about the Native Vegetation Precinct Plan as applicable
- A site assessment report including a habitat hectare assessment of any patches of native vegetation and details of trees
- An offset statement that explains that an offset has been identified and how it will be secured.

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Melbourne 2020

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For more information contact the DELWP Customer Service Centre 136 186

www.delwp.vic.gov.au

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This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

Obtaining this publication does not guarantee that an application will meet the requirements of Clauses 52.16 or 52.17 of the Victoria Planning Provisions and Victorian planning schemes or that a permit to remove native vegetation will be granted.

Notwithstanding anything else contained in this publication, you must ensure that you comply with all relevant laws, legislation, awards or orders and that you obtain and comply with all permits, approvals and the like that affect, are applicable or are necessary to undertake any action to remove, lop or destroy or otherwise deal with any native vegetation or that apply to matters within the scope of Clauses 52.16 or 52.17 of the Victoria Planning Provisions and Victorian planning schemes.

Appendix 1: Description of native vegetation to be removed

The species-general offset test was applied to your proposal. This test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the species offset threshold. The threshold is set at 0.005 per cent of the mapped habitat value for a species. When the proportional impact is above the species offset threshold a species offset is required. This test is done for all species mapped at the site. Multiple species offsets will be required if the species offset threshold is exceeded for multiple species.

Where a zone requires species offset(s), the species habitat units for each species in that zone is calculated by the following equation in accordance with the Guidelines:

$$\text{Species habitat units} = \text{extent} \times \text{condition} \times \text{species landscape factor} \times 2, \text{ where the species landscape factor} = 0.5 + (\text{habitat importance score}/2)$$

The species offset amount(s) required is the sum of all species habitat units per zone

Where a zone does not require a species offset, the general habitat units in that zone is calculated by the following equation in accordance with the Guidelines:

$$\text{General habitat units} = \text{extent} \times \text{condition} \times \text{general landscape factor} \times 1.5, \text{ where the general landscape factor} = 0.5 + (\text{strategic biodiversity value score}/2)$$

The general offset amount required is the sum of all general habitat units per zone.

Native vegetation to be removed

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
99-99	Patch	gipp0053	Endangered	0	no	0.510	0.030	0.030	0.855		0.021	General
58-GI	Patch	gipp0048	Least Concern	0	no	0.410	0.746	0.746	0.980	0.576	0.482	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.431	0.482	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.431	0.482	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.431	0.482	504755 Coast Bitter-bush <i>Adriana quadripartita</i>
84-84	Patch	gipp0048	Least Concern	0	no	0.360	0.018	0.018	0.980	0.700	0.011	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.700	0.011	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.700	0.011	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.700	0.011	504755 Coast Bitter-bush <i>Adriana quadripartita</i>

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
59-GI	Patch	gipp0048	Least Concern	2	no	0.530	0.809	0.809	0.924	0.686	0.723	500836 Coast Helmet-orchid <i>Corybas despectans</i>
										0.299	0.723	503615 Coast Twin-leaf <i>Zygophyllum billardierei</i>
										0.299	0.723	504210 Coast Wirilda <i>Acacia uncifolia</i>
										0.299	0.723	504755 Coast Bitter-bush <i>Adriana quadripartita</i>

Appendix 2: Information about impacts to rare or threatened species' habitats on site

This table lists all rare or threatened species' habitats mapped at the site.

Species common name	Species scientific name	Species number	Conservation status	Group	Habitat impacted	% habitat value affected
Coast Helmet-orchid	<i>Corybas despectans</i>	500836	Vulnerable	Dispersed	Habitat importance map	0.0080
Coast Twin-leaf	<i>Zygophyllum billardierei</i>	503615	Rare	Dispersed	Habitat importance map	0.0078
Coast Wirilda	<i>Acacia uncifolia</i>	504210	Rare	Dispersed	Habitat importance map	0.0061
Coast Bitter-bush	<i>Adriana quadripartita</i>	504755	Vulnerable	Dispersed	Habitat importance map	0.0052
King Quail	<i>Coturnix chinensis victoritae</i>	10012	Endangered	Dispersed	Habitat importance map	0.0049
Creeping Rush	<i>Juncus revolutus</i>	501839	Rare	Dispersed	Habitat importance map	0.0036
Dune Wood-sorrel	<i>Oxalis rubens</i>	502390	Rare	Dispersed	Habitat importance map	0.0036
Coast Fescue	<i>Poa billardierei</i>	501361	Rare	Dispersed	Habitat importance map	0.0034
Dense Leek-orchid	<i>Prasophyllum spicatum</i>	504506	Endangered	Dispersed	Habitat importance map	0.0021
Marsh Saltbush	<i>Atriplex paludosa</i> subsp. <i>paludosa</i>	500326	Rare	Dispersed	Habitat importance map	0.0019
Veined Spear-grass	<i>Austrostipa rudis</i> subsp. <i>australis</i>	504940	Rare	Dispersed	Habitat importance map	0.0018
Glossy Grass Skink	<i>Pseudemoia rawlinsoni</i>	12683	Vulnerable	Dispersed	Habitat importance map	0.0016
Salt Lawrencia	<i>Lawrencia spicata</i>	501888	Rare	Dispersed	Habitat importance map	0.0010
Dune Poa	<i>Poa poiformis</i> var. <i>ramifer</i>	504826	Rare	Dispersed	Habitat importance map	0.0010
Green Leek-orchid	<i>Prasophyllum lindleyanum</i>	502702	Vulnerable	Dispersed	Habitat importance map	0.0010
Grey Mangrove	<i>Avicennia marina</i> subsp. <i>australasica</i>	500345	Rare	Dispersed	Habitat importance map	0.0010
Swamp Skink	<i>Lissolepis coventryi</i>	12407	Vulnerable	Dispersed	Habitat importance map	0.0008
Leafy Twig-sedge	<i>Cladium procerum</i>	500786	Rare	Dispersed	Habitat importance map	0.0008
Purple Blown-grass	<i>Lachnagrostis punicea</i> subsp. <i>punicea</i>	504206	Rare	Dispersed	Habitat importance map	0.0008

Parsley Xanthosia	<i>Xanthosia leiophylla</i>	504562	Rare	Dispersed	Habitat importance map	0.0007
Lewin's Rail	<i>Lewinia pectoralis pectoralis</i>	10045	Vulnerable	Dispersed	Habitat importance map	0.0007
Mauve-tuft Sun-orchid	<i>Thelymitra malvina</i>	503374	Vulnerable	Dispersed	Habitat importance map	0.0006
Growing Grass Frog	<i>Litoria raniformis</i>	13207	Endangered	Dispersed	Habitat importance map	0.0005
Rough Blown-grass	<i>Lachnagrostis rudis</i> subsp. <i>rudis</i>	500159	Endangered	Dispersed	Habitat importance map	0.0005
Golden Cowslips	<i>Diuris behrii</i>	501061	Vulnerable	Dispersed	Habitat importance map	0.0004
Grey Plover	<i>Pluvialis squatarola</i>	10136	Endangered	Dispersed	Habitat importance map	0.0003
Pacific Golden Plover	<i>Pluvialis fulva</i>	10137	Vulnerable	Dispersed	Habitat importance map	0.0003
Clover Glycine	<i>Glycine latrobeana</i>	501456	Vulnerable	Dispersed	Habitat importance map	0.0003
Grey Goshawk	<i>Accipiter novaehollandiae novaehollandiae</i>	10220	Vulnerable	Dispersed	Habitat importance map	0.0002
Lesser Sand Plover	<i>Charadrius mongolus</i>	10139	Critically endangered	Dispersed	Habitat importance map	0.0002
Hooded Plover	<i>Thinornis rubricollis rubricollis</i>	10138	Vulnerable	Dispersed	Habitat importance map	0.0002
Whimbrel	<i>Numenius phaeopus</i>	10150	Vulnerable	Dispersed	Habitat importance map	0.0001
Chestnut-rumped Heathwren	<i>Calamanthus pyrrhopygius</i>	10498	Vulnerable	Dispersed	Habitat importance map	0.0001
Great Knot	<i>Calidris tenuirostris</i>	10165	Endangered	Dispersed	Habitat importance map	0.0001
Red Knot	<i>Calidris canutus</i>	10164	Endangered	Dispersed	Habitat importance map	0.0001
Common Bent-wing Bat (eastern ssp.)	<i>Miniopterus schreibersii oceanensis</i>	61342	Vulnerable	Dispersed	Habitat importance map	0.0001
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	10226	Vulnerable	Dispersed	Habitat importance map	0.0001
Ruddy Turnstone	<i>Arenaria interpres</i>	10129	Vulnerable	Dispersed	Habitat importance map	0.0001
Blue-billed Duck	<i>Oxyura australis</i>	10216	Endangered	Dispersed	Habitat importance map	0.0001
Intermediate Egret	<i>Ardea intermedia</i>	10186	Endangered	Dispersed	Habitat importance map	0.0001
Common Sandpiper	<i>Actitis hypoleucos</i>	10157	Vulnerable	Dispersed	Habitat importance map	0.0001

Greater Sand Plover	<i>Charadrius leschenaultii</i>	10141	Critically endangered	Dispersed	Habitat importance map	0.0001
Elegant Parrot	<i>Neophema elegans</i>	10307	Vulnerable	Dispersed	Habitat importance map	0.0001
Eastern Great Egret	<i>Ardea modesta</i>	10187	Vulnerable	Dispersed	Habitat importance map	0.0001
Little Egret	<i>Egretta garzetta nigripes</i>	10185	Endangered	Dispersed	Habitat importance map	0.0001
Musk Duck	<i>Biziura lobata</i>	10217	Vulnerable	Dispersed	Habitat importance map	0.0001
Baillon's Crake	<i>Porzana pusilla palustris</i>	10050	Vulnerable	Dispersed	Habitat importance map	0.0001
Australasian Shoveler	<i>Anas rhynchosotis</i>	10212	Vulnerable	Dispersed	Habitat importance map	0.0001
Eastern Curlew	<i>Numenius madagascariensis</i>	10149	Vulnerable	Dispersed	Habitat importance map	0.0001
Hardhead	<i>Aythya australis</i>	10215	Vulnerable	Dispersed	Habitat importance map	0.0001
Gull-billed Tern	<i>Gelochelidon nilotica macrotarsa</i>	10111	Endangered	Dispersed	Habitat importance map	0.0001
White-throated Needletail	<i>Hirundapus caudacutus</i>	10334	Vulnerable	Dispersed	Habitat importance map	0.0001
Curlew Sandpiper	<i>Calidris ferruginea</i>	10161	Endangered	Dispersed	Habitat importance map	0.0001
Common Greenshank	<i>Tringa nebularia</i>	10158	Vulnerable	Dispersed	Habitat importance map	0.0001
Black Falcon	<i>Falco subniger</i>	10238	Vulnerable	Dispersed	Habitat importance map	0.0000
Black-tailed Godwit	<i>Limosa limosa</i>	528553	Vulnerable	Dispersed	Habitat importance map	0.0000
Sand Brome	<i>Bromus arenarius</i>	500497	Rare	Dispersed	Habitat importance map	0.0000
Marsh Sandpiper	<i>Tringa stagnatilis</i>	10159	Vulnerable	Dispersed	Habitat importance map	0.0000
Lace Monitor	<i>Varanus varius</i>	12283	Endangered	Dispersed	Habitat importance map	0.0000
Little Tern	<i>Sterna albibrons sinensis</i>	10117	Vulnerable	Dispersed	Habitat importance map	0.0000

Habitat group

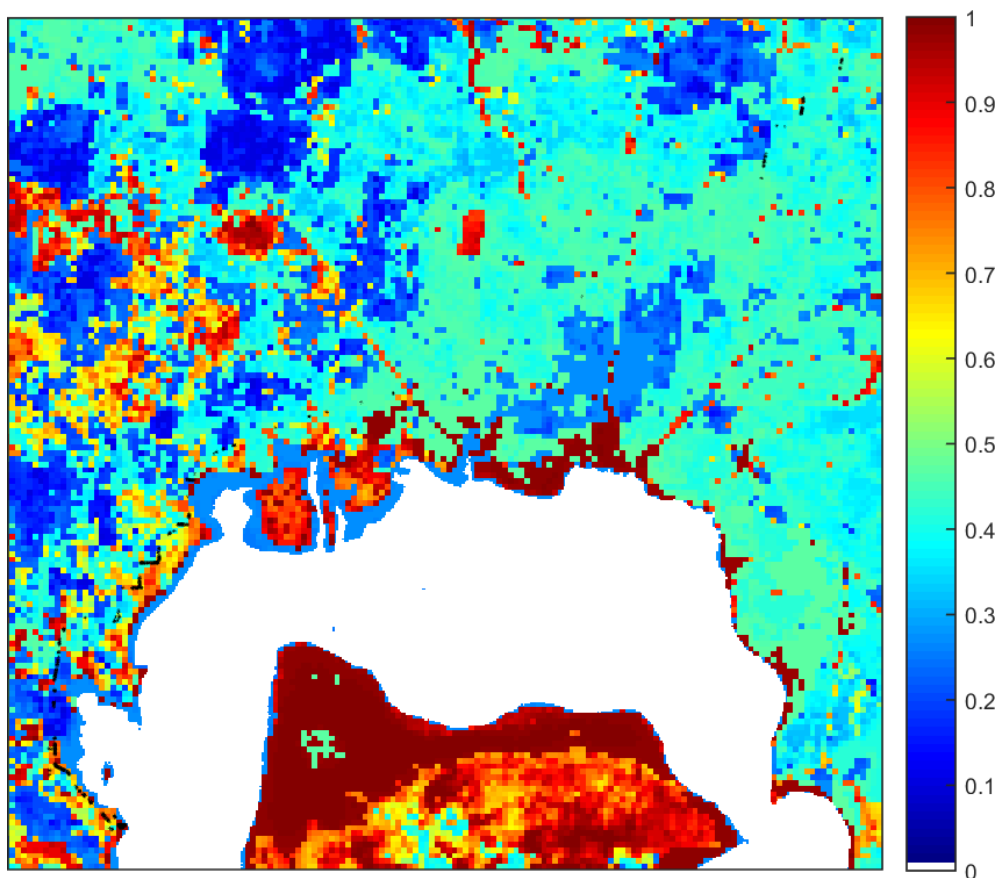
- Highly localised habitat means there is 2000 hectares or less mapped habitat for the species
- Dispersed habitat means there is more than 2000 hectares of mapped habitat for the species

Habitat impacted

- Habitat importance maps are the maps defined in the Guidelines that include all the mapped habitat for a rare or threatened species
- Top ranking maps are the maps defined in the Guidelines that depict the important areas of a dispersed species habitat, developed from the highest habitat importance scores in dispersed species habitat maps and selected VBA records
- Selected VBA record is an area in Victoria that represents a large population, roosting or breeding site etc.

Appendix 3 – Images of mapped native vegetation

2. Strategic biodiversity values map



3. Aerial photograph showing mapped native vegetation



A



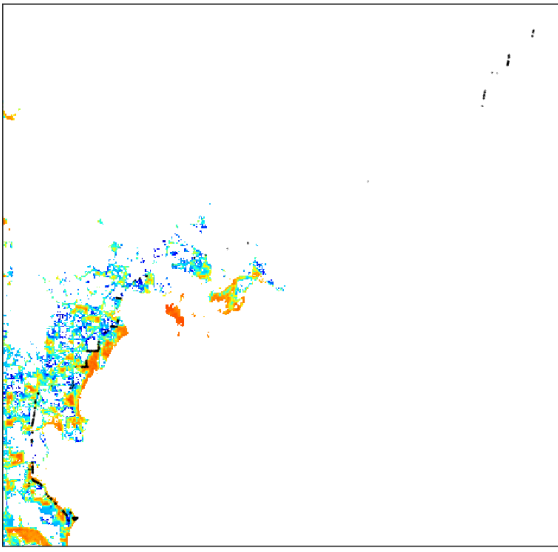
4. Map of the property in context



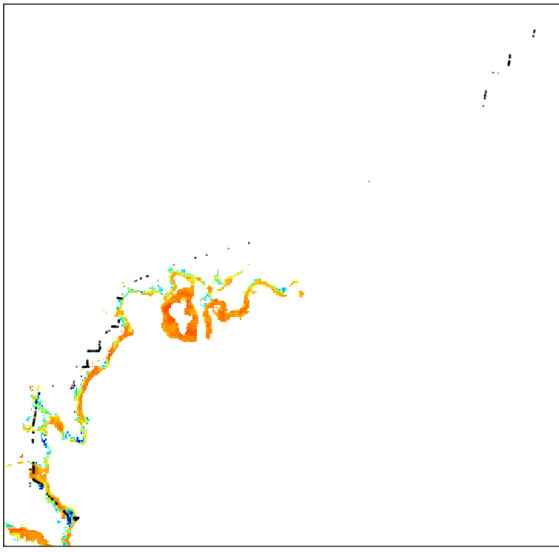
Yellow boundaries denote areas of proposed native vegetation removal.
Red boundaries denote areas of past removal.

4. Habitat importance maps

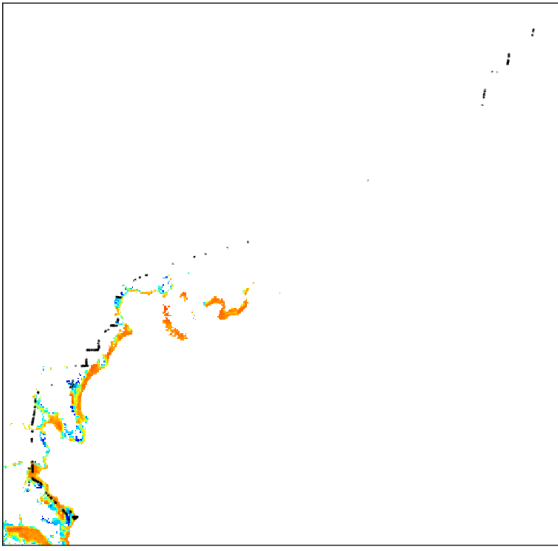
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Corybas despectans
500836



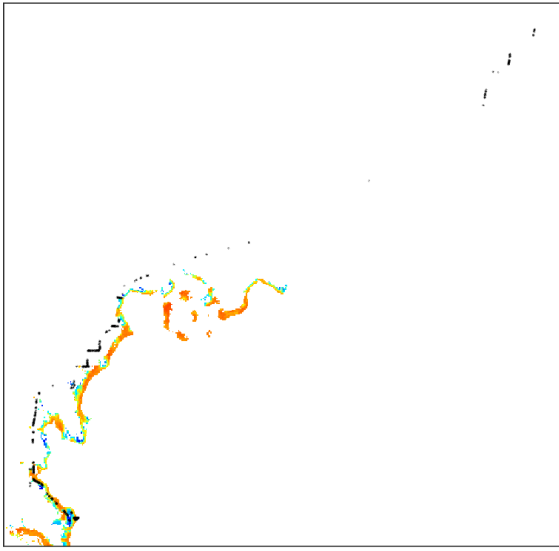
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Zygophyllum billardieri
503615



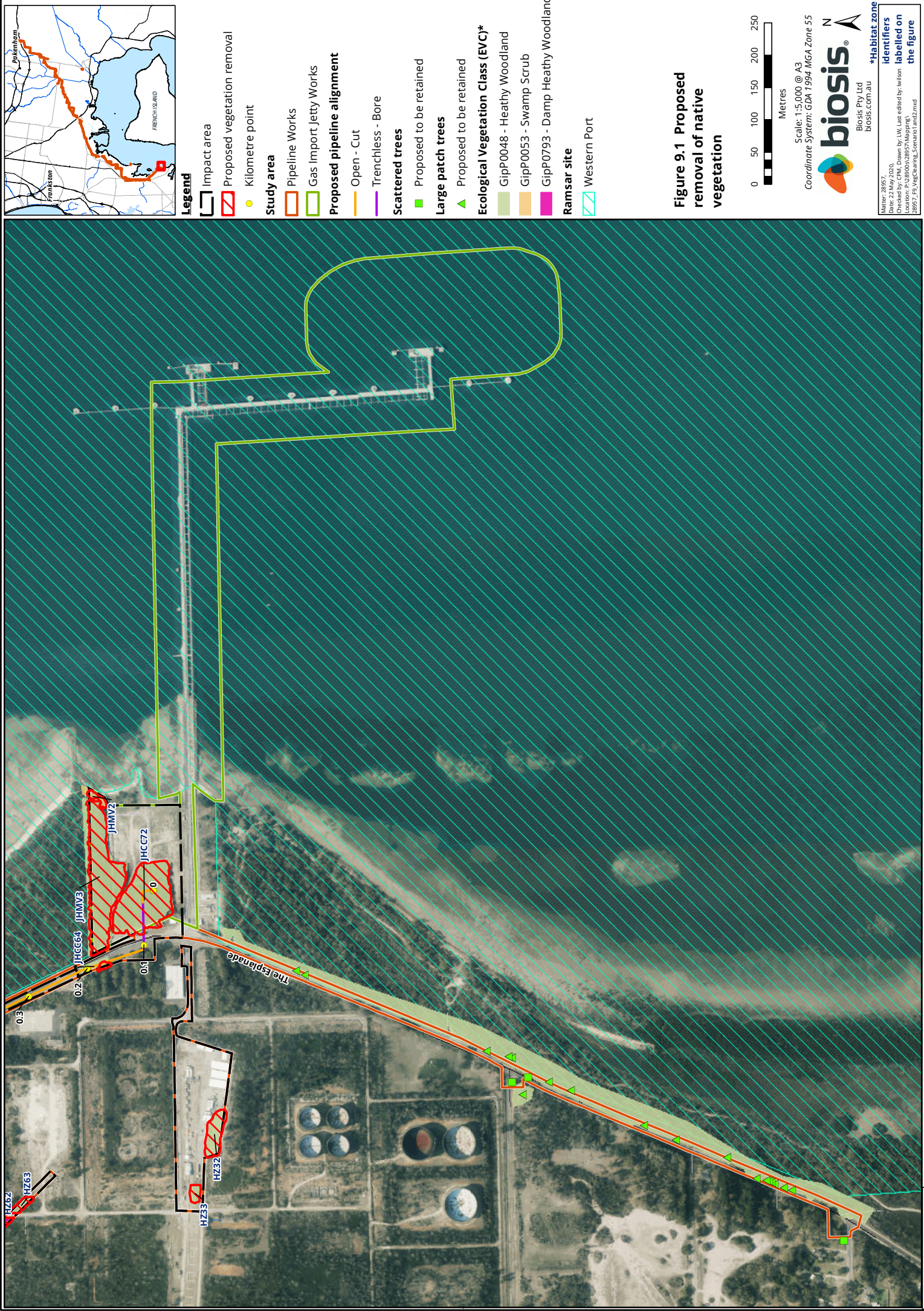
Coast Wirilda
Acacia uncifolia
504210



Coast Bitter-bush
Adriana quadripartita
504755



Appendix 6 Project mapping



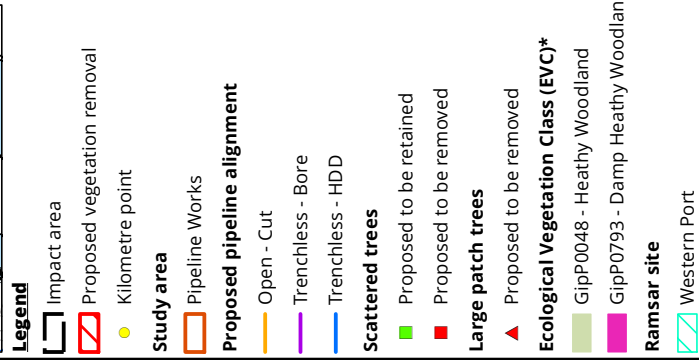
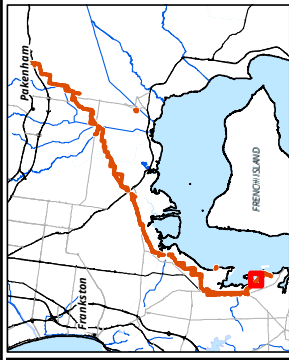


Figure 9.2 Proposed removal of native vegetation

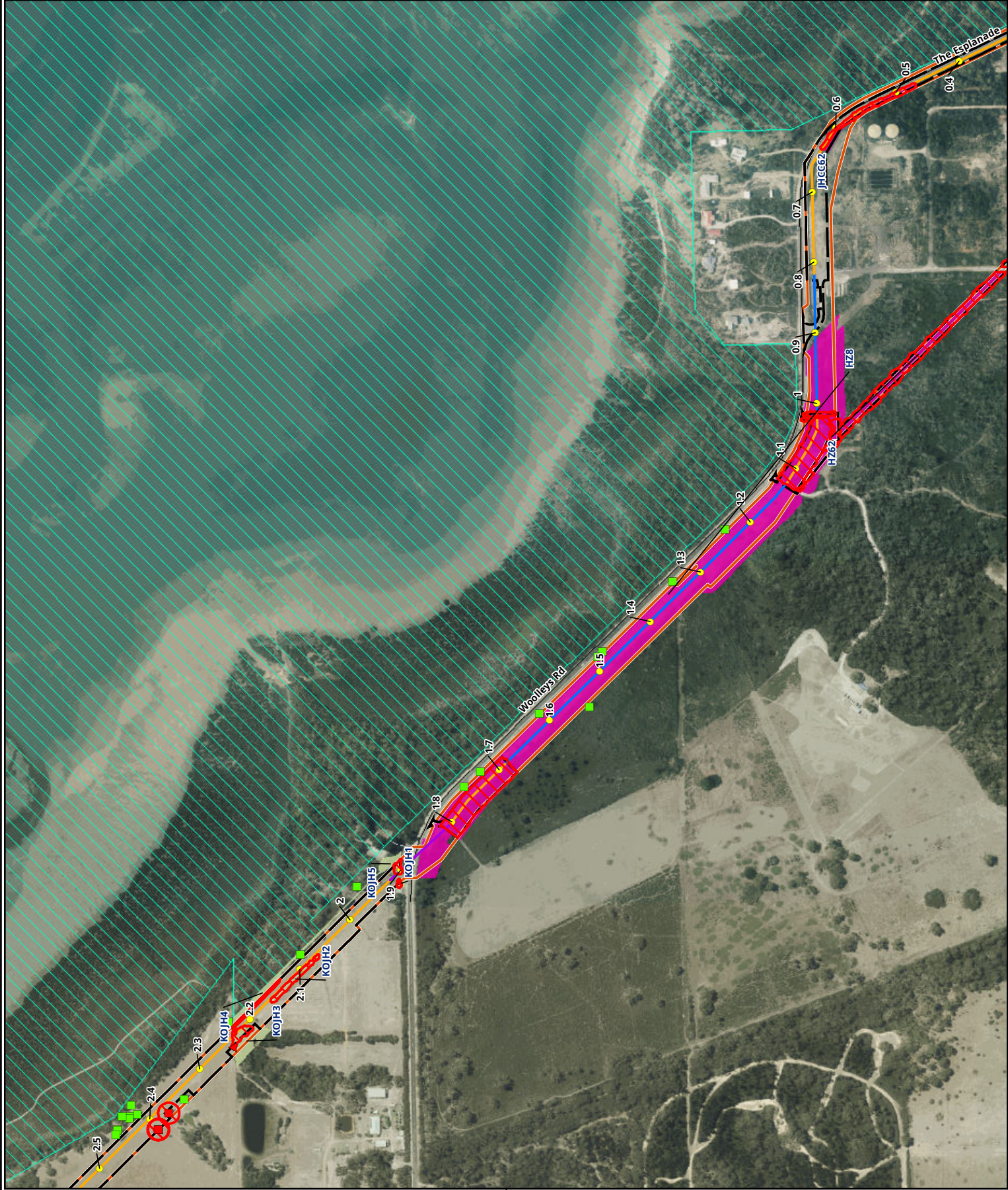


Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



Matter: 28987
 Date: 22 May 2020
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 Location: P:\389005\28957\Mapping\9857_13_VegClearing_Scenarios.mxd
 *Habitat zone identifiers labelled on the figure



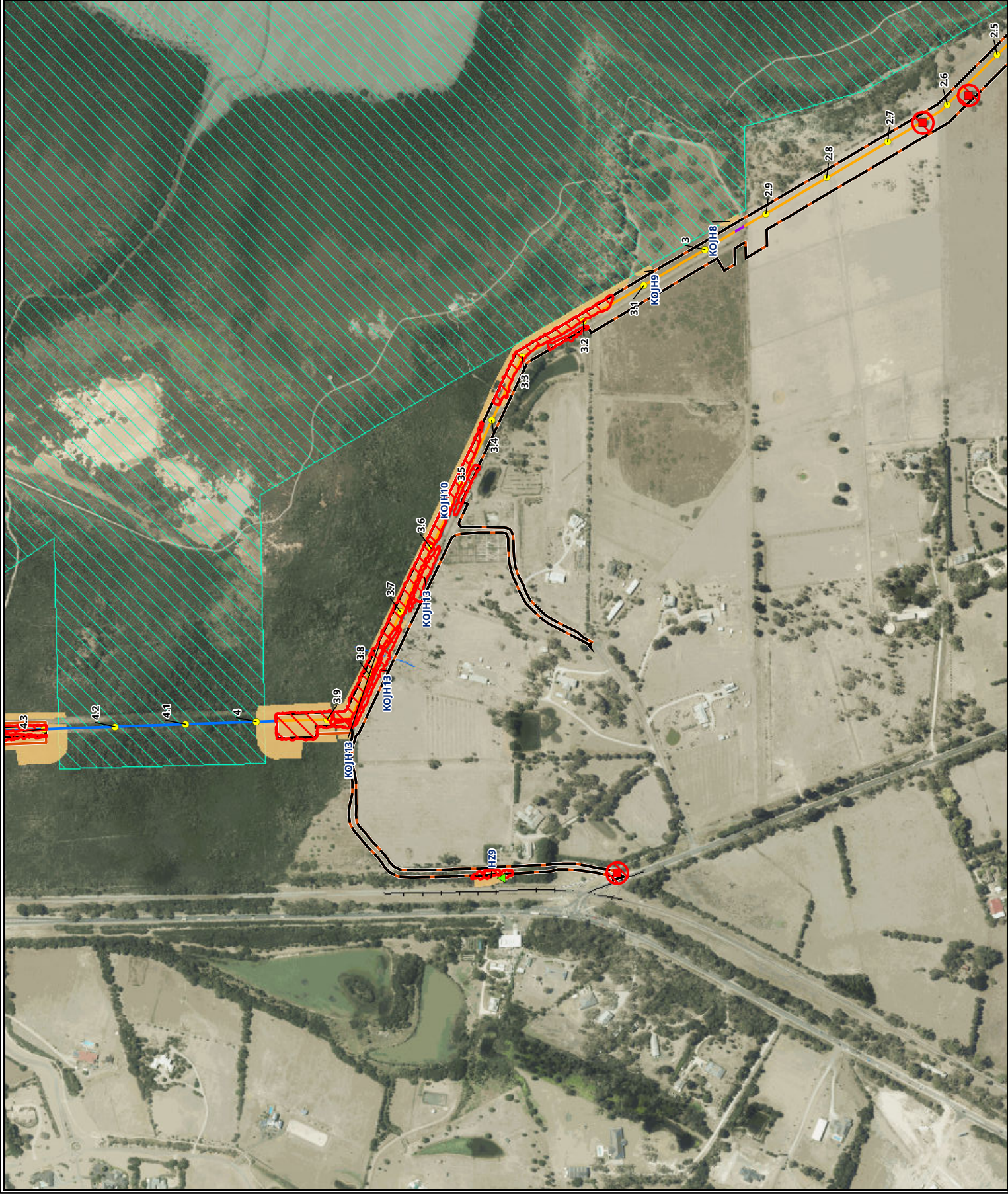
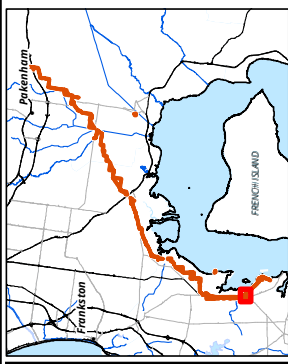
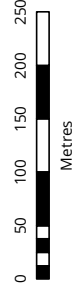


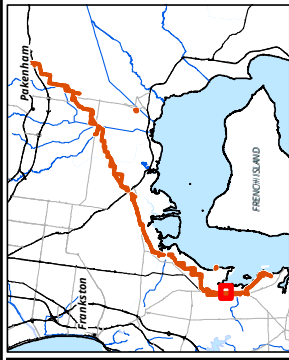
Figure 9.3 Proposed removal of native vegetation



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***Habitat zone identifiers labelled on the figure**





Legend

Impact area

Proposed vegetation removal

Kilometre point

Study area

Pipeline Works

Proposed pipeline alignment

Open - Cut

Trenchless - HDD

Scattered trees

Proposed to be retained

Proposed to be removed

Large patch trees

Proposed to be removed

Ecological Vegetation Class (EVC)*

GipP0175 - Grassy Woodland

GipP0821 - Tall Marsh

Ramsar site

Western Port

Metres

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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Material: 28/05/20

Date: 22 May 2020

Checked by: CHW, Drawn by: LW, Last edited by: Wilson

Location: P:\389005\28957\Mapping\

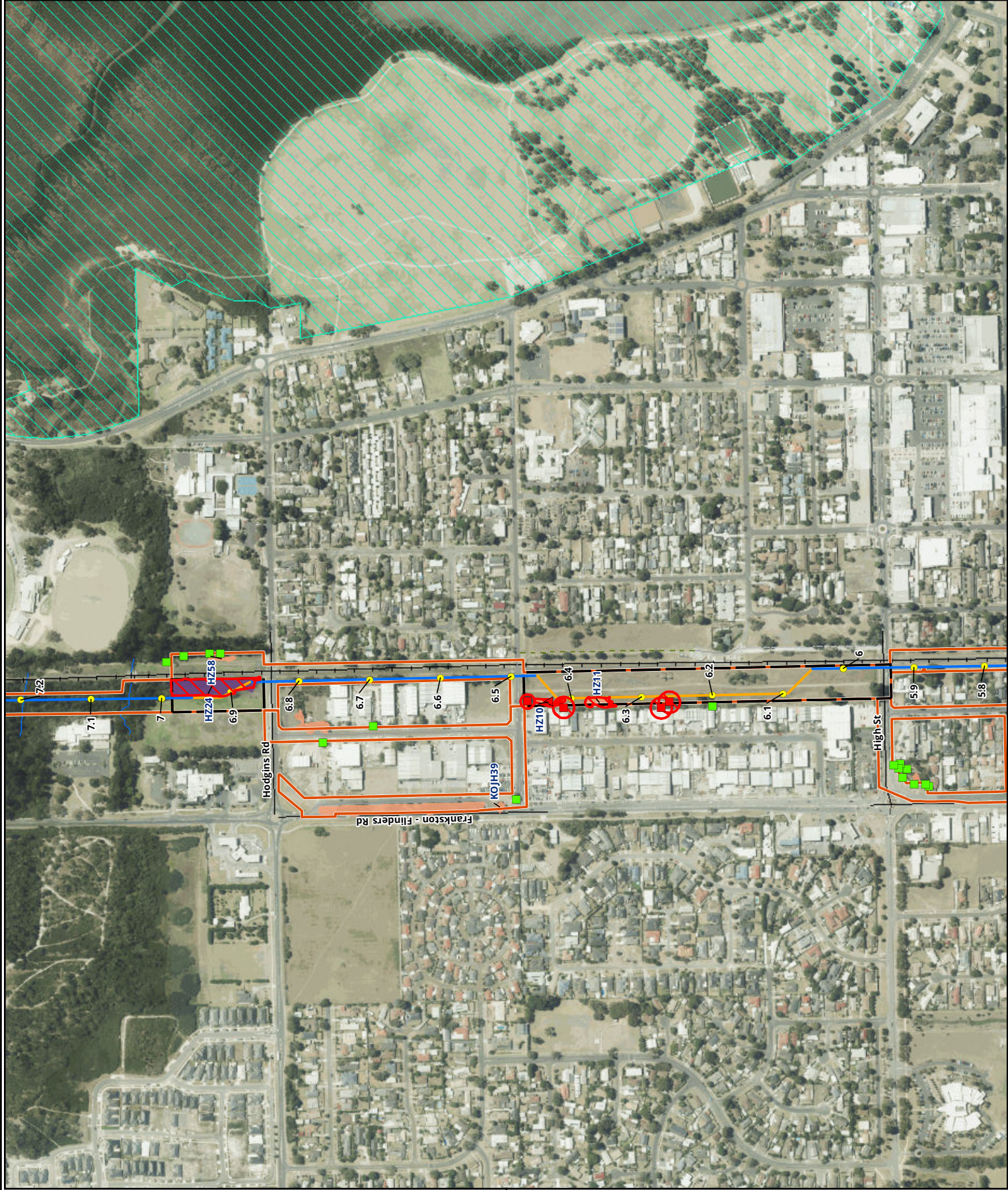
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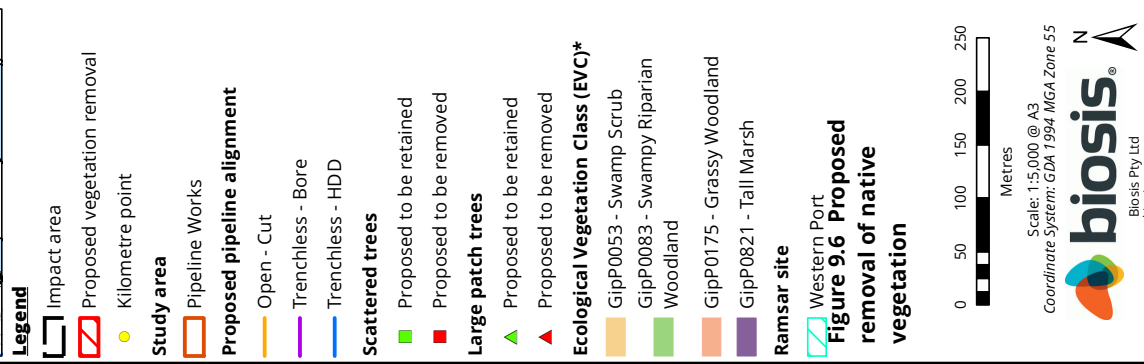
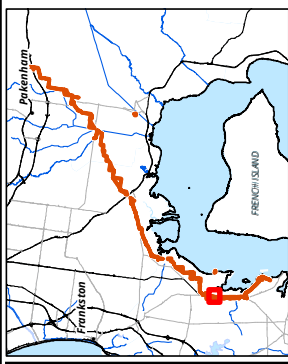
*Habitat zone

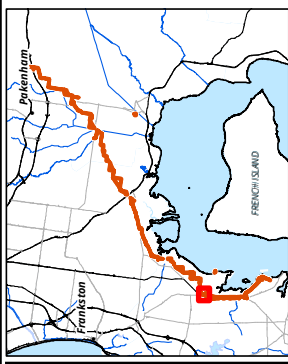
identifiers

labelled on

the figure





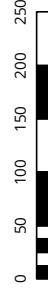




Legend

- Impact area
- Proposed vegetation removal
- Kilometre point
- Study area
- Pipeline Works
- Proposed pipeline alignment
- Open - Cut
- Trenchless - Bore
- Scattered trees
- Proposed to be retained
- Proposed to be removed
- Ecological Vegetation Class (EVC)*
- GipP0048 - Heathy Woodland
- GipP0053 - Swamp Scrub

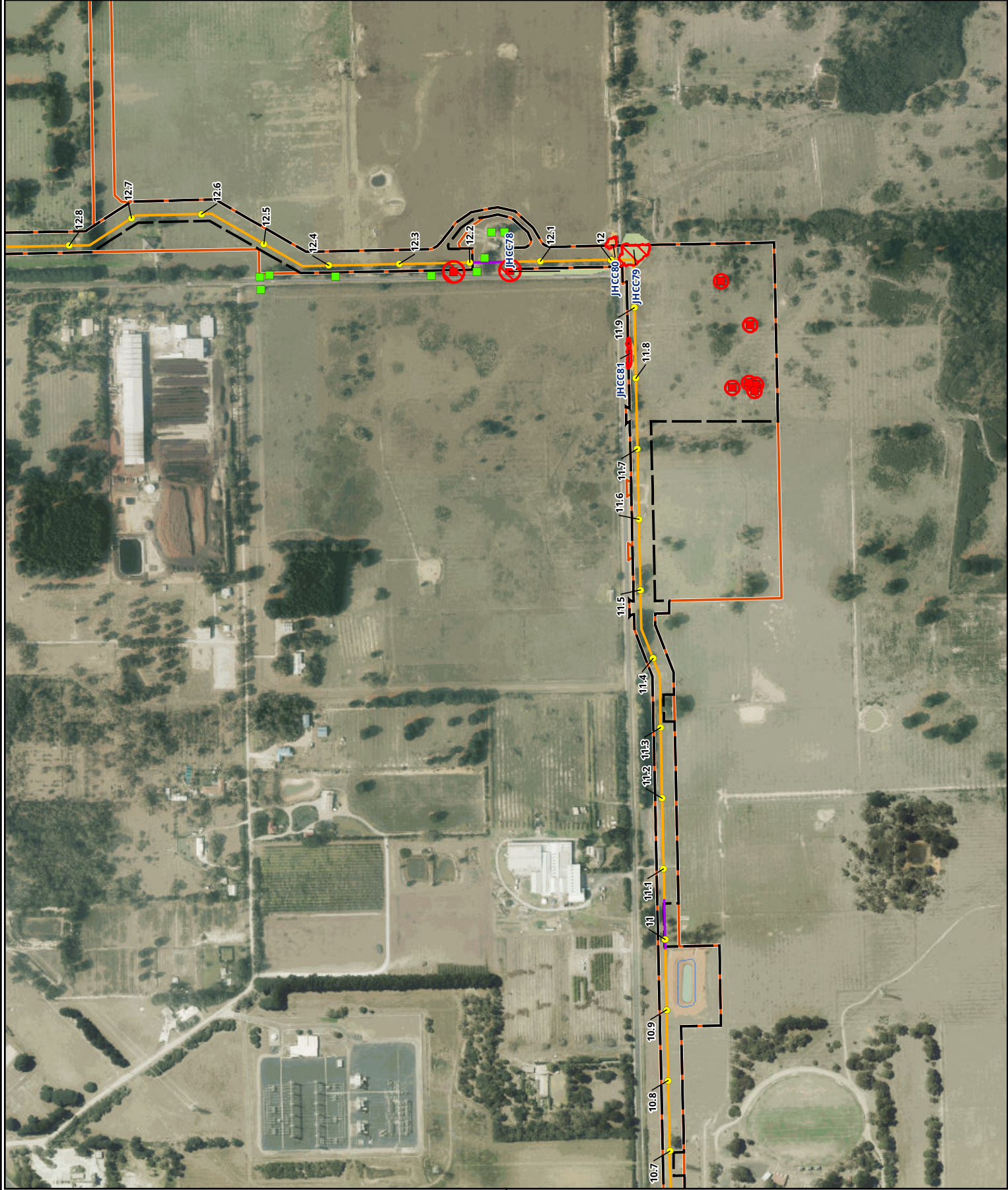
Figure 9.8 Proposed removal of native vegetation



Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



*Habitat zone identifiers labelled on the figure

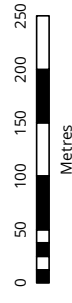




Legend

- Impact area
- Proposed vegetation removal
- Kilometre point
- Study area**
- Pipeline Works
- Proposed pipeline alignment**
- Open - Cut
- Trenchless - HDD
- Scattered trees**
- Proposed to be retained
- Proposed to be removed
- Large patch trees**
- Proposed to be retained
- Proposed to be removed
- Ecological Vegetation Class (EVC)***
- GipP0048 - Heathy Woodland
- GipP0053 - Swamp Scrub
- GipP0175 - Grassy Woodland
- GipP0653 - Aquatic Hermland
- GipP0937 - Swampy Woodland
- Ramsar site**
- Western Port

Figure 9.10 Proposed removal of native vegetation



Scale: 1:5,000 @ A3

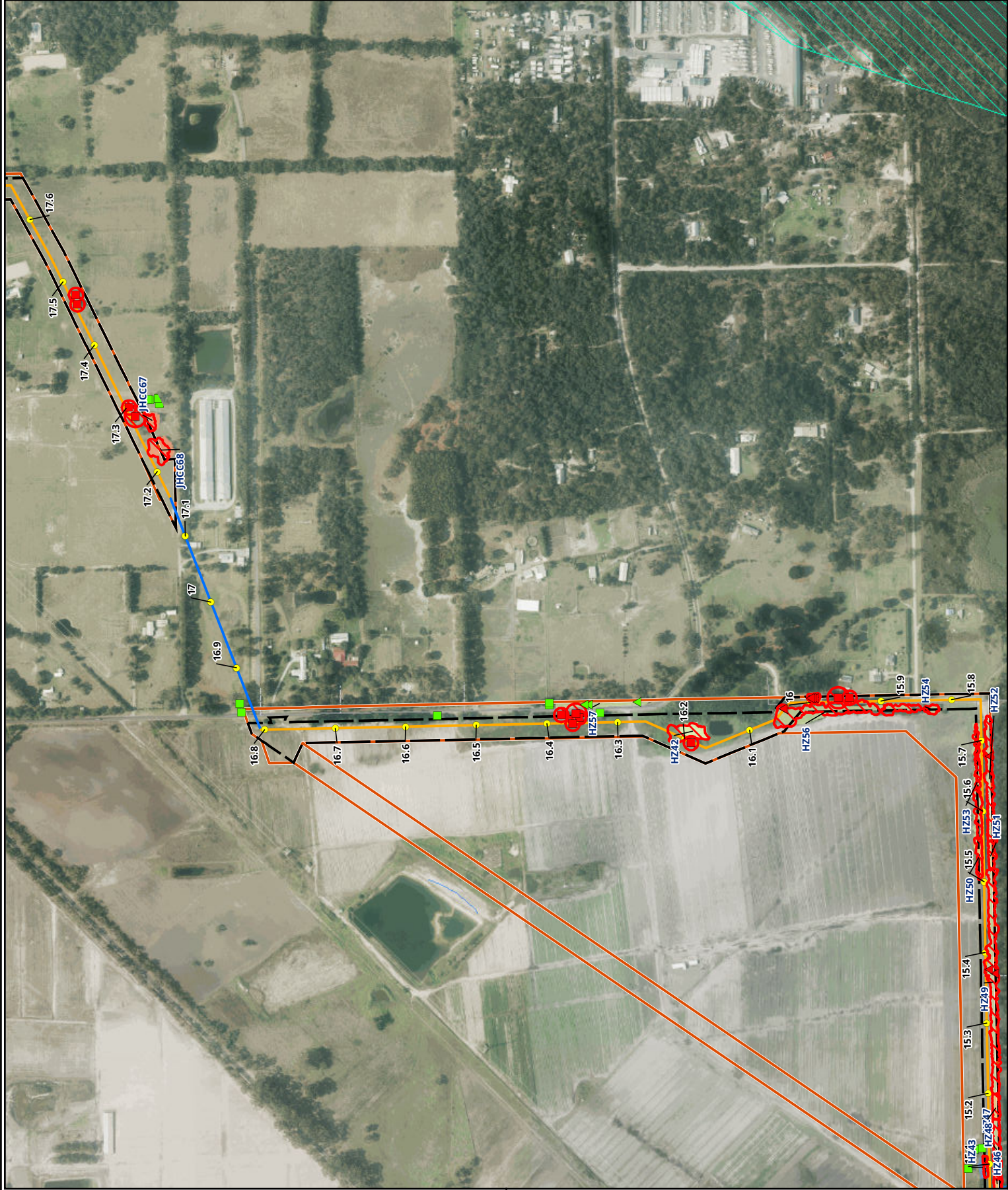
Coordinate System: GDA 1994 MGA Zone 55

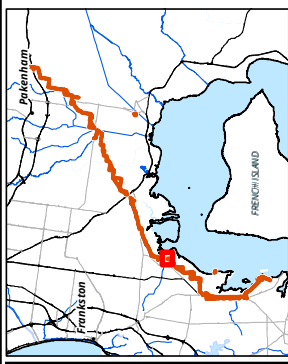


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*Habitat zone

Identifiers labelled on the figure

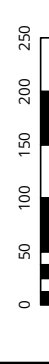




Legend

- Impact area
- Proposed vegetation removal
- Kilometre point
- Study area
- Pipeline Works
- Proposed pipeline alignment
- Open - Cut
- Trenchless - HDD
- Scattered trees
- Proposed to be retained
- Large patch trees
- Proposed to be retained
- Proposed to be removed
- Ecological Vegetation Class (EVC)*
- GipP0012 - Wet Swale Herbland
- GipP0048 - Heathy Woodland
- GipP0053 - Swamp Scrub
- Ramsar site
- Western Port

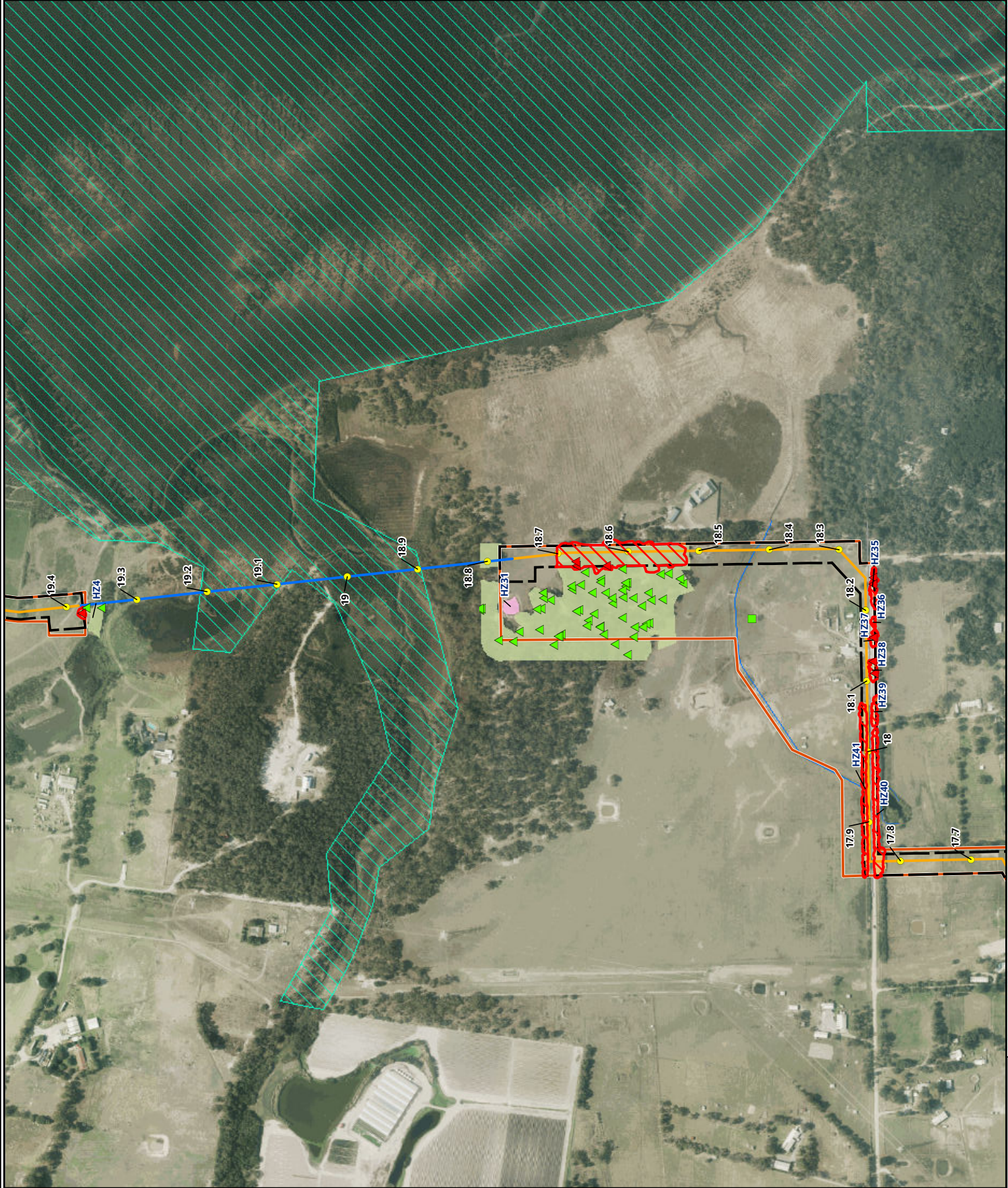
Figure 9.11 Proposed removal of native vegetation

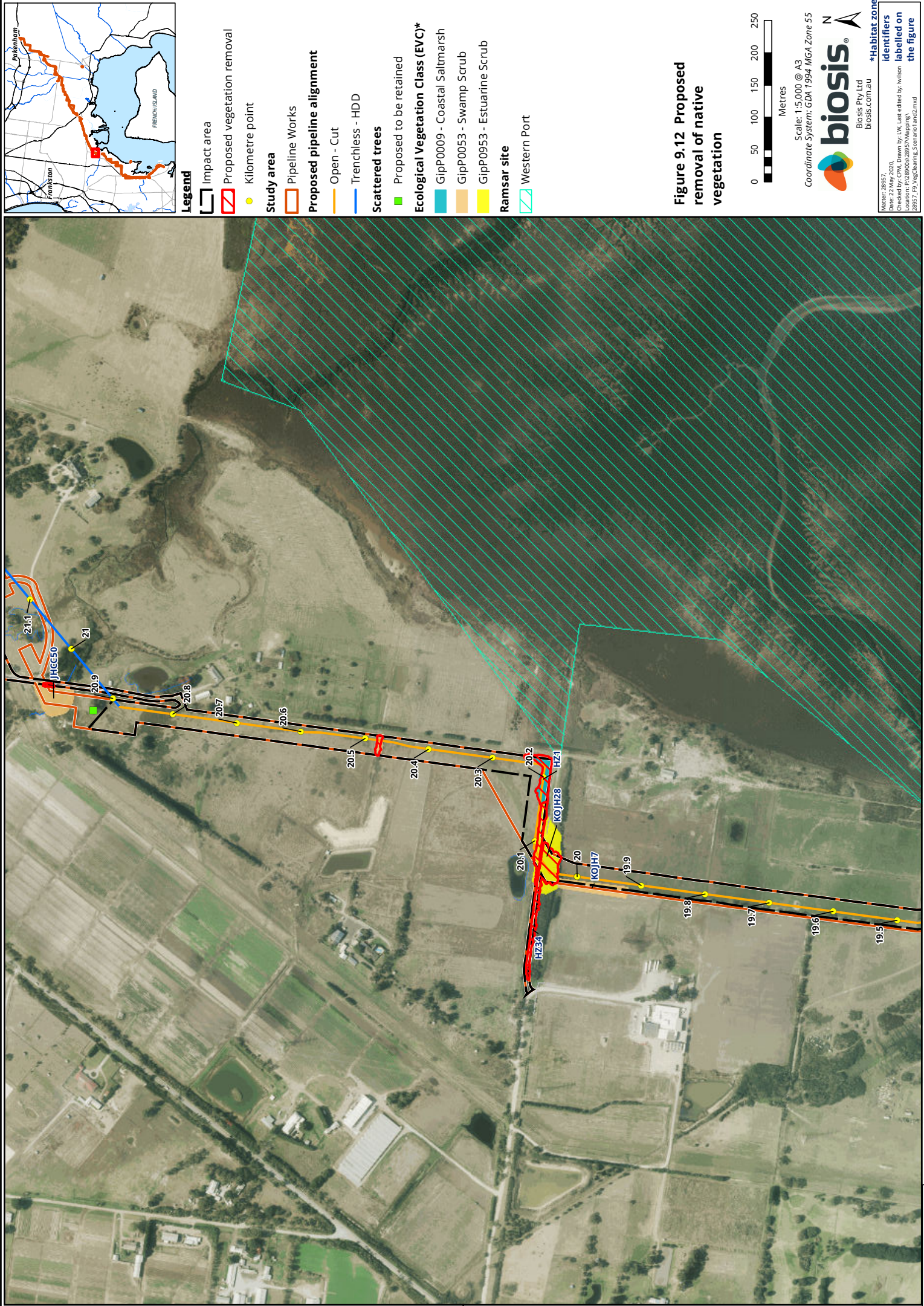


Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



*Habitat zone identifiers labelled on the figure





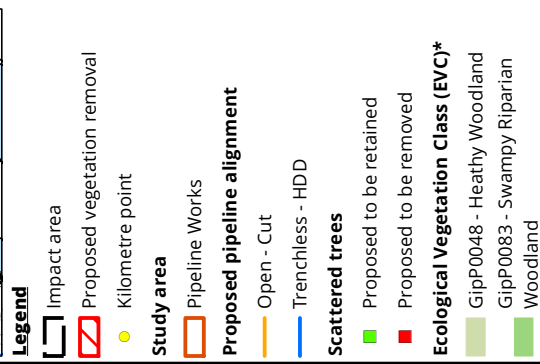
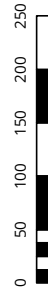


Figure 9.13 Proposed removal of native vegetation



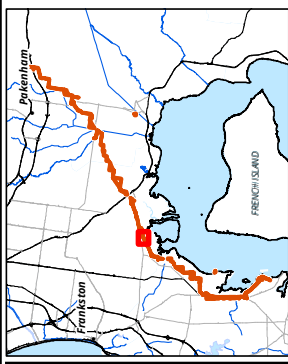
Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



Habitat zone identifiers labelled on the figure

Matrix: 28957
Date: 22 May 2020
Checked by: CPM, Drawn by: LW, Last edited by: Wilson
Location: P:\389005\28957\Mapping\9957_P3_VegClearing_Scenario_Land.mxd





Legend

Impact area

Proposed vegetation removal

Kilometre point

Study area

Pipeline Works

Proposed pipeline alignment

Open - Cut

Trenchless - Bore

Trenchless - HDD

Scattered trees

Proposed to be retained

Proposed to be removed

Ecological Vegetation Class (EVC)*

GipP0083 - Swampy Riparian

Woodland

Ramsar site

Western Port

Metres

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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Habitat zone

identifiers

labelled on

the figure

Western Port

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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biosis.com.au

Habitat zone

identifiers

labelled on

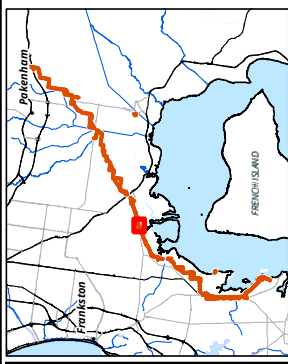
the figure

Western Port



Figure 9.14 Proposed removal of native vegetation

Western Port
Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55
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Biosis Pty Ltd
biosis.com.au
Habitat zone
identifiers
labelled on
the figure



Legend

- Impact area
- Proposed vegetation removal
- Kilometre point

Study area

- Pipeline Works

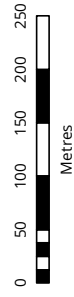
Proposed pipeline alignment

- Open - Cut
- Trenchless - Bore

Scattered trees

- Proposed to be retained
- Proposed to be removed

Figure 9.15 Proposed removal of native vegetation



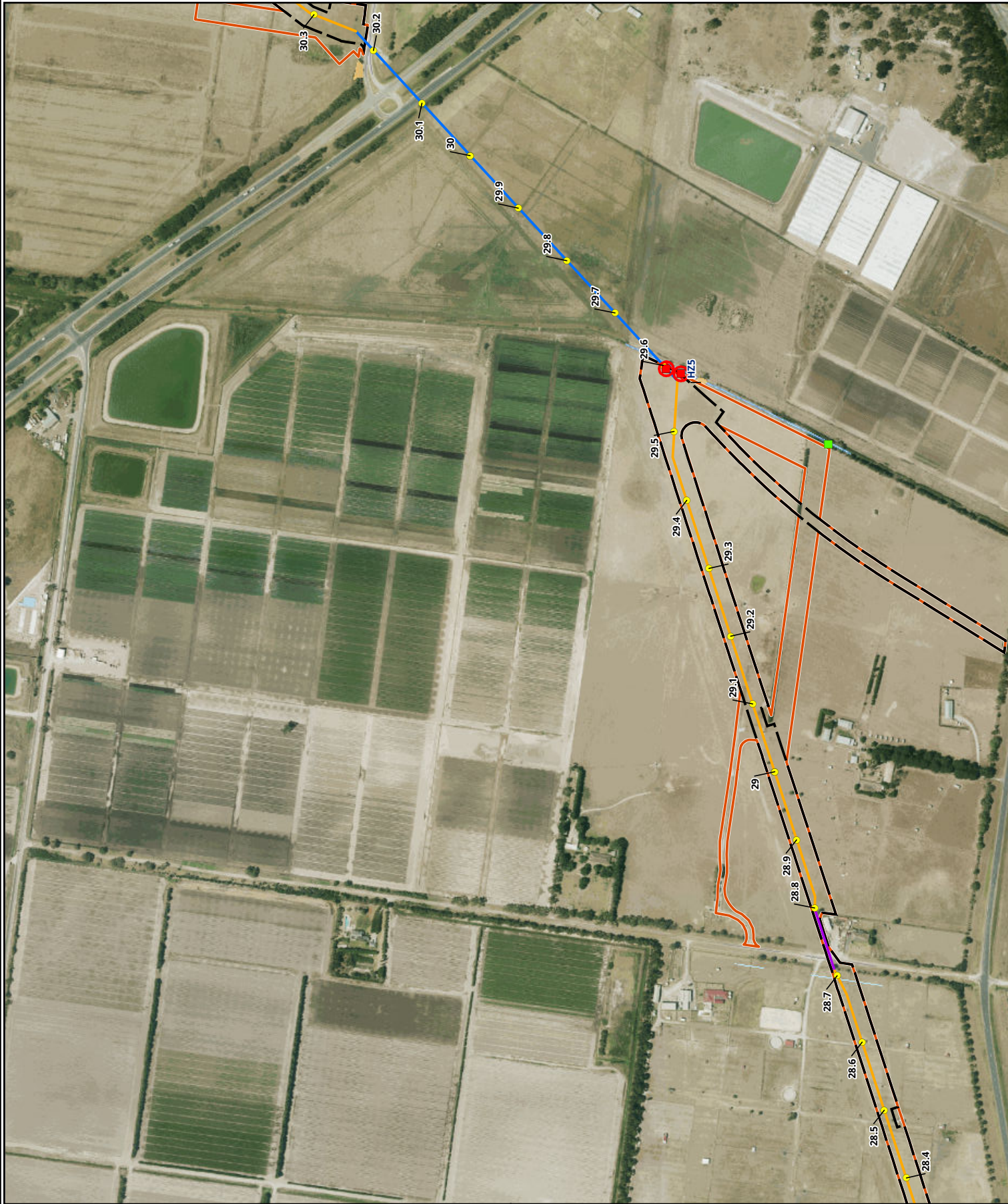
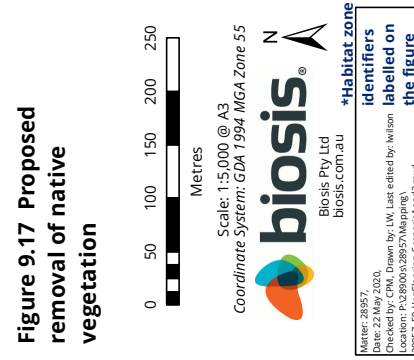
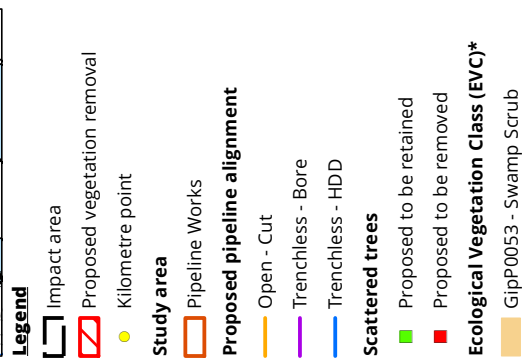
Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



*Habitat zone

Identifiers labelled on the figure







Legend

Impact area

Kilometre point

Study area

Pipeline Works

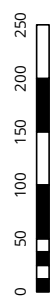
Proposed pipeline alignment

Open - Cut

Trenchless - HDD



Figure 9.19 Proposed removal of native vegetation



Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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*Habitat zone identifiers labelled on the figure

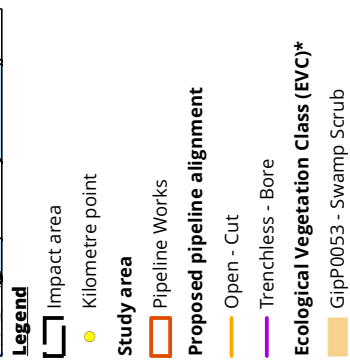
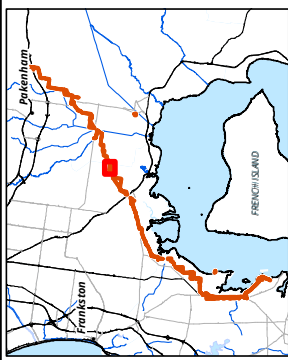
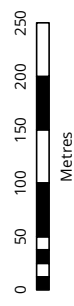


Figure 9.20 Proposed removal of native vegetation

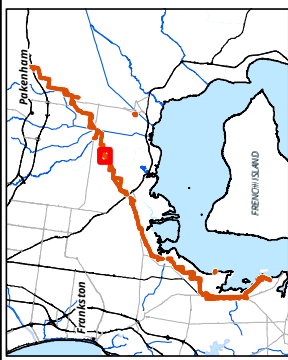


Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55
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Habitat zone identifiers labelled on the figure

Matrix: 28957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\289005\28957\Mapping\19957_P1_VegClearing_Scenario_land.mxd





Legend

- Impact area
- Kilometre point
- Study area**
- Pipeline Works
- Proposed pipeline alignment
- Open - Cut

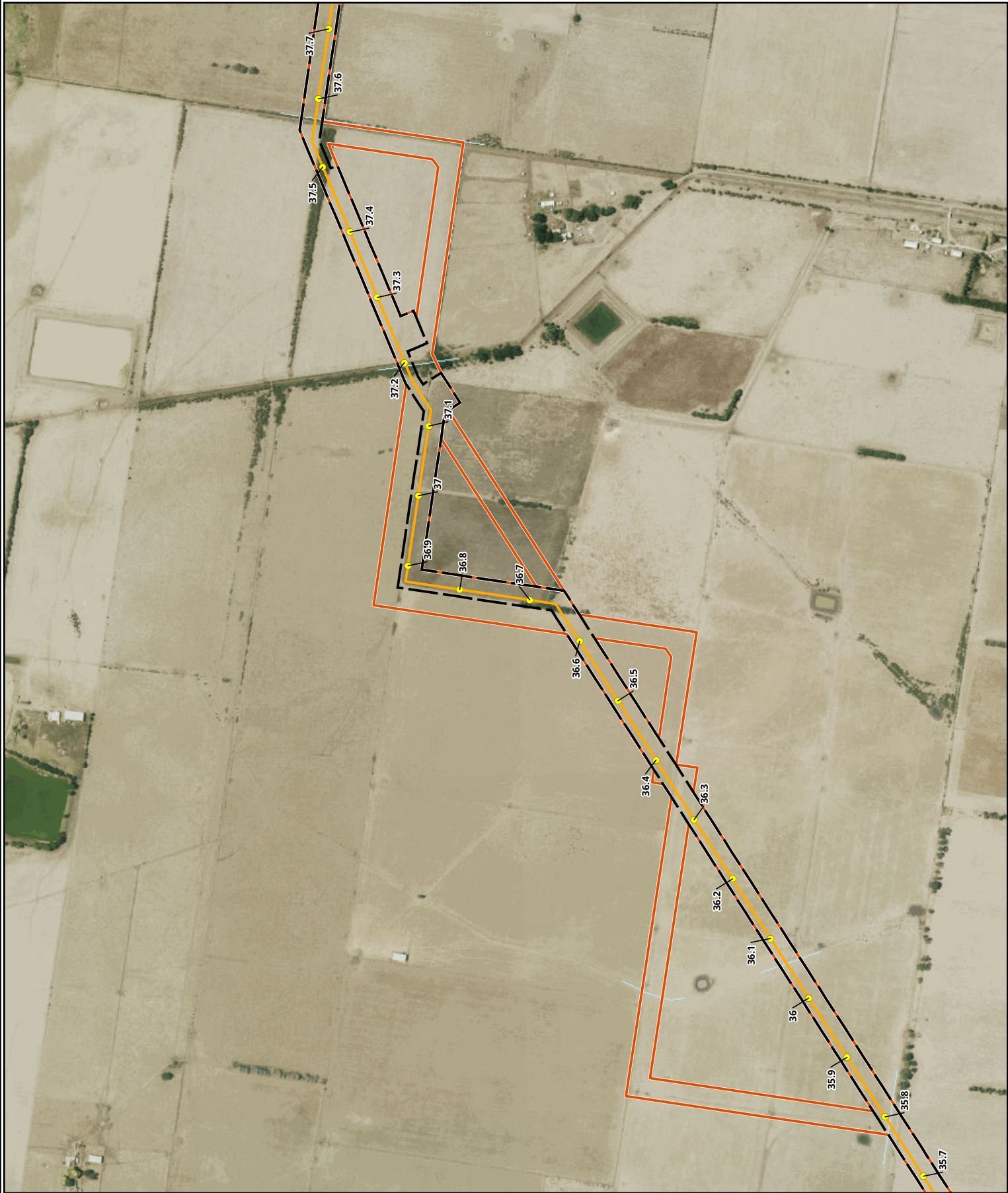
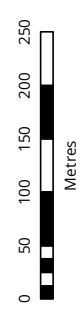


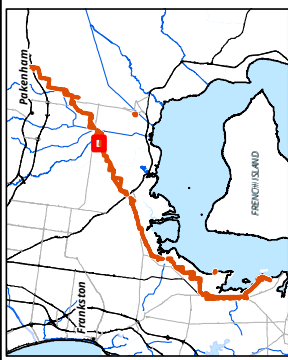
Figure 9.21 Proposed removal of native vegetation

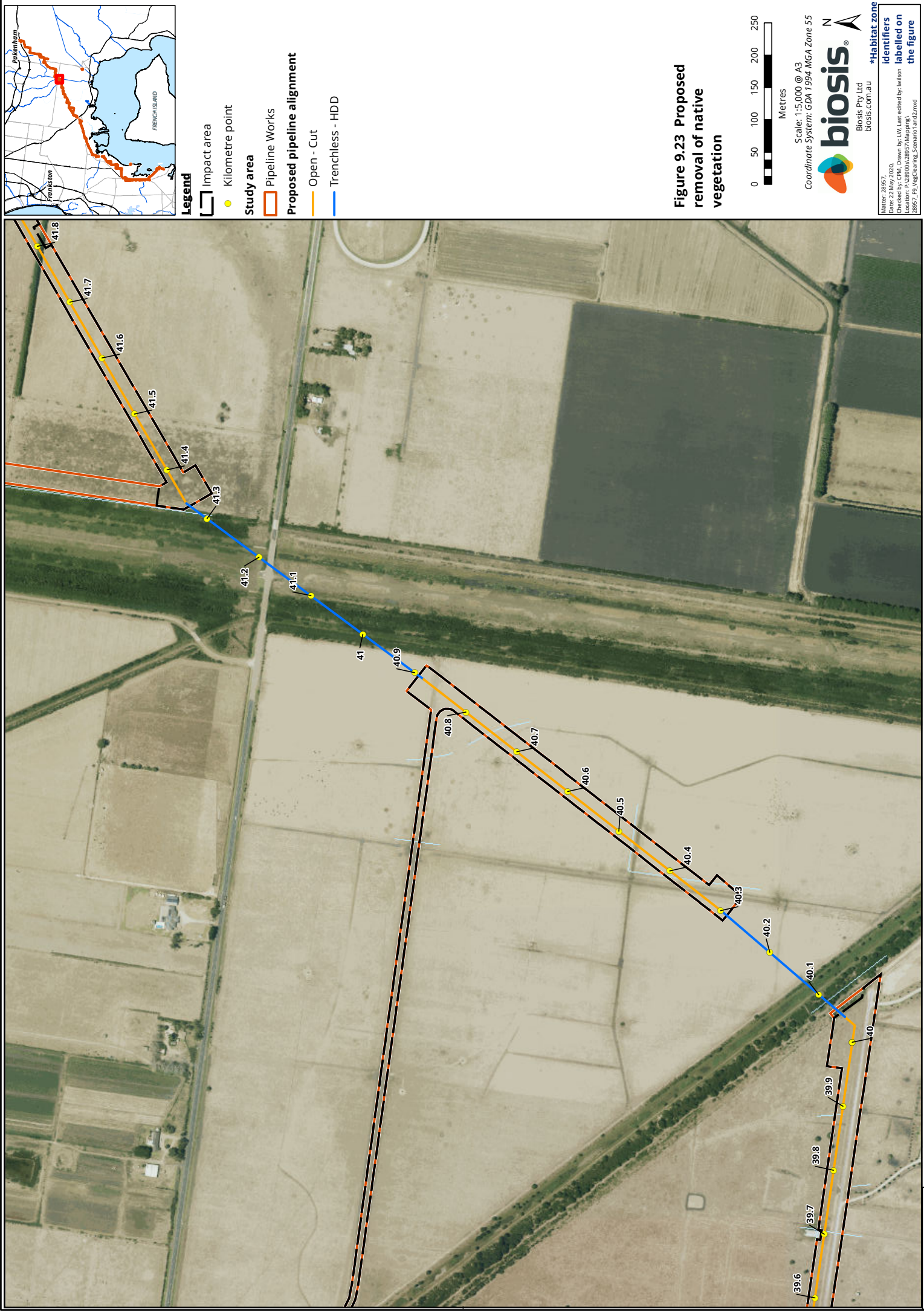


Scale: 1:5,000 @ A3
 Coordinate System: GDA 1994 MGA Zone 55
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Habitat zone
 identifiers
 labelled on
 the figure

Matrix: 39957
 Date: 22 May 2020
 Checked by: CPM, Drawn by: LW, Last edited by: Wilson
 Location: P:\389005\38957\Mapping\38957_P3_VegClearing_Scenario_Land.mxd





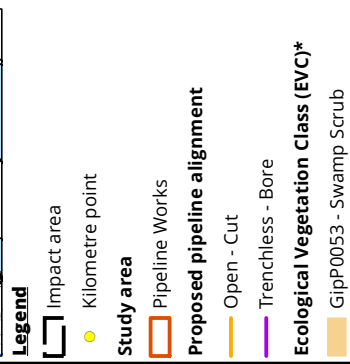
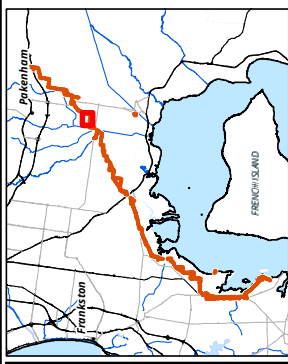
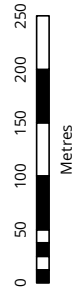
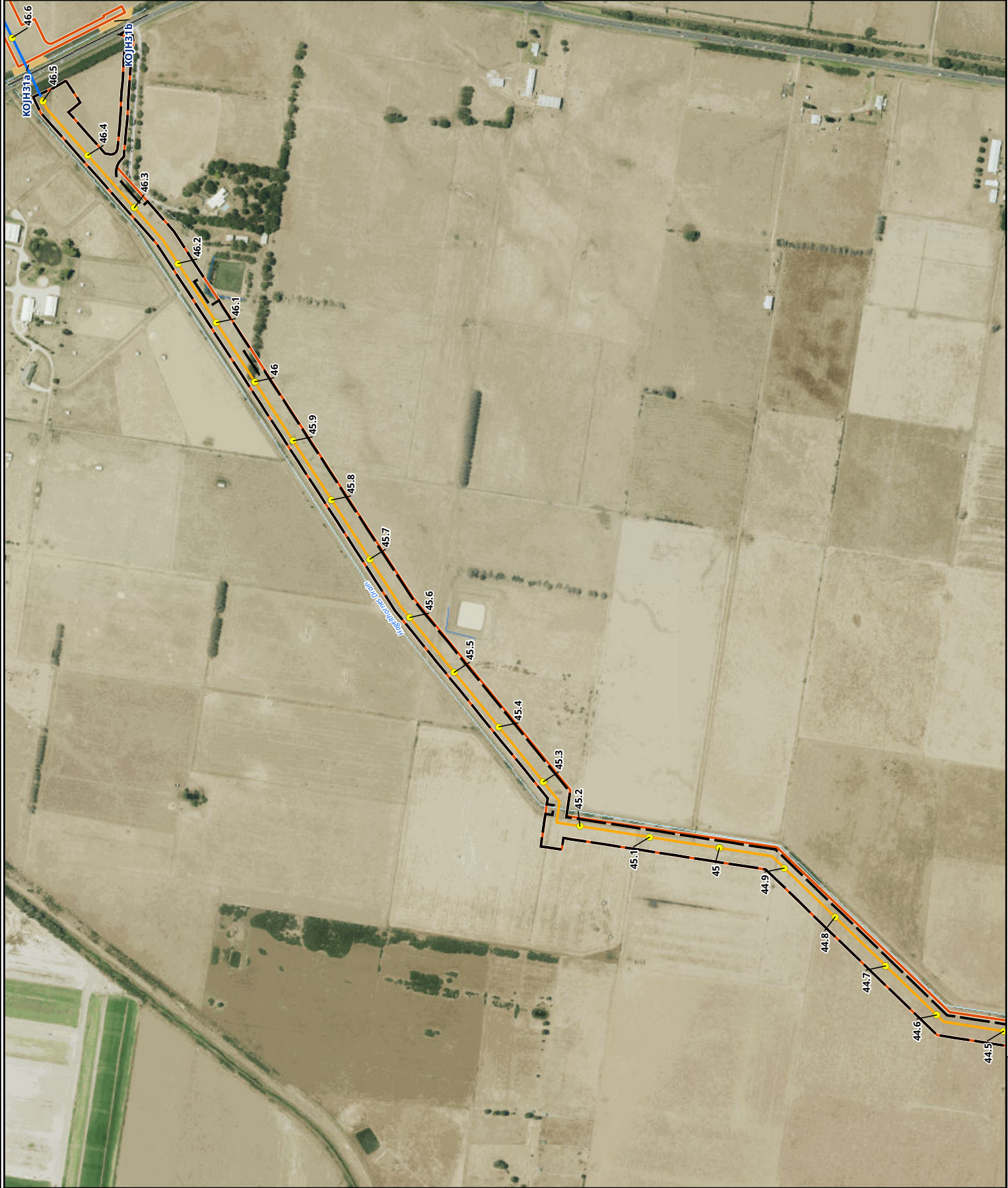
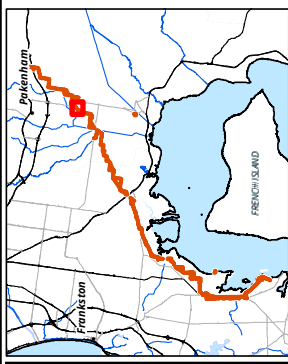


Figure 9.24 Proposed removal of native vegetation



*Habitat zone identifiers labelled on the figure

Matrix: 38957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\389005\38957\Mapping\9957_P3_VegClearing_Scenario_land.mxd



Legend

Impact area

Kilometre point

Study area

Pipeline Works

Proposed pipeline alignment

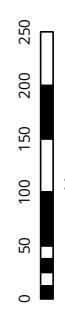
Open - Cut

Trenchless - HDD

Ecological Vegetation Class (EVC)*

GipP0053 - Swamp Scrub

Figure 9.25 Proposed removal of native vegetation

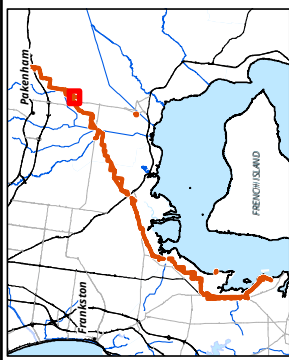


Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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***Habitat zone identifiers labelled on the figure**

Matrix: 38957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\389005\38957\Mapping\38957_P3_VegClearing_Scenario_Land.mxd



Legend

Impact area

Kilometre point

Study area

Pipeline Works

Proposed pipeline alignment

Open - Cut

Trenchless - HDD

Ecological Vegetation Class (EVC)*

GipP0053 - Swamp Scrub

GipP0821 - Tall Marsh

Figure 9.26 Proposed removal of native vegetation



Metres

Scale: 1:5,000 @ A3

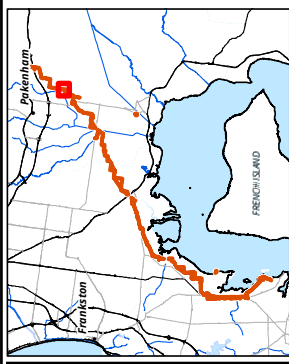
Coordinate System: GDA 1994 MGA Zone 55



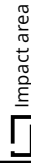
*Habitat zone identifiers labelled on the figure

Matrix: 38957
Date: 22 May 2020
Checked by: CHW, Drawn by: LW, Last edited by: Wilson
Location: P:\38905\38957\Mapping\38957_P3_VegClearing_Scenario_Land.mxd

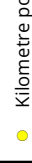




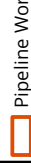
Legend



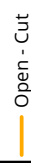
Impact area



Proposed vegetation removal



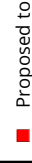
Kilometre point



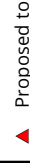
Study area



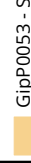
Pipeline Works



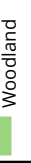
Proposed pipeline alignment



Open - Cut



Trenchless - HDD



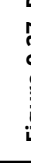
Scattered trees



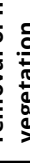
Proposed to be retained



Proposed to be removed



Large patch trees



Proposed to be removed



Ecological Vegetation Class (EVC)*



GipP0053 - Swamp Scrub

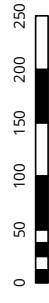


GipP0083 - Swampy Riparian



Woodland

Figure 9.27 Proposed removal of native vegetation



Metres

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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*Habitat zone

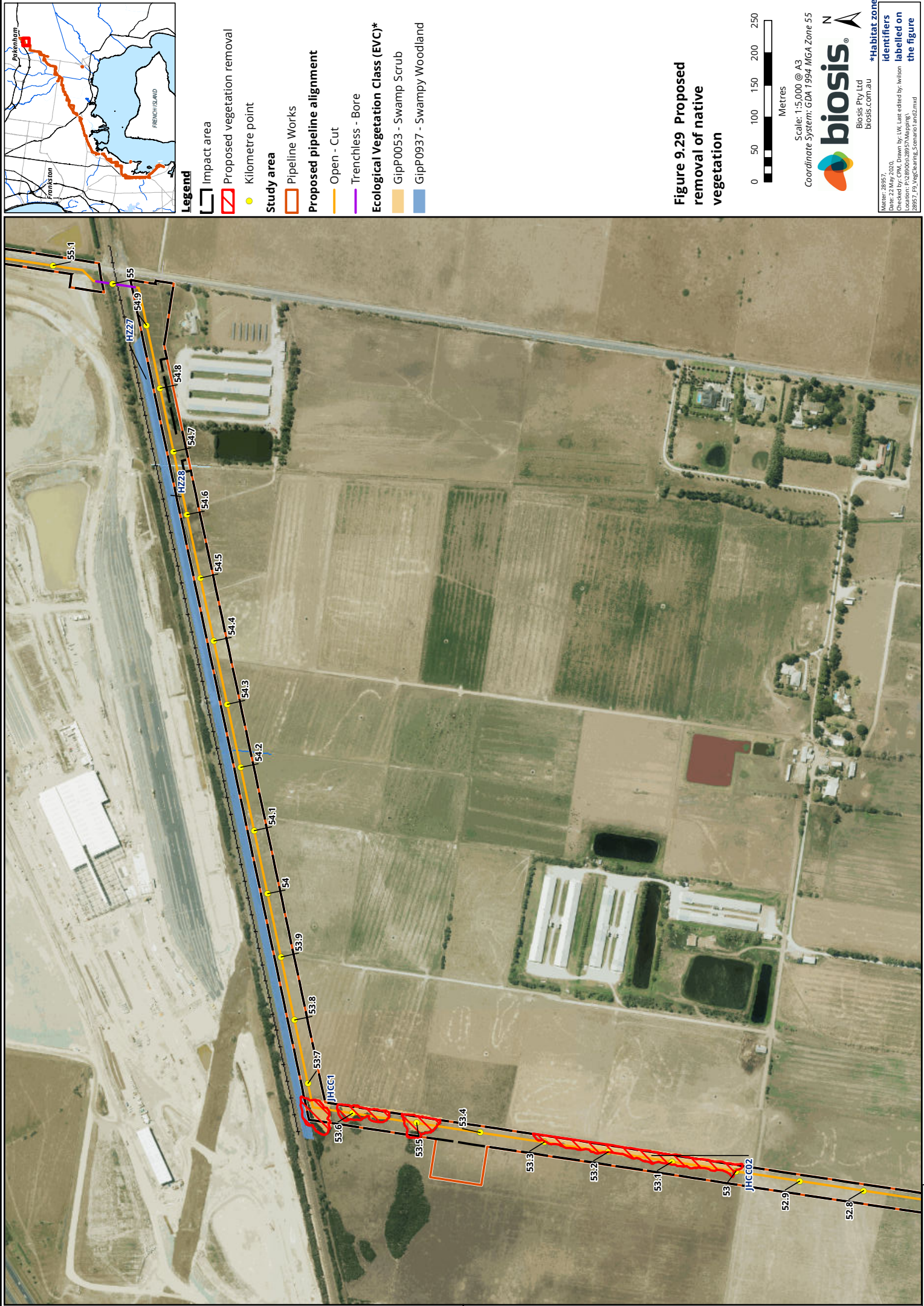
Identifiers

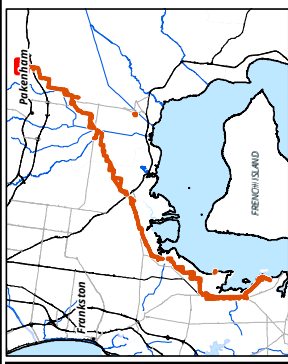
labelled on

the figure

Location: P:\389005\38957\Mapping\

9957_P_VegClearing_Scenario_land.mxd





Legend

Impact area

Kilometre point

Study area

Pipeline Works

Proposed pipeline alignment

Open - Cut

Trenchless - Bore



Figure 9.31 Proposed removal of native vegetation

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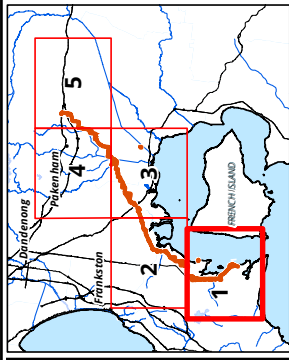
biosis.com.au

Habitat zone

identifiers

labelled on

the figure



- Legend**
- Search area
 - Local government area
 - Victorian Biodiversity Atlas (VBA) flora record DELWP (2017b)
 - Study area
 - Pipeline Works
 - Gas Import Jetty Works
 - Ramsar site
 - Western Port

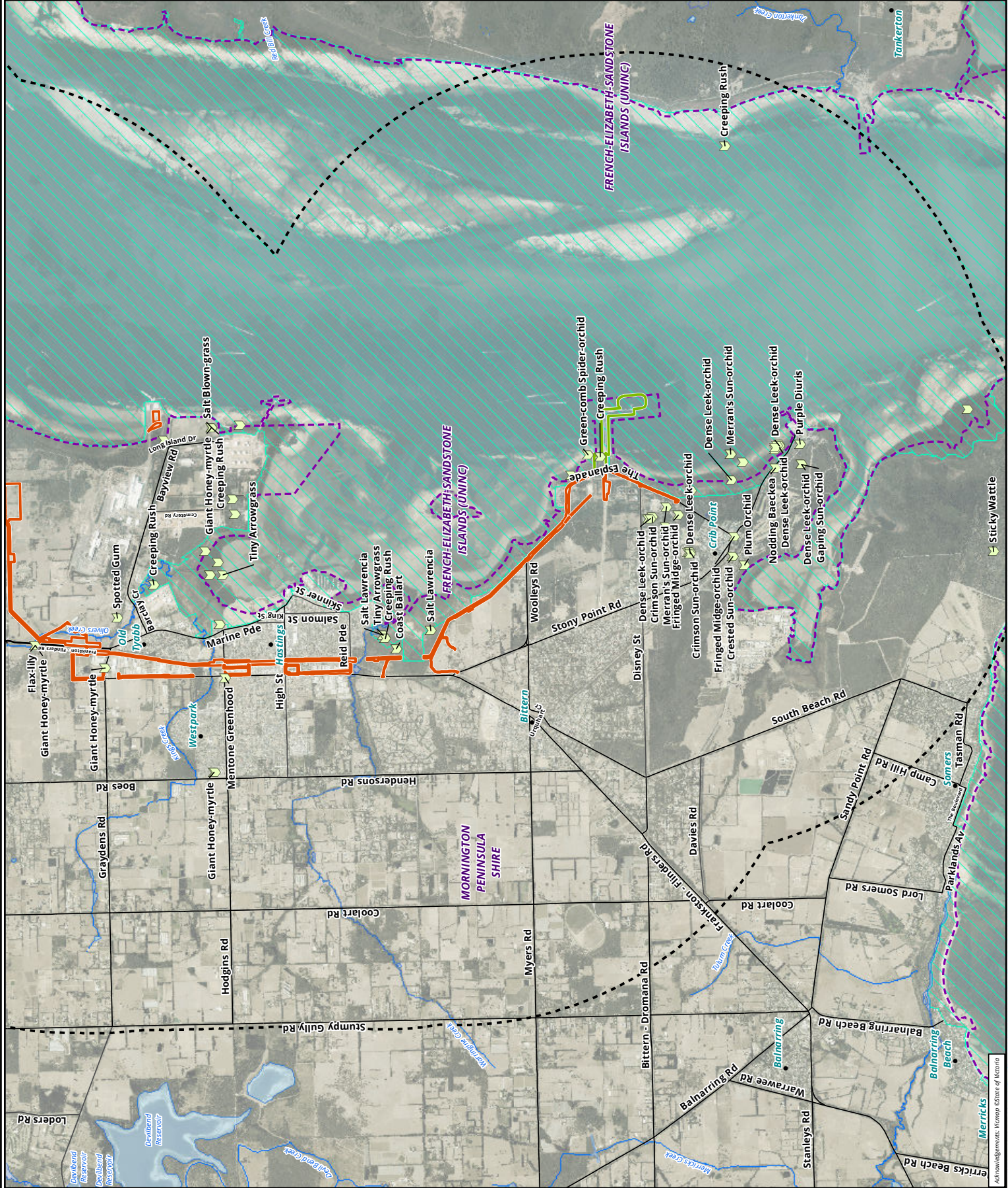
Figure 11.1 Significant flora within the project search area

Scale: 1:50,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

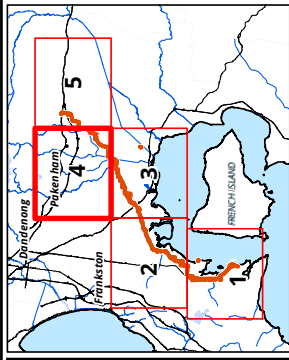
0 0.4 0.8 1.2 1.6 2
Kilometers

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Matrix: 28957
Date: 22 May 2020
Checked by: CHW, Drawn by: LW, Last edited by: Wilson
Location: P:\0389005\28957\Mapping\19957_F11_Significant Flora.mxd



Acknowledgements: Mornington Peninsula Shire



- Legend**
- Search area
 - Local government area
 - Victorian Biodiversity Atlas (VBA) flora record DELWP (2017b)
 - Study area**
 - Pipeline Works
 - Gas Import Jetty Works

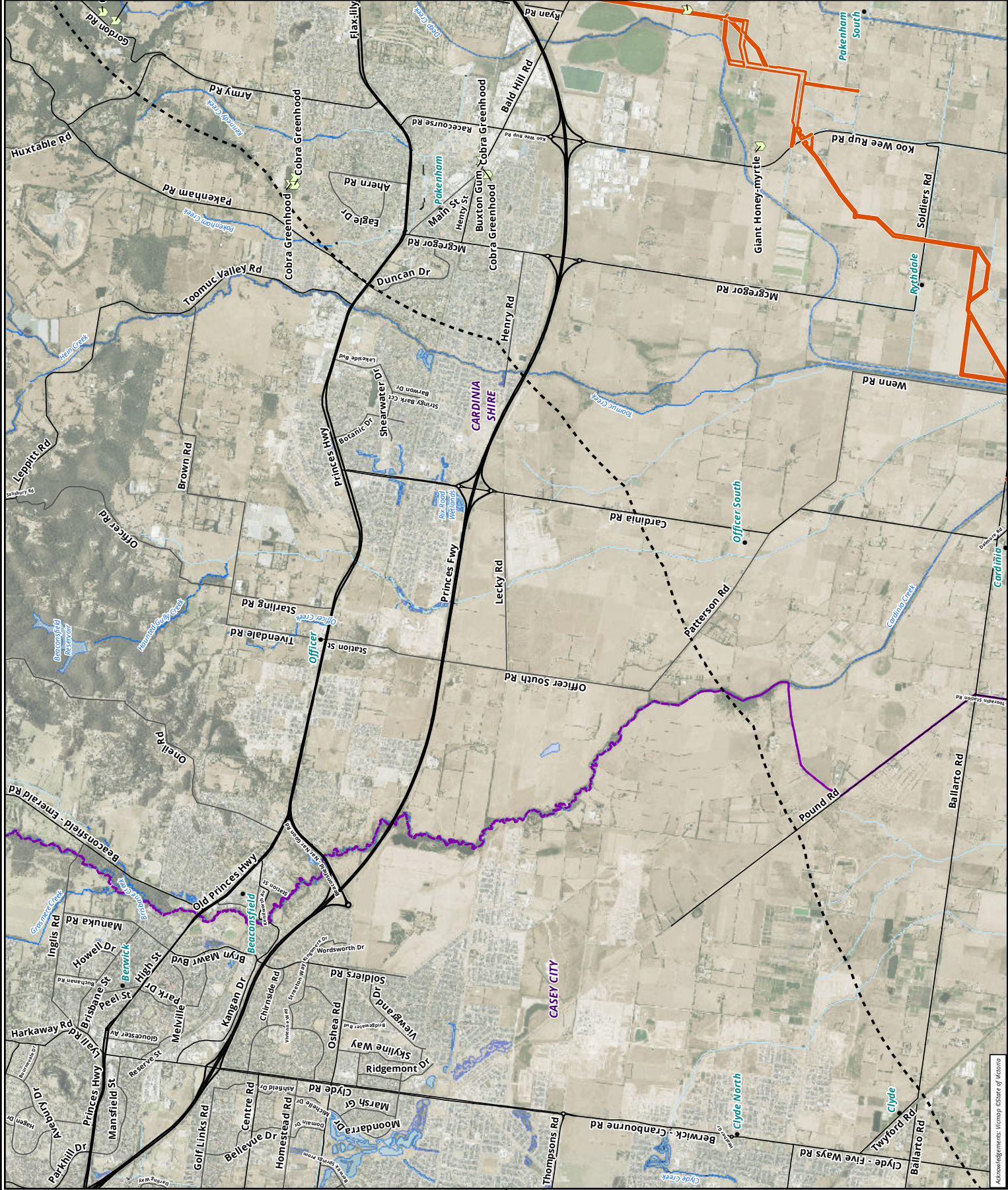
Figure 11.4 Significant flora within the project search area



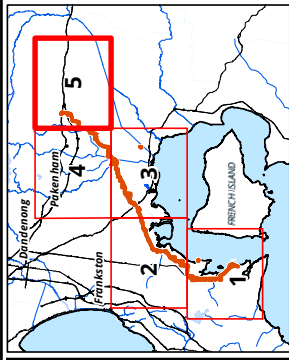
Scale: 1:50,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



Matrix: 39457
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\0389005\38957\Mapping\038957_F1_Significant Flora.mxd



Acknowledgements: Victoria, State of Victoria



Legend

Search area

Local government area

Victorian Biodiversity Atlas (VBA)

flora record DELWP (2017b)

Study area

Pipeline Works

Gas Import Jetty Works

**Figure 11.5 Significant
flora within the project
search area**



Scale: 1:50,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



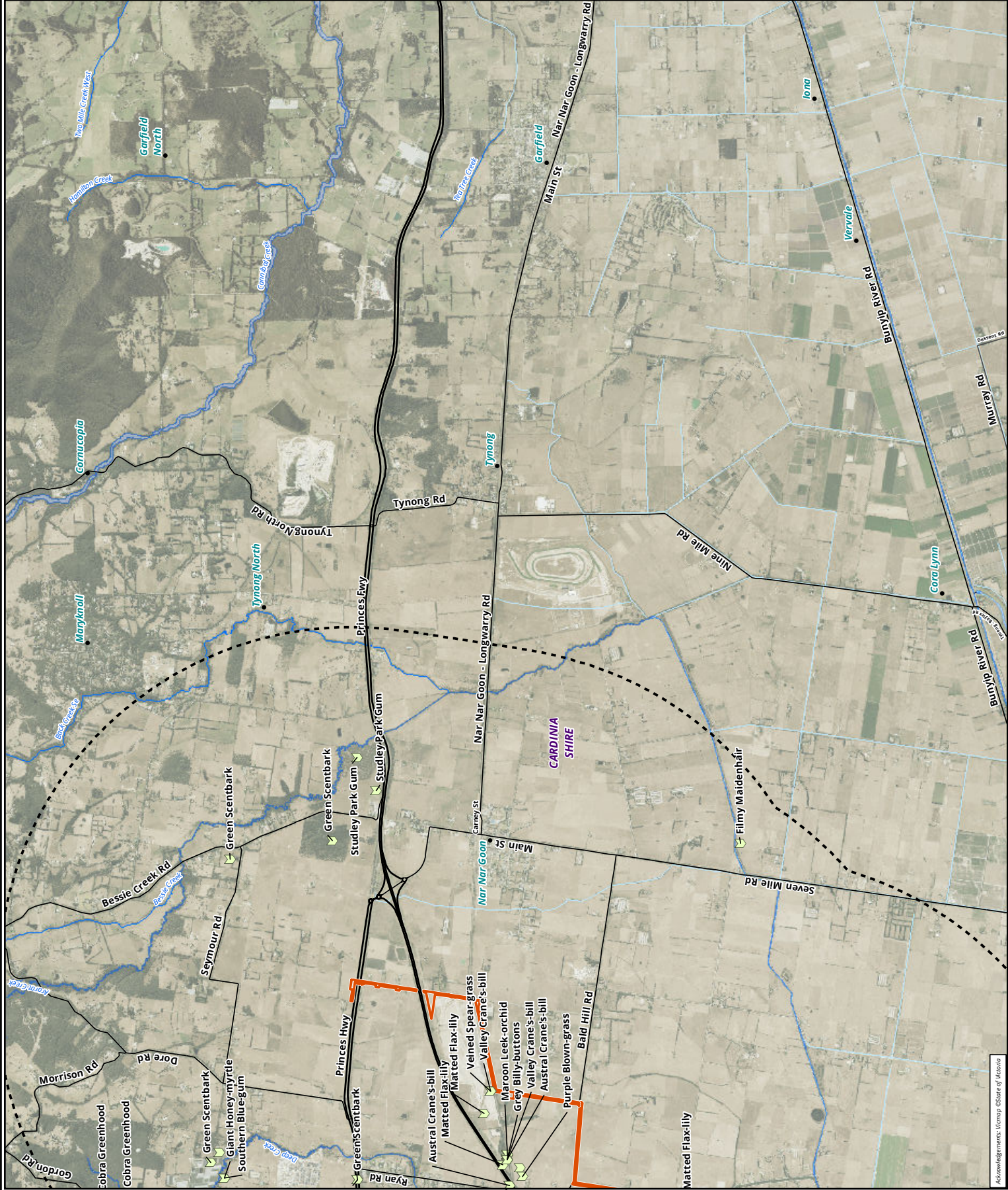
Map: 39957

Date: 22 May 2020

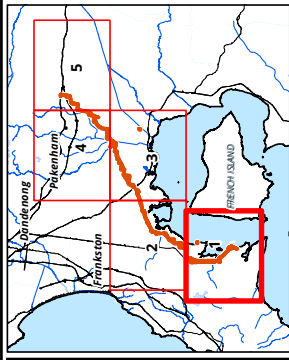
Checked by: CPW, Drawn by: LW, Last edited by: Wilson

Location: P:\039005\3957\Mapping\

3957_F1_Significant Flora.mxd



Acknowledgements: Victoria State of Victoria



Legend

--- Search area

Study area

Pipeline Works

Gas Import Jetty Works

Fauna records

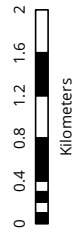
DELWP advisory listed

FFG act listed

Ramsar site

Western Port

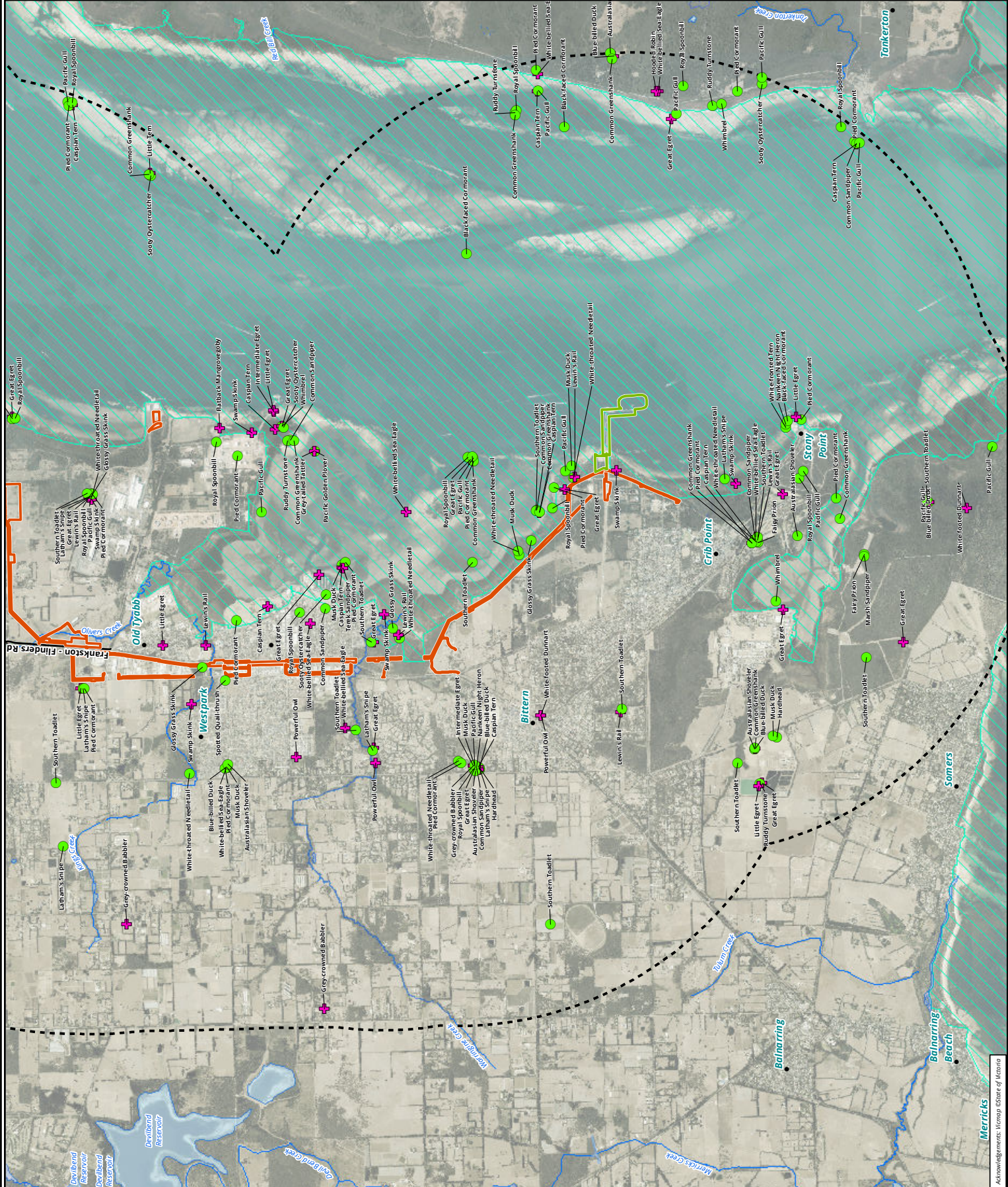
Figure 12.1 State significant fauna within the project search area



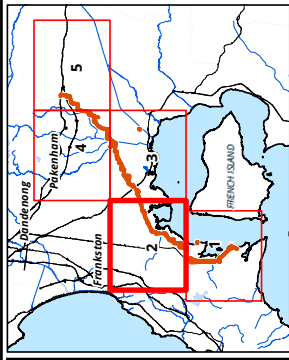
Scale: 1:50,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



Matrix: 289x7
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\030005\28957\Mapping\03057_F12_StateSignif_Fauna.mxd



Acknowledgements: Vermap, State of Victoria



Legend

- Search area
- Study area
- Pipeline Works
- Fauna records
- DELWP advisory listed
- FFG act listed
- Ramsar site
- Western Port

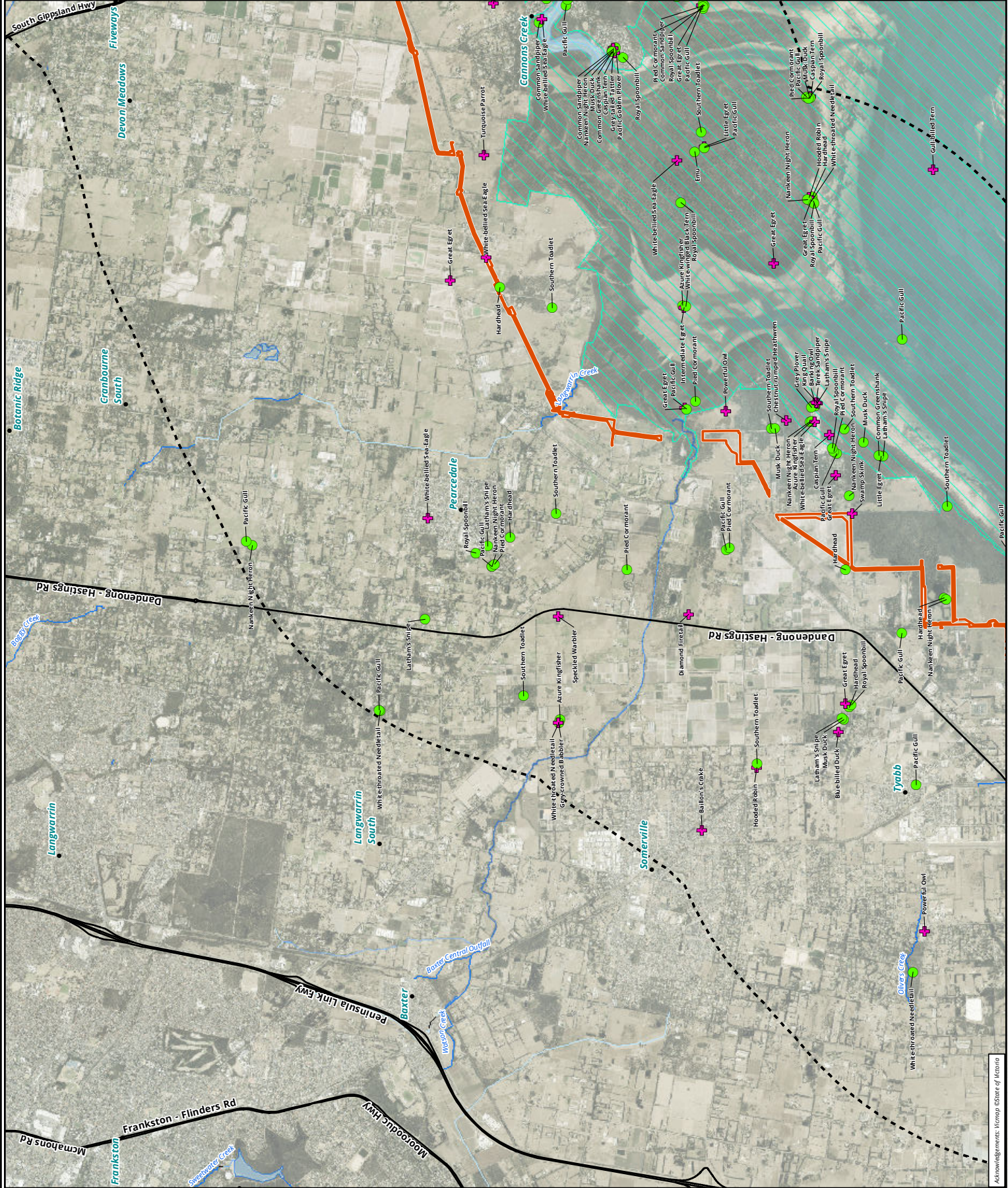
Figure 12.2 State significant fauna within the project search area



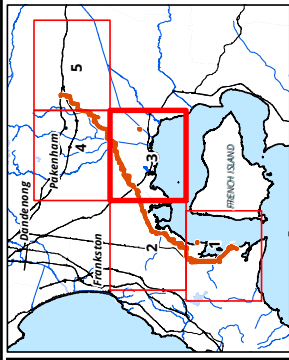
Scale: 1:50,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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Matrix: 38957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\039005\38957\Mapping\03957_F12_StateListed_Fauna.mxd



Acknowledgements: Victoria State of Marine



Legend

Search area

Study area

Pipeline Works

Fauna records

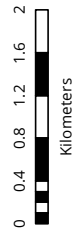
DELWP advisory listed

FFG act listed

Ramsar site

Western Port

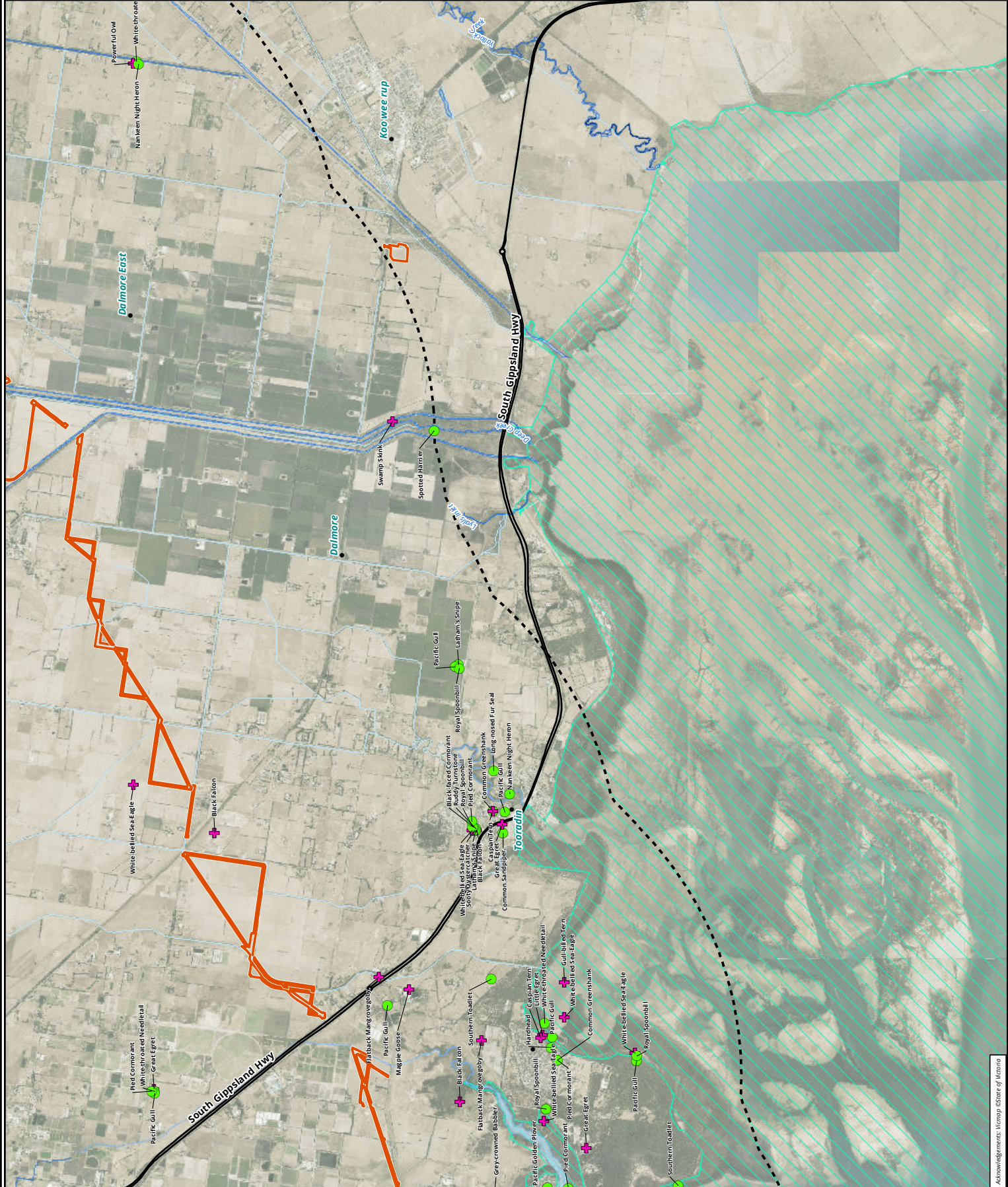
Figure 12.3 State significant fauna within the project search area



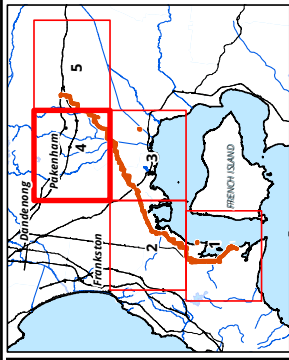
Scale: 1:50,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



Matrix: 38957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\0389005\38957\Mapping\18957_F12_StateSignif_Fauna.mxd



Acknowledgements: Vermap, State of Victoria



Legend

- Search area
- Study area
- Pipeline Works
- Fauna records**
 - DELWP advisory listed
 - FFG act listed
- Ramsar site**
 - Western Port

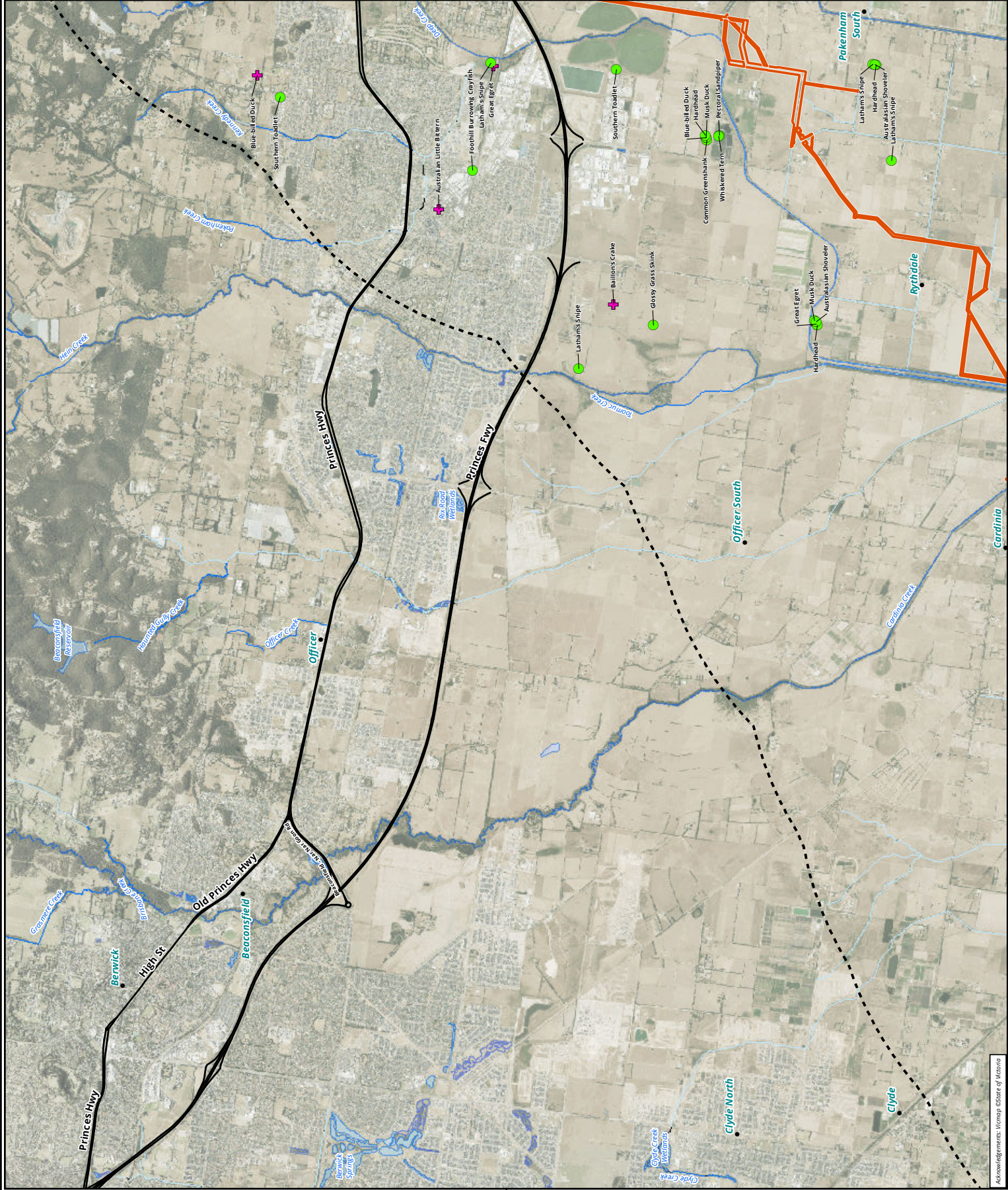
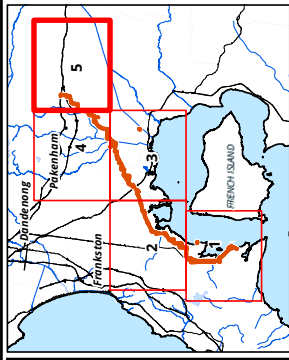


Figure 12.4 State significant fauna within the project search area



Scale: 1:50,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

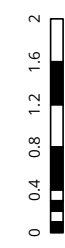




Legend

- Search area
- Study area
- Pipeline Works
- Fauna records
- DELWP advisory listed
- FFG act listed
- Ramsar site
- Western Port

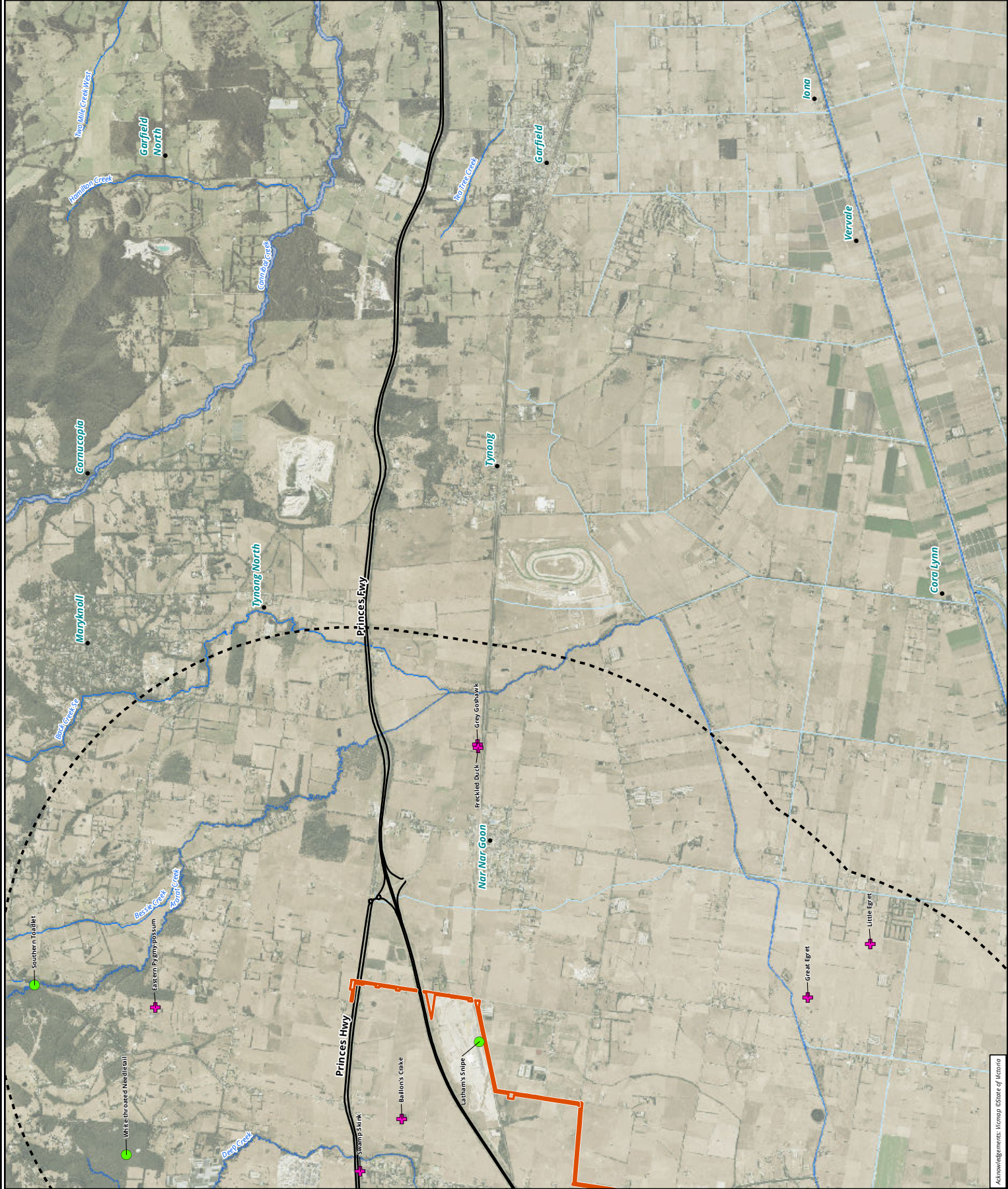
Figure 12.5 State significant fauna within the project search area



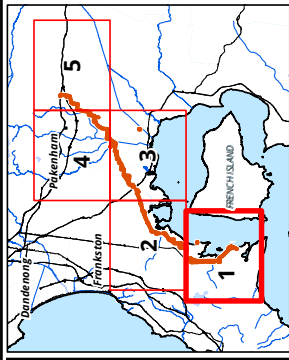
Scale: 1:50,000 @ A3
 Coordinate System: GDA 1994 MGA Zone 55



Matrix: 38957
 Date: 22 May 2020
 Created by: CPW, Drawn by: LW, Last edited by: Wilson
 Location: P:\389005\38957\Mapping\19957_F12_StateSignificant_Fauna.mxd



Acknowledgements: Vermap, State of Victoria



Legend

Search area

Study area

Pipeline Works

Gas Import Jetty Works

EPBC Act 1999

Eastern Curlew

Southern Brown Bandicoot

Other species

Ramsar site

Western Port

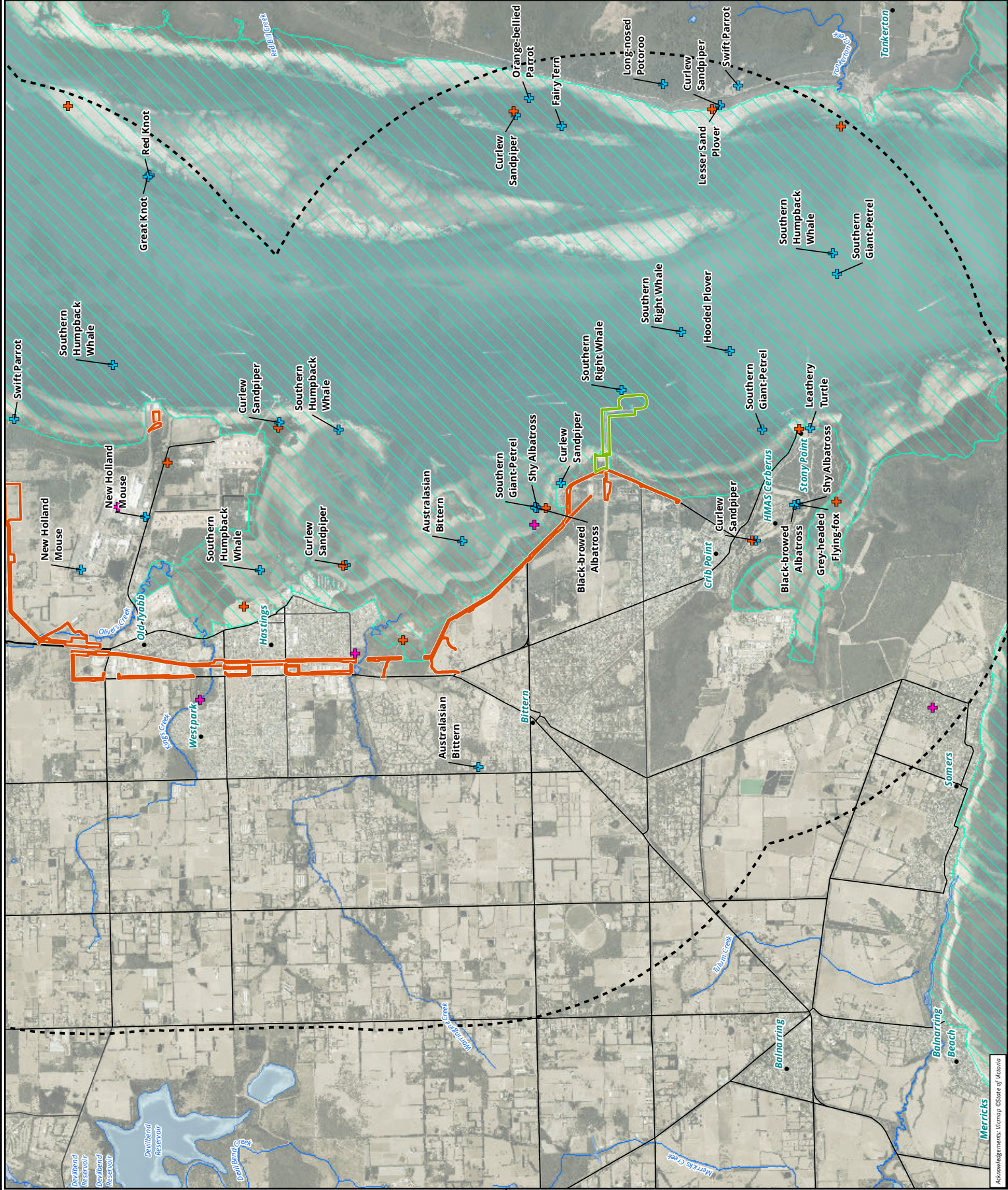
Figure 13.1 Nationally significant fauna within the project search area



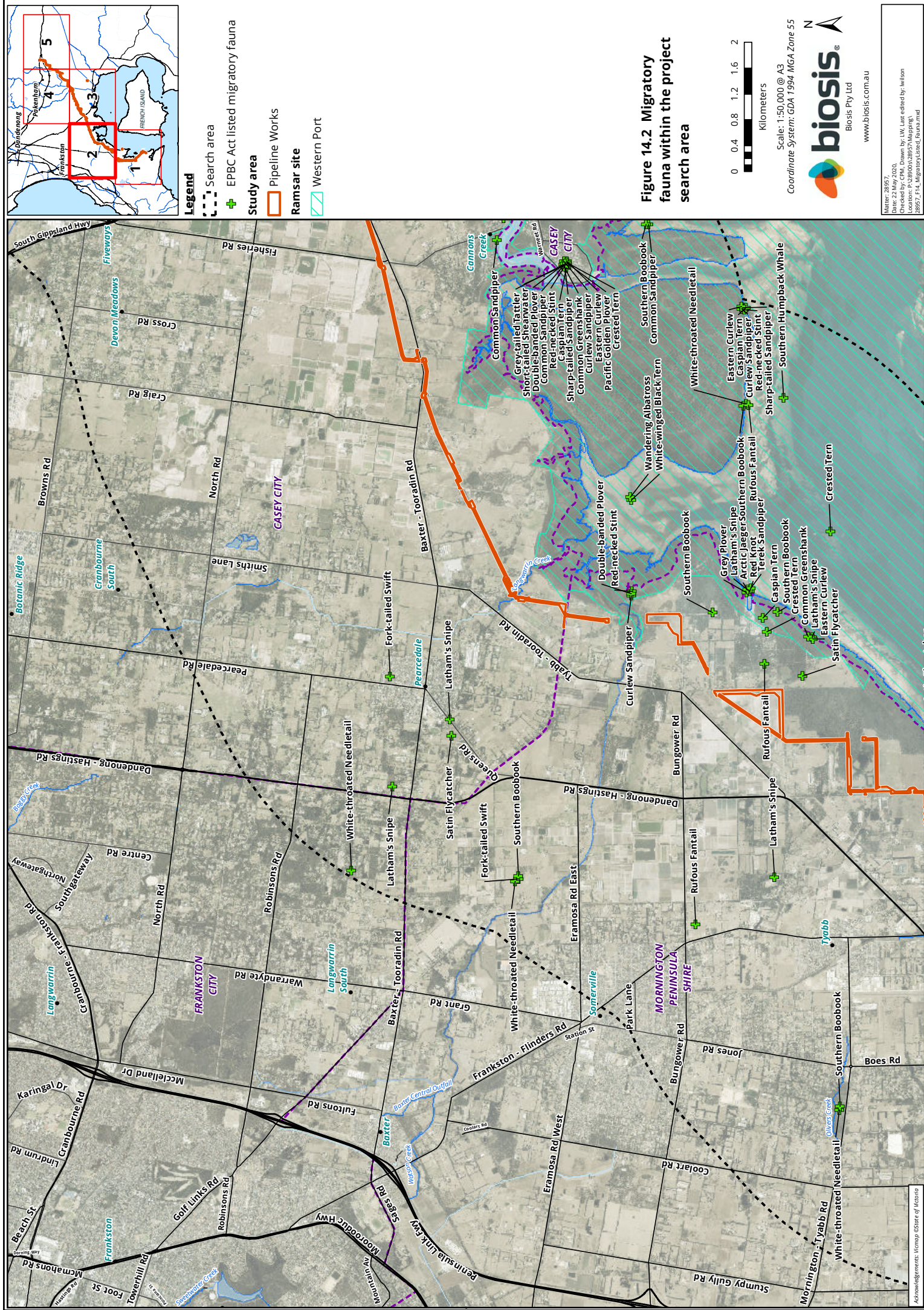
Scale: 1:50,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

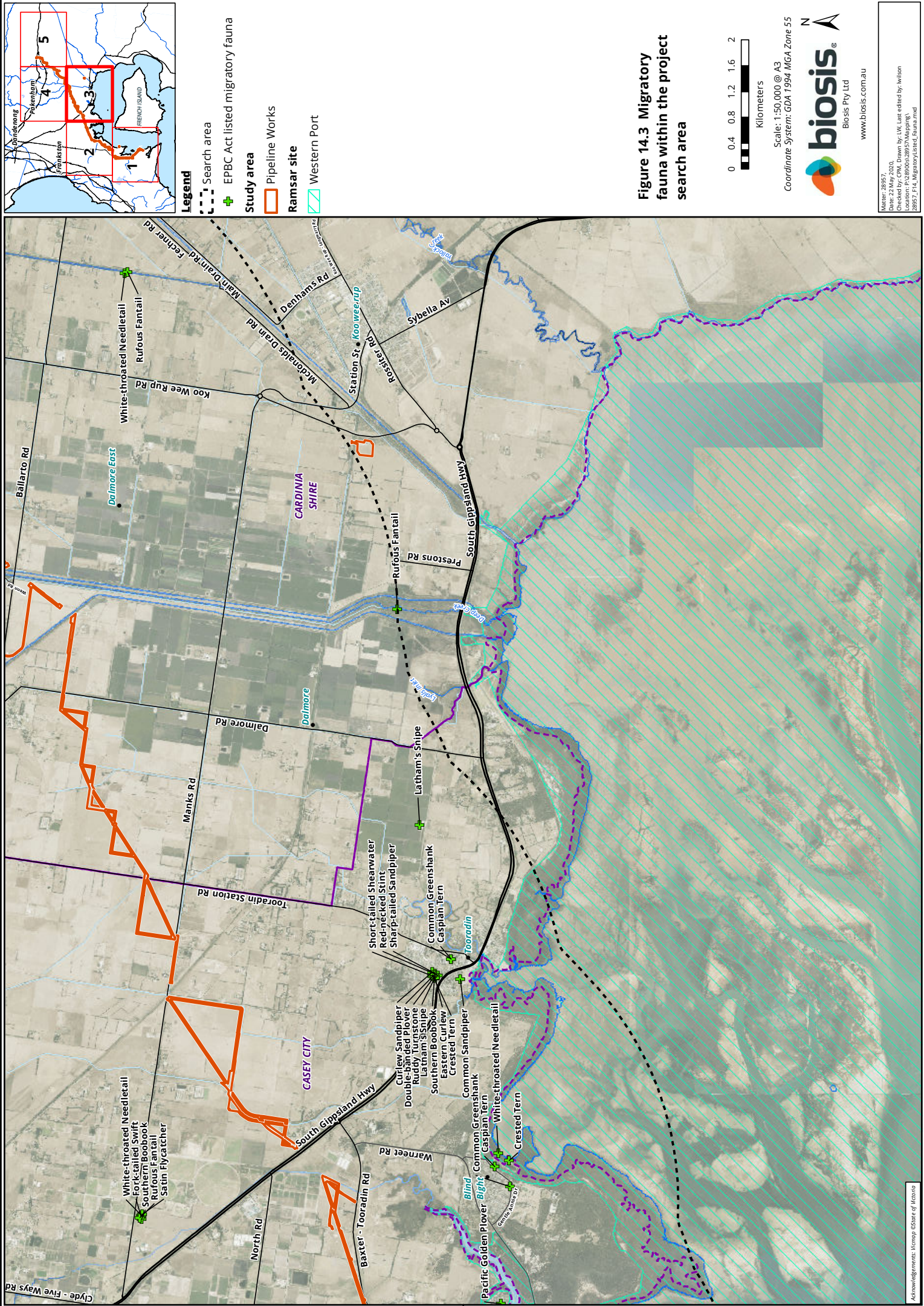


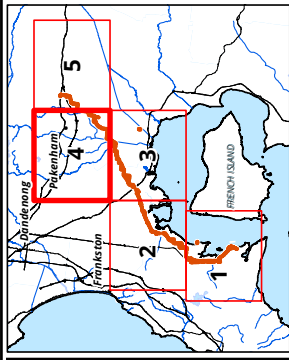
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Date: 22 May 2020
Created by: CHW, Drawn by: LW, Last edited by: Wilson
Location: P:\0389005\38957\Mapping\19957_F13_Nationally_Signed_Fauna.mxd



Acknowledgements: Vermap, Office of Marine







Legend

Search area

EPBC Act listed migratory fauna

Study area

Pipeline Works

Figure 14.4 Migratory fauna within the project search area



Scale: 1:50,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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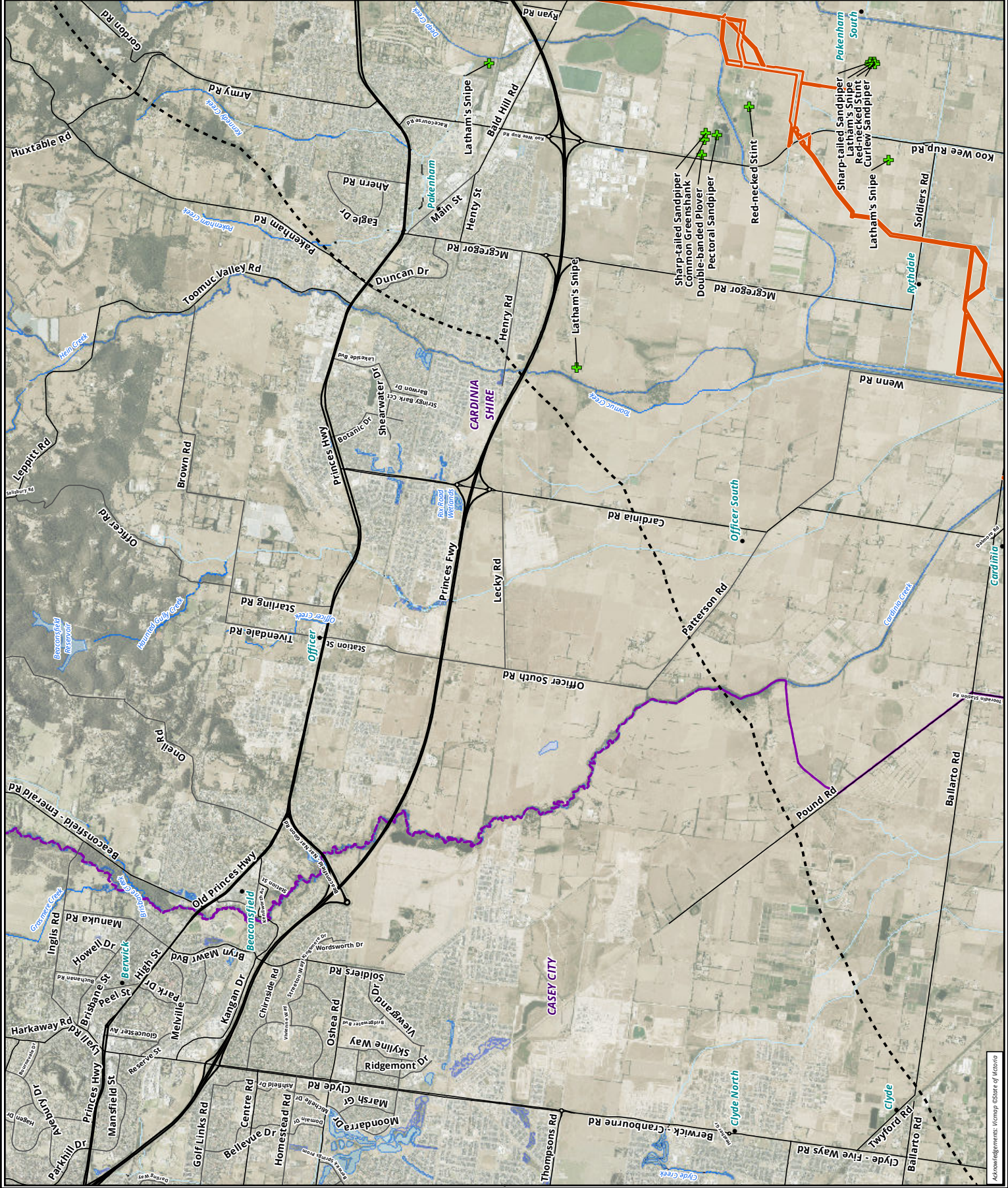
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Date: 22 May 2020

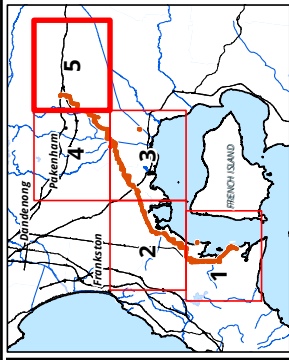
Created by: CPW, Drawn by: LW, Last edited by: Wilson

Location: P:\0389005\38957\Mapping\

38957_F14_MigratoryListed_Fauna.mxd



Acknowledgements: Venns, © State of Victoria



Legend

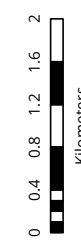
--- Search area

+ EPBC Act listed migratory fauna

Study area

▭ Pipeline Works

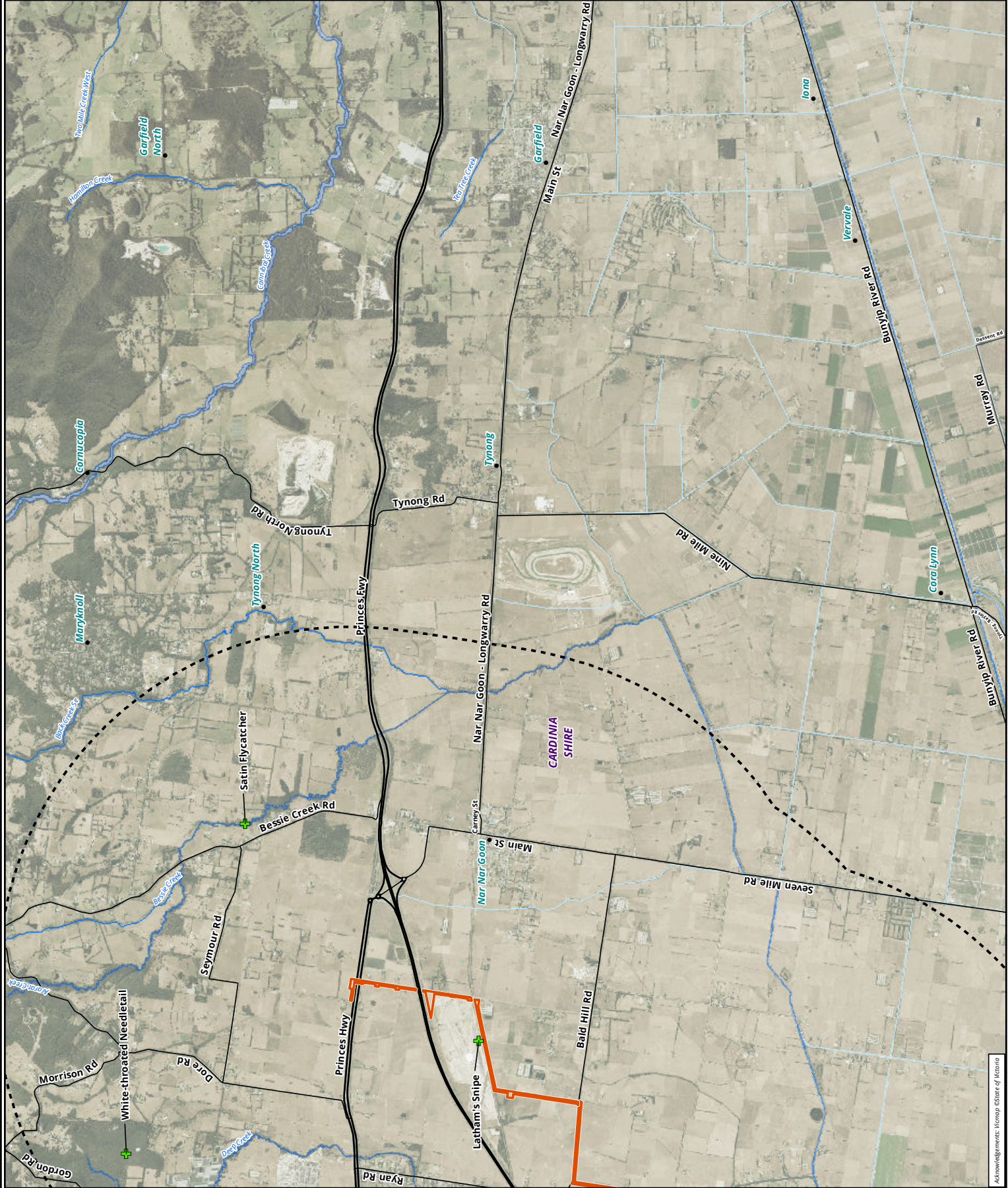
Figure 14.5 Migratory fauna within the project search area



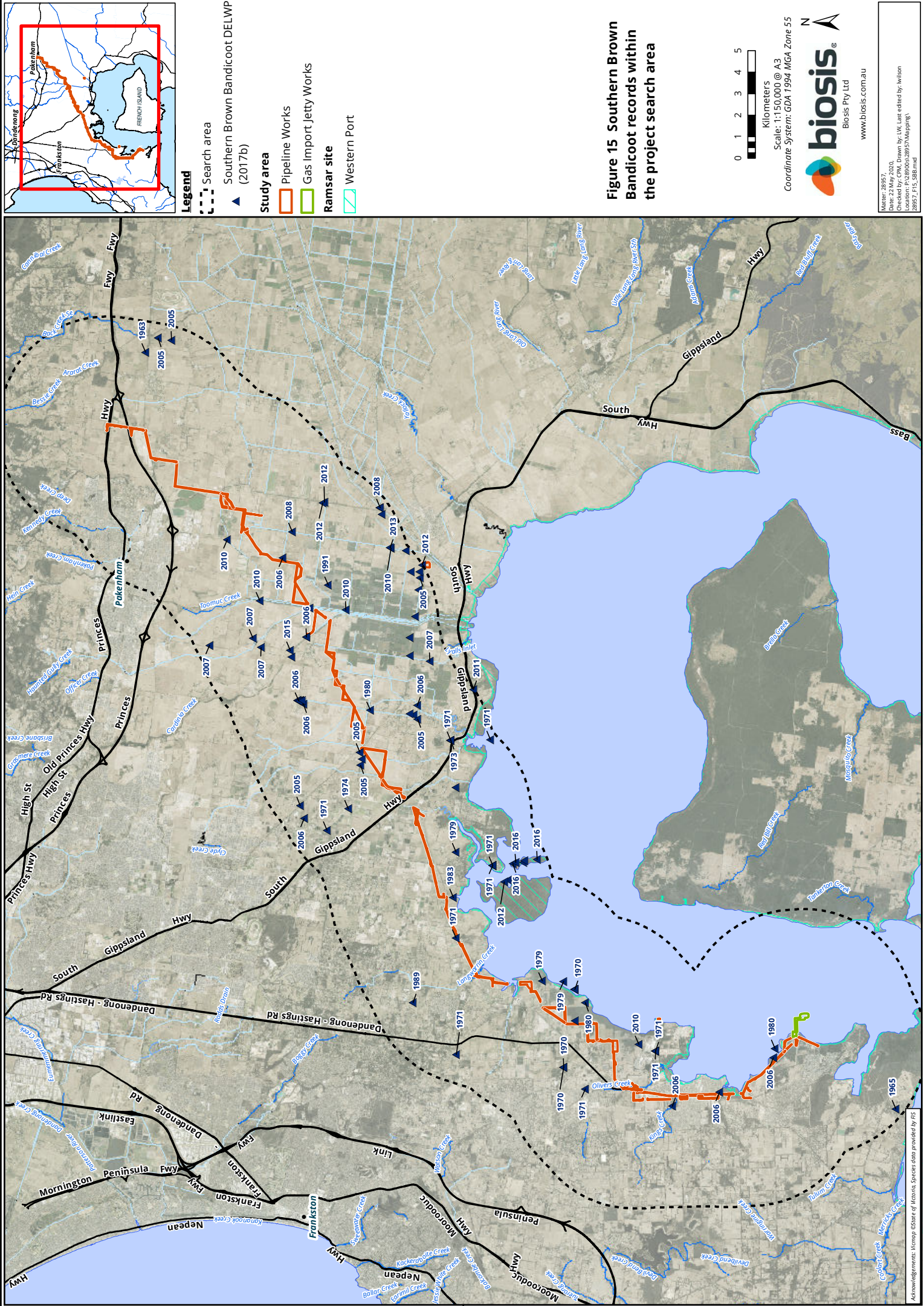
Scale: 1:50,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



Matrix: 38957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\0389005\38957\Mapping\19957_F14_MigratoryListedFauna.mxd

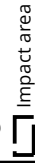


Acknowledgements: Vermap, State of Victoria





Legend

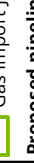


Impact area

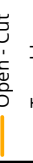


SBB habitat

Study area



Pipeline Works



Gas Import Jetty Works

Proposed pipeline alignment



Open - Cut



Trenchless - Bore



Trenchless - HDD

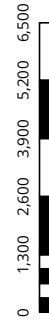


Ramsar site



Western Port

Figure 16.1 Southern Brown Bandicoot habitat within the impact area - overview



Meters

Scale: 1:119,900 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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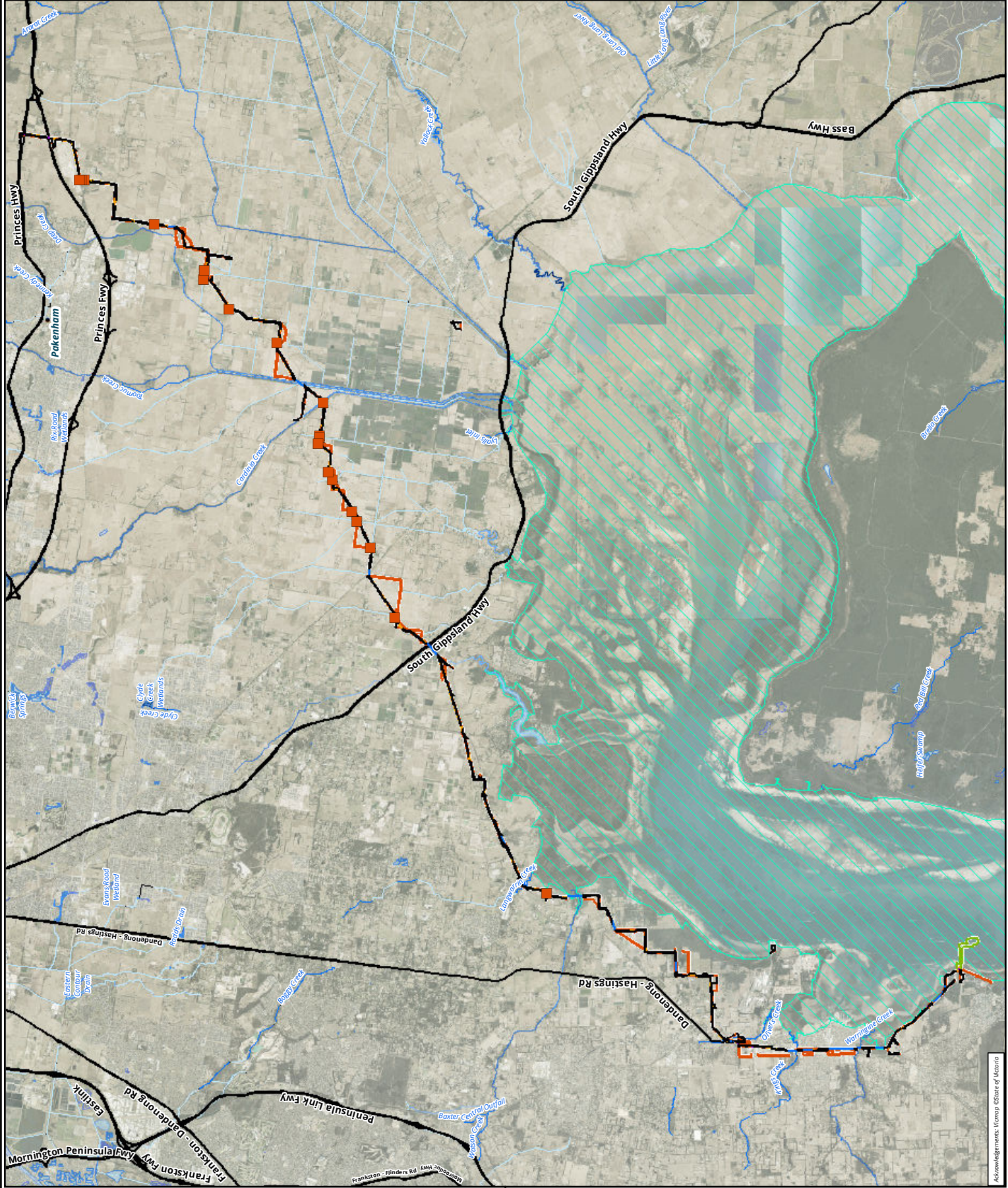
www.biosis.com.au

Matrix: 38957

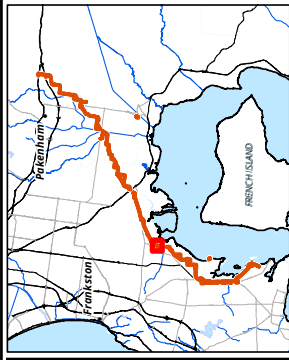
Date: 22 May 2020

Checked by: CHW, Drawn by: LW, Last edited by: JWilson

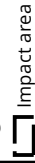
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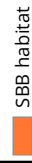
Acknowledgements: Verraag, Centre of Marine



Legend

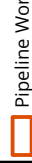


Impact area



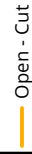
SBB habitat

Study area



Pipeline Works

Proposed pipeline alignment



Open - Cut



Trenchless - HDD

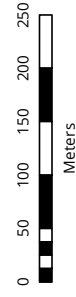


Ramsar site



Western Port

Figure 16.2 Southern Brown Bandicoot habitat within the impact area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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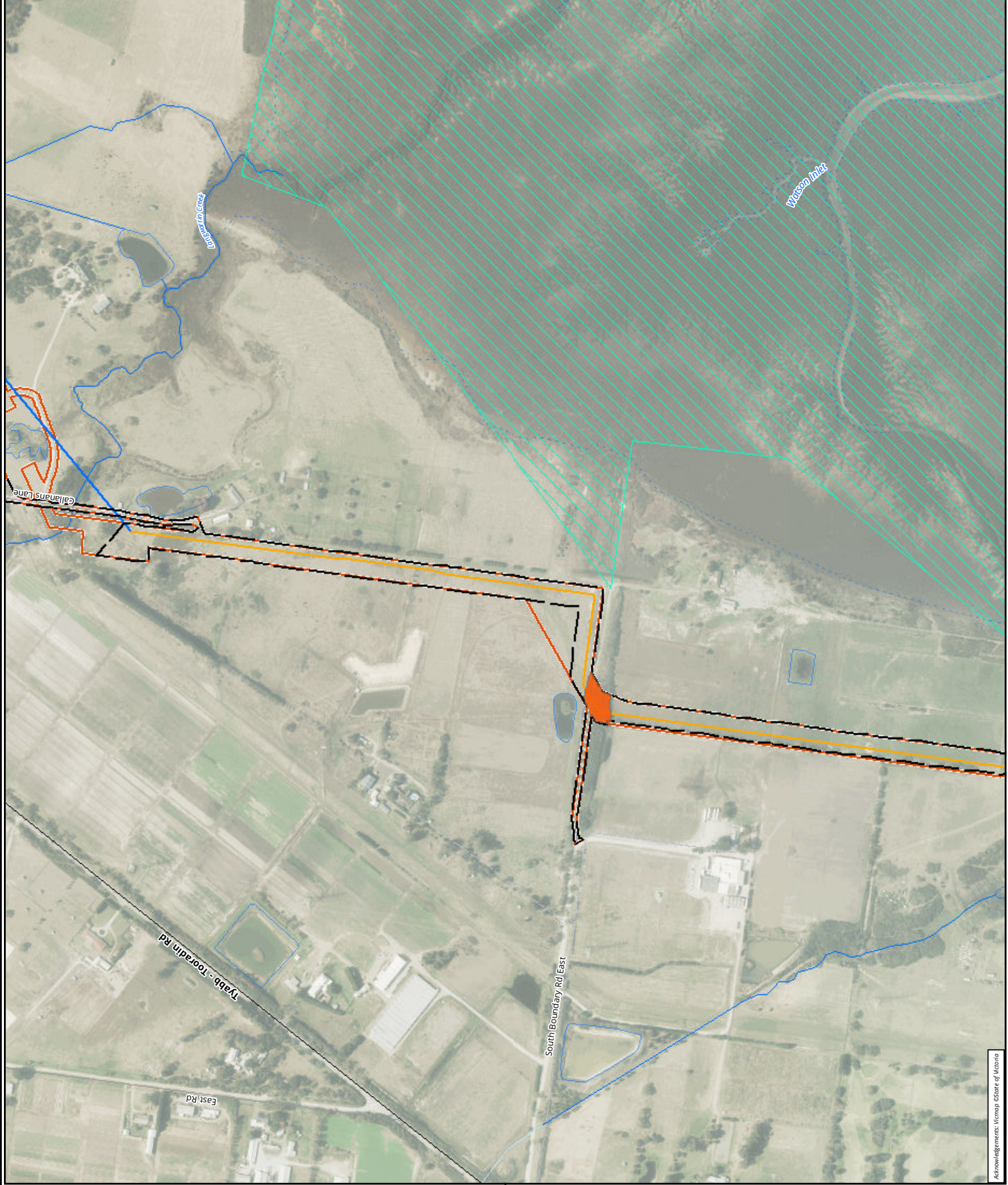
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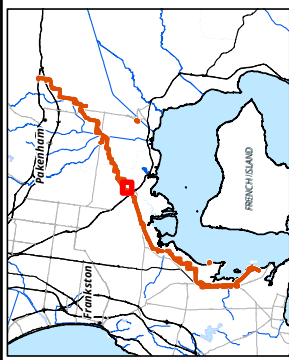
Date: 22 May 2020

Checked by: CHW, Drawn by: LW, Last edited by: Wilson

Location: P:\389505\38957\Mapping\

38957_F16_SBBHabitatMapSeries.mxd





Legend

Impact area

SBB habitat

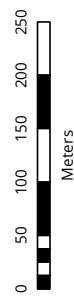
Study area

Pipeline Works

Proposed pipeline alignment

Open - Cut

Figure 16.3 Southern Brown Bandicoot habitat within the impact area



Scale: 1:5,000 @ A3

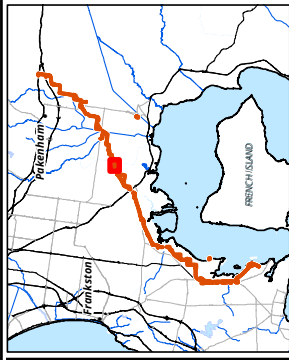
Coordinate System: GDA 1994 MGA Zone 55



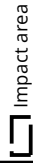
Matrix: 38957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\389005\38957\Mapping\38957_F16_SBBHabitatMapSeries.mxd



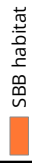
Acknowledgements: Vermap, State of Victoria



Legend

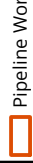


Impact area



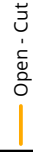
SBB habitat

Study area



Pipeline Works

Proposed pipeline alignment

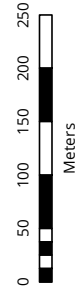


Open - Cut



Trenchless - Bore

**Figure 16.4 Southern
Brown Bandicoot habitat
within the impact area**



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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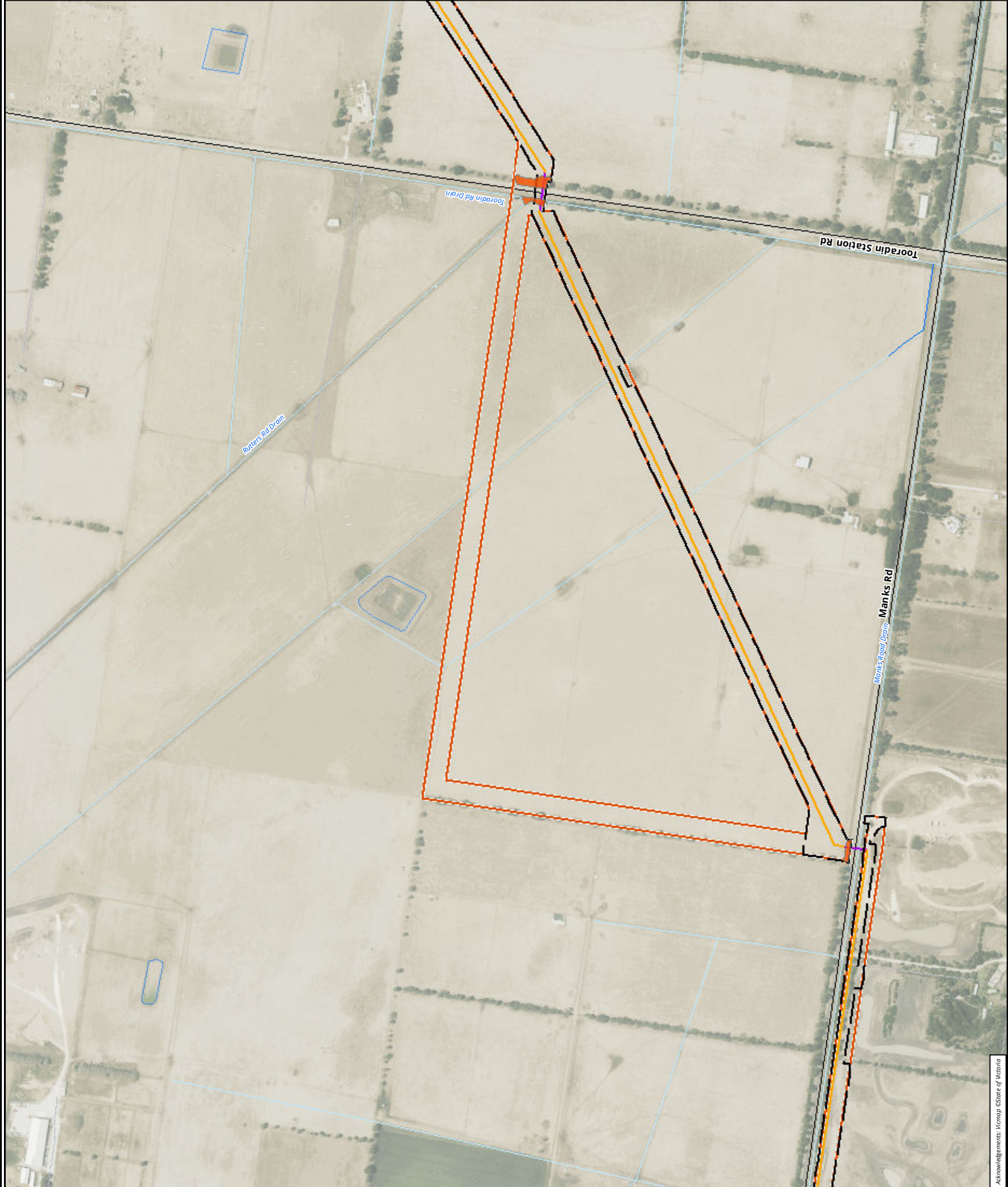
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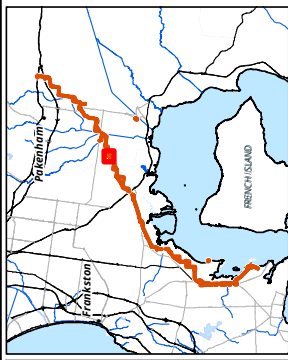
Date: 22 May 2020

Checked by: CHW, Drawn by: LW, Last edited by: Wilson

Location: P:\389505\38957\Mapping\

38957_F16_SBBHabitatMapSeries.mxd

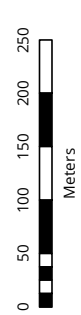




Legend

- Impact area
- SBB habitat
- Study area**
- Pipeline Works
- Proposed pipeline alignment**
- Open - Cut

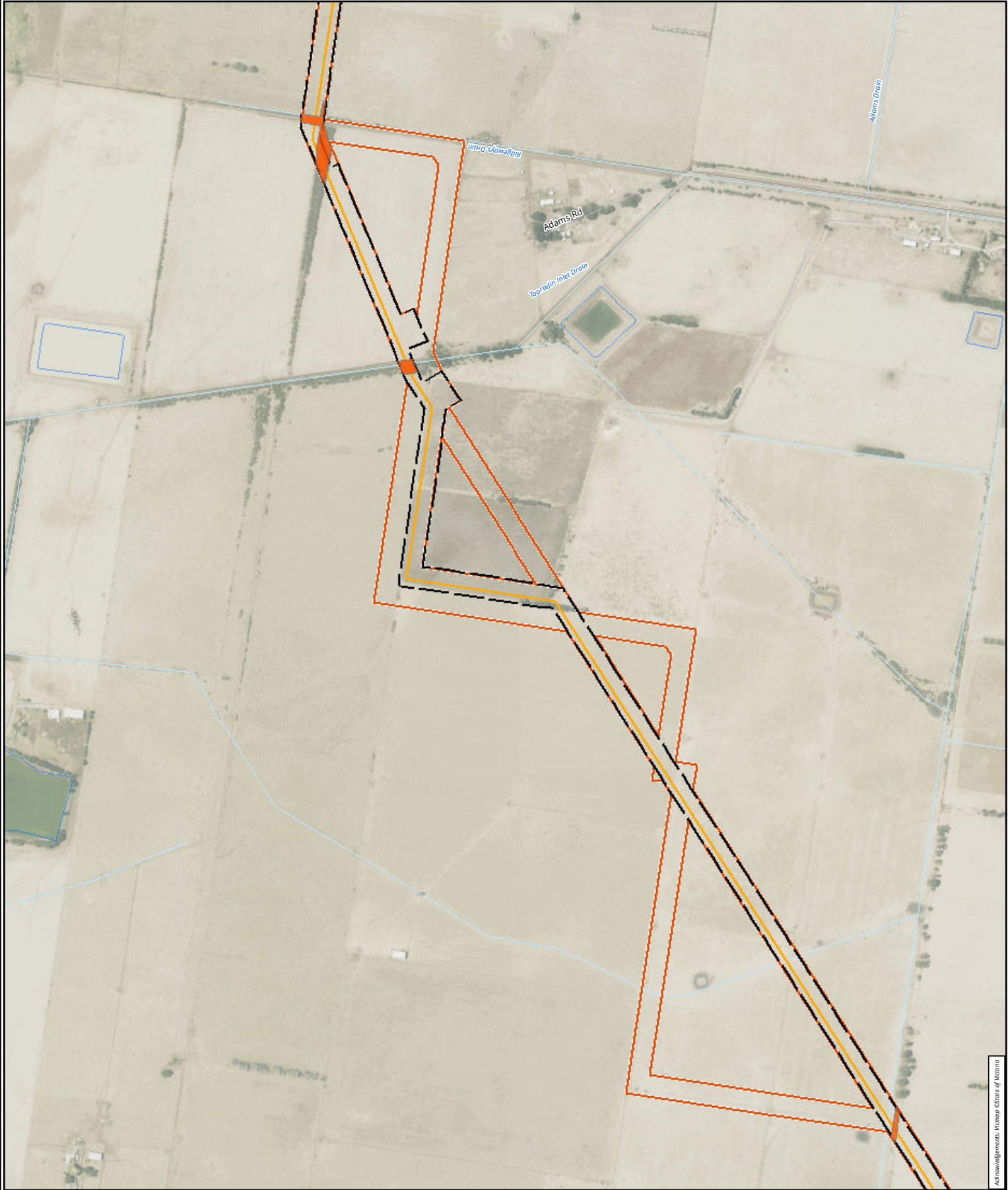
Figure 16.5 Southern Brown Bandicoot habitat within the impact area

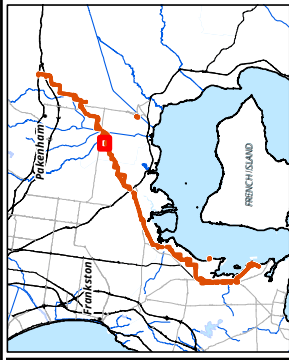


Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



Matrix: 38957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\389005\38957\Mapping\38957_F16_SBBHabitatMapSeries.mxd





Legend

Impact area

SBB habitat

Study area

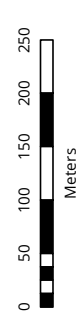
Pipeline Works

Proposed pipeline alignment

Open - Cut

Trenchless - Bore

Figure 16.6 Southern Brown Bandicoot habitat within the impact area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



Matrix: 38957

Date: 22 May 2020

Checked by: CPW, Drawn by: LW, Last edited by: Wilson

Location: P:\389505\38957\Mapping\

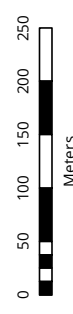
38957_F16_SBBHabitatMapSeries.mxd



Legend

- Impact area
- SBB habitat
- Study area**
- Pipeline Works
- Proposed pipeline alignment**
- Open - Cut
- Trenchless - HDD

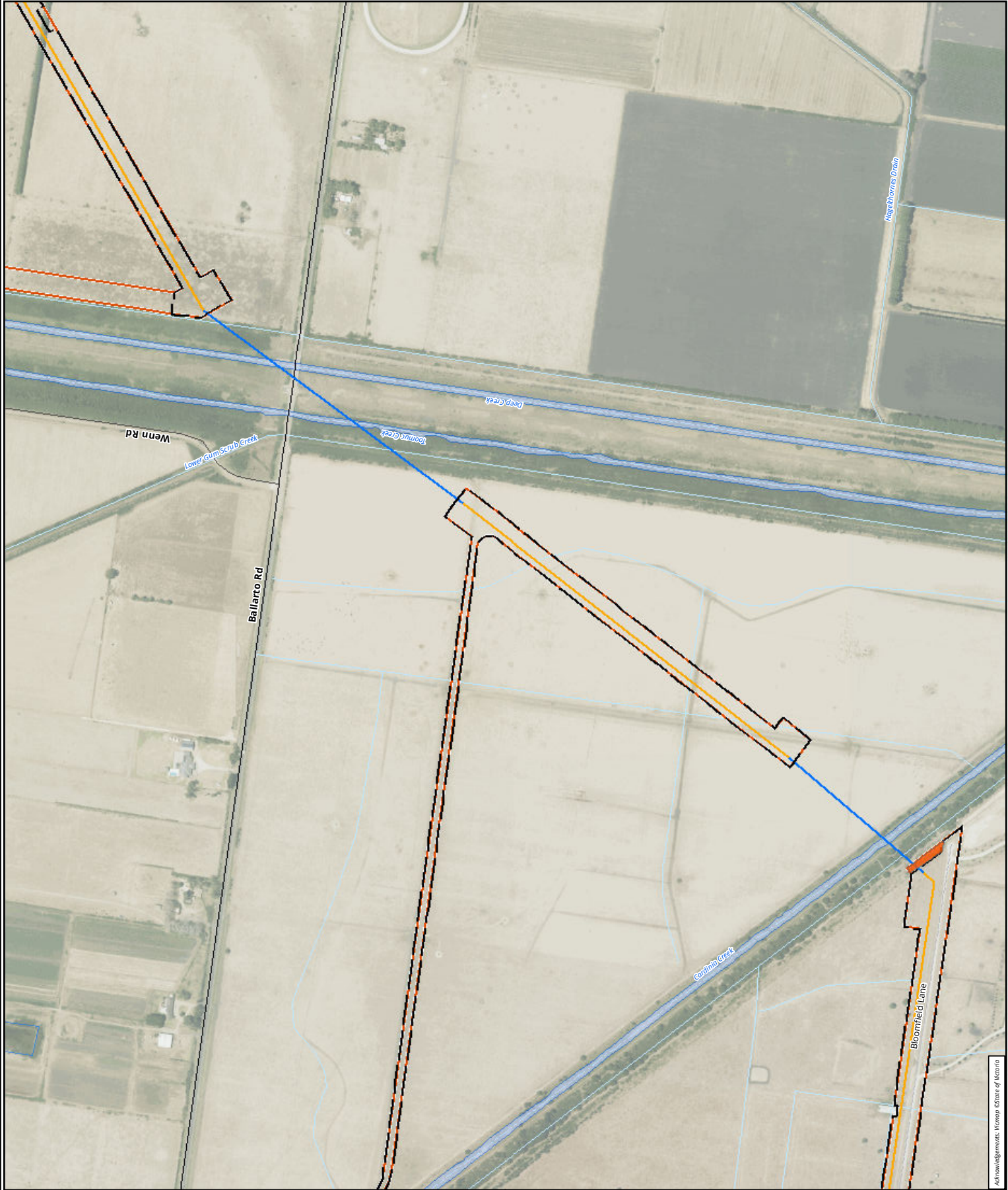
Figure 16.7 Southern Brown Bandicoot habitat within the impact area

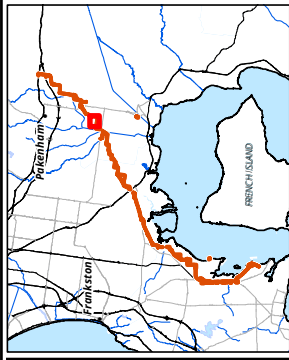


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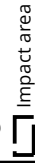


Number: 28957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\0389005\28957\Mapping\16957_F16_SBBHabitatMapSeries.mxd

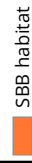




Legend

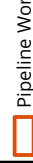


Impact area



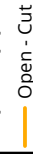
SBB habitat

Study area

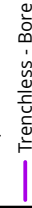


Pipeline Works

Proposed pipeline alignment



Open - Cut



Trenchless - Bore

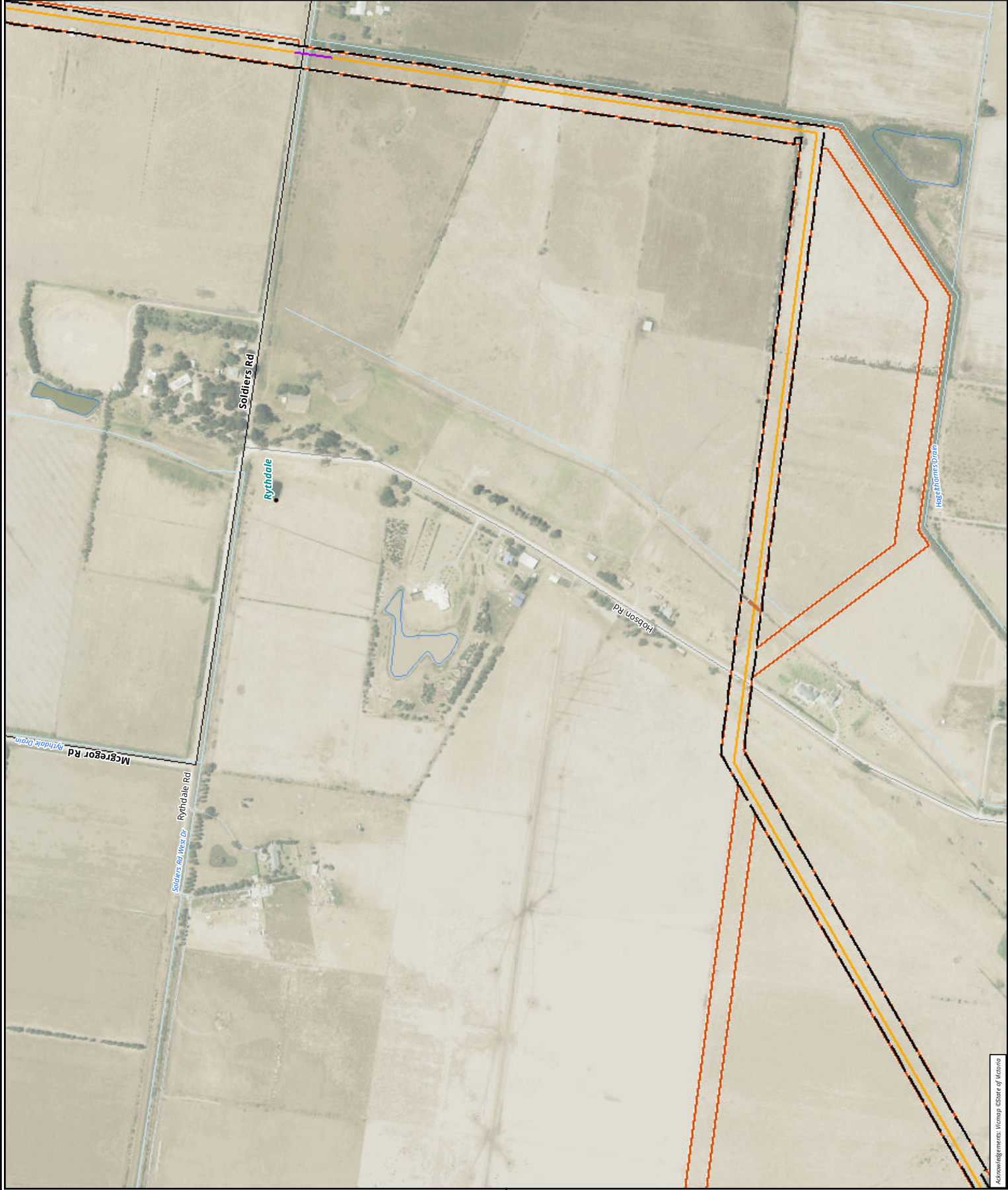
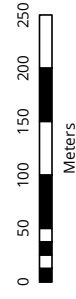


Figure 16.8 Southern Brown Bandicoot habitat within the impact area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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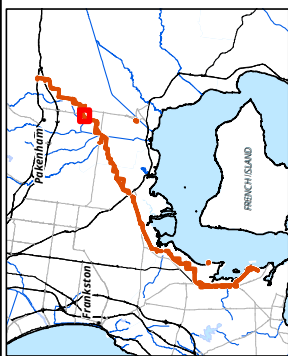
Matrix: 38957

Date: 22 May 2020

Checked by: CPW, Drawn by: LW, Last edited by: Wilson

Location: P:\389505\38957\Mapping\

38957_F16_SBBHabitatMapSeries.mxd



Legend

Impact area

SBB habitat

Study area

Pipeline Works

Proposed pipeline alignment

Open - Cut

Trenchless - HDD

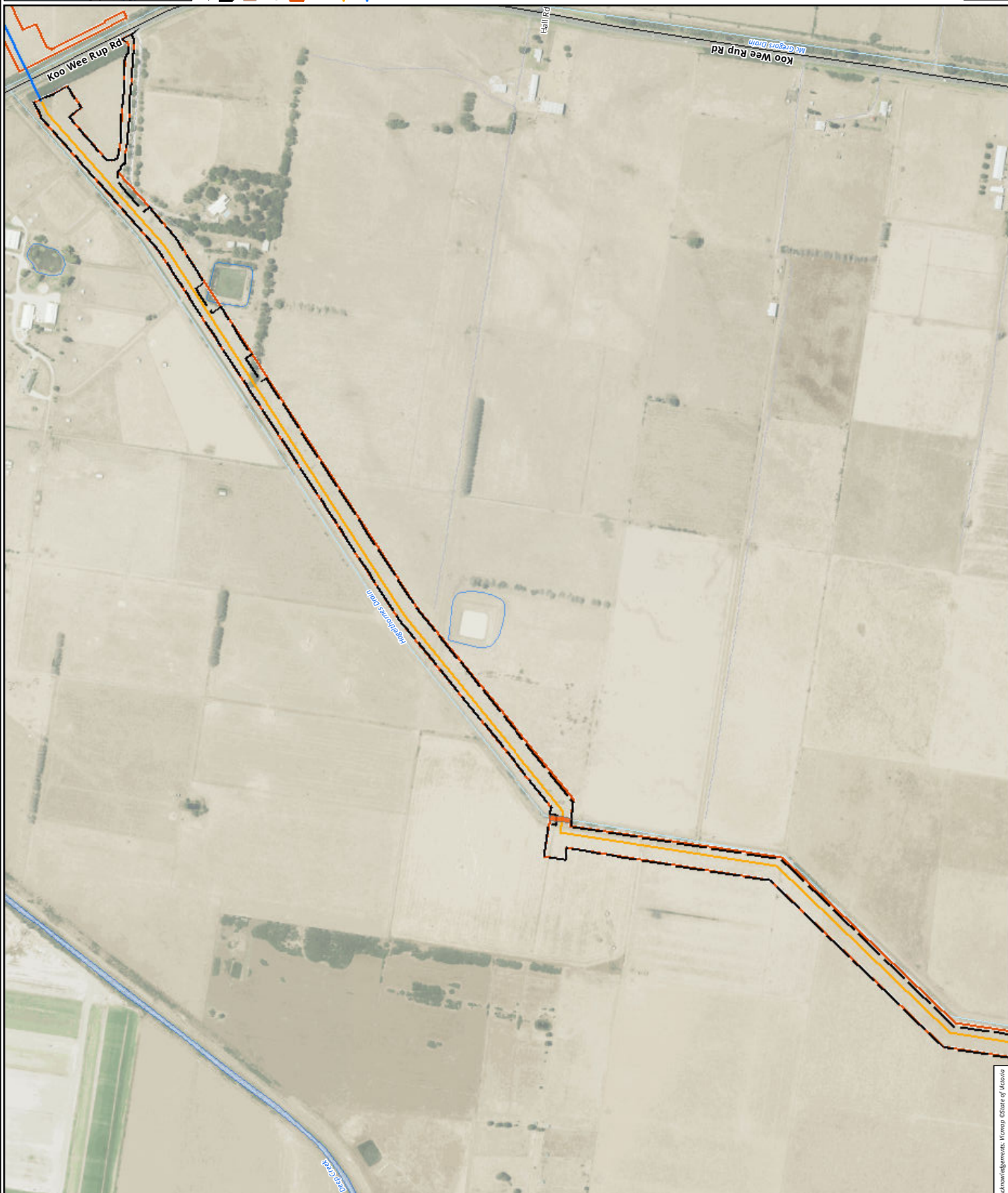
Figure 16.9 Southern Brown Bandicoot habitat within the impact area

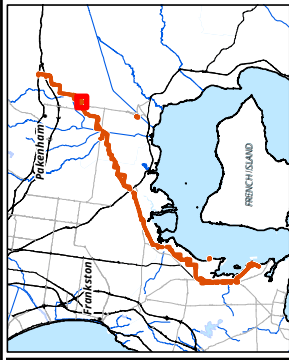


Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55



Number: 28957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\389005\28957\Mapping\16957_F16_SBBHabitatMapSeries.mxd





Legend

Impact area

SBB habitat

Study area

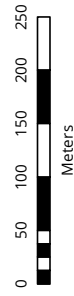
Pipeline Works

Proposed pipeline alignment

Open - Cut

Trenchless - HDD

Figure 16.10 Southern Brown Bandicoot habitat within the impact area

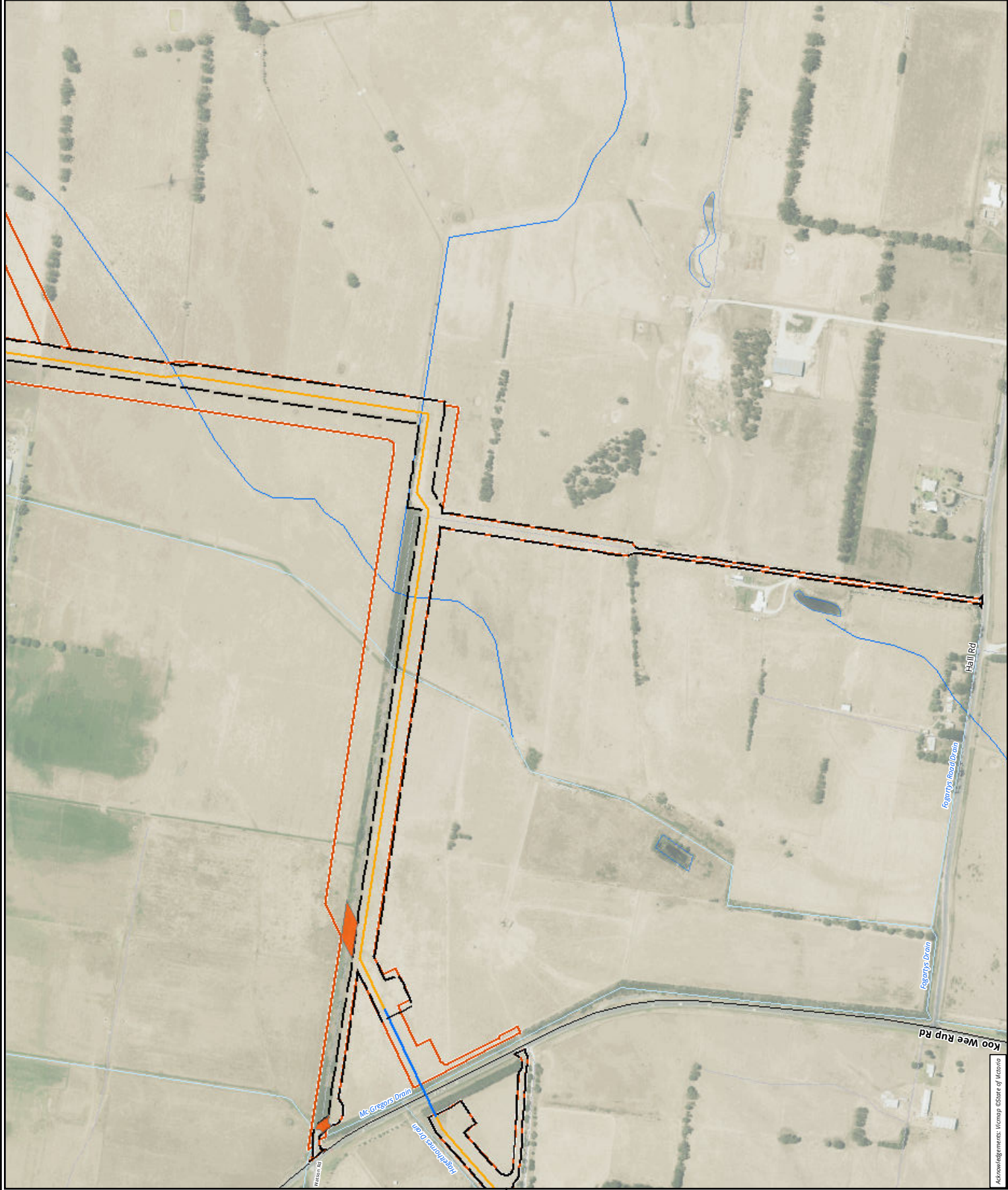


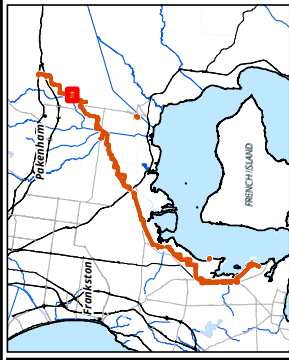
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Coordinate System: GDA 1994 MGA Zone 55



Matrix: 38957
Date: 22 May 2020
Checked by: CPW, Drawn by: LW, Last edited by: Wilson
Location: P:\389505\38957\Mapping\38957_F16_SBBHabitatMapSeries.mxd





Legend

Impact area

SBB habitat

Study area

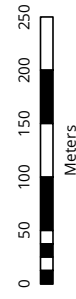
Pipeline Works

Proposed pipeline alignment

Open - Cut

Trenchless - HDD

Figure 16.11 Southern Brown Bandicoot habitat within the impact area



Meters

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



Matrix: 38957

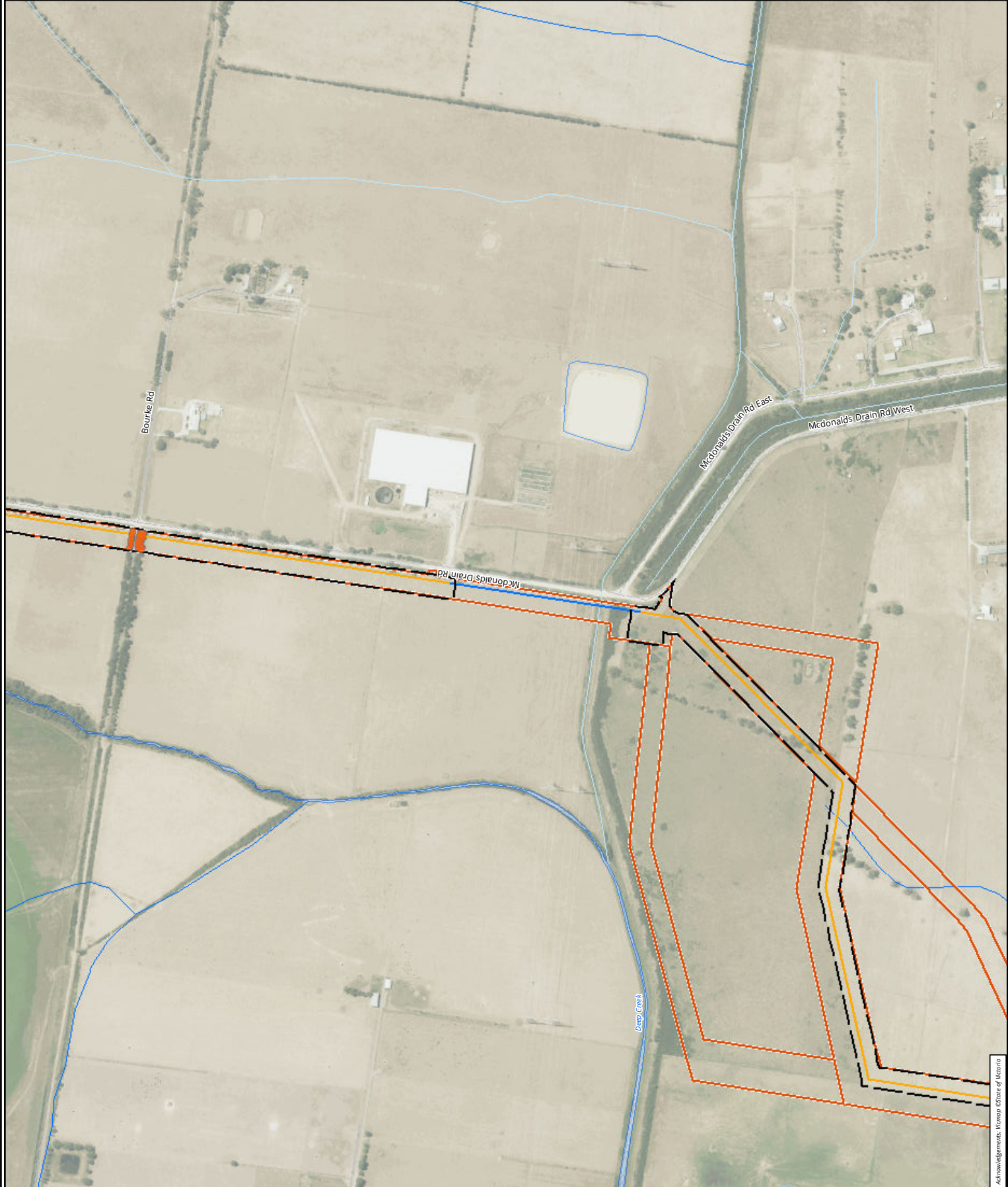
Date: 22 May 2020

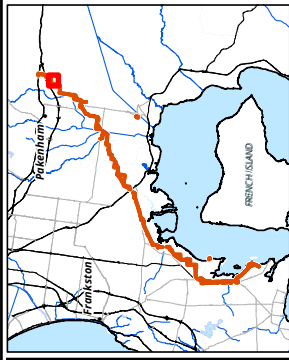
Checked by: CHW, Drawn by: LW, Last edited by: Wilson

Location: P:\38957\38957 Mapping\

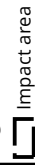
38957_F16_SBB Habitat Map Series.mxd

Acknowledgements: Vermap, State of Victoria

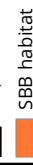




Legend



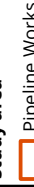
Impact area



SBB habitat

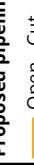


Study area

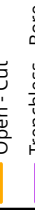


Pipeline Works

Proposed pipeline alignment

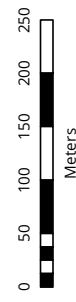


Open - Cut



Trenchless - Bore

Figure 16.12 Southern Brown Bandicoot habitat within the impact area



Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



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Matrix: 38957

Date: 22 May 2020

Checked by: CHW, Drawn by: LW, Last edited by: Wilson

Location: P:\38957\38957 Mapping\

38957_F16_SBB Habitat Map Series.mxd



Aerial photography: Vermap, State of Victoria

Appendix 7 Project assessments against the EPBC Act

This section includes assessments against relevant EPBC Act significant impact criteria for the following MNES potentially impacted by the Project:

- EPBC Act listed threatened species
- Western Port Ramsar site
- EPBC Act listed migratory species.

A 7.1 Growling Grass Frog

Significant impact criteria	Likelihood of significant impact	Justification
Significant impact Guidelines 1.1 (vulnerable species)		
Will the action lead to a long term decrease in the size of an important population?	Low	The Project is unlikely to lead to a long term decrease in the size of an important population as it would only temporarily impact on habitat. Impacts are mitigated by avoiding areas of occupancy and by implementation of MM-FF02 Aquatic fauna impacts, MM-FF04 Contractor awareness, MM-FF08 Injury and/or disturbance to fauna, MM-FF11 Growling Grass Frog.
Will the action reduce the area of occupancy of an important population?	Negligible	The Project is unlikely to reduce the area or occupancy of an important population as it would avoid the Growling Grass Frog water bodies and only temporarily impact linear habitat within the Western Outfall Drain. Impacts are mitigated by avoiding areas occupancy and by implementation of MM-FF02 Aquatic fauna impacts, MM-FF04 Contractor awareness, MM-FF08 Injury and/or disturbance to fauna, MM-FF11 Growling Grass Frog.
Will the works fragment an existing population into two or more populations?	Negligible	The Project would temporarily fragment habitat, however there would be no permanent or long-term barriers to movement such that the existing population is fragmented. Habitat would be rehabilitated / stabilised following trenching. Impacts are mitigated using MM-FF02 Aquatic fauna impacts, MM-FF04 Contractor awareness
Will the works adversely affect habitat critical to the survival of a species?	Negligible	Habitat critical to the survival of a species is defined by DoE (2013) as areas that are necessary for essential activities (e.g. foraging, breeding, roosting, or dispersal), for the long-term maintenance of the species, maintaining genetic diversity and long term evolutionary development, and/or the recovery of the species. The Project would not have long-term impacts on Growling Grass Frog habitat, and is unlikely to affect habitat critical to the survival of the species. Impacts are mitigated by avoiding areas of occupancy and by implementation of MM-FF02 Aquatic fauna impacts, MM-FF11 Growling Grass Frog, MM-FF13 Surface water sedimentation and runoff & MM-FF14 Surface water contamination.

Significant impact criteria	Likelihood of significant impact	Justification
Will the works disrupt the breeding cycle of an important population?	Negligible	Growing Grass Frog breeding occurs in still waterbodies. As such, the breeding cycle of the population of Growing Grass Frog would not be impacted. The RoW is reduced around areas of important populations, and does not cross between areas of important populations. The Project would undertake most works outside of winter when they may be lying dormant, and would include pre-clearance checks in the active season. Impacts are mitigated using MM-FF02 Aquatic fauna impacts, MM-FF04 Contractor awareness, MM-FF11 Growing Grass Frog.
Will the works modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Low	The works would result in the temporary removal of grassy, potential habitat for the Growing Grass Frog. Impacts to habitat/stream would be remediated so that it is in the same condition or better as before. The Project would not have long-term impacts on habitat quality. Impacts are mitigated using MM-FF02 Aquatic fauna impacts, MM-FF04 Contractor awareness, MM-FF08 Injury and/or disturbance to fauna, MM-FF11 Growing Grass Frog, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination.
Will the works result in the introduction and establishment of invasive species that are harmful to the vulnerable species?	Low	The Project is unlikely to result in the introduction of invasive species through effective vehicle / construction hygiene management practices. Impacts are mitigated using MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness.
Will the works introduce disease that may cause the species to decline?	Negligible	The Project is unlikely to result in the introduction of pathogens or diseases through effective vehicle / construction hygiene management practices. Impacts are mitigated using MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness.
Will the works interfere substantially with the recovery of the species?	Negligible	It is unlikely that the works would interfere with the recovery of the species as population declines are not likely to result from the works. Impacts would be mitigated using MM-FF02 Aquatic fauna impacts, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, , MM-FF08 Injury and/or disturbance to fauna, MM-FF11 Growing Grass Frog, MM-FF14 Surface water contamination, MM-FF15 Lighting impacts to fauna, and MM-FF16 Dust impacts to flora/fauna.
Significant impact Guidelines for the vulnerable Growing Grass Frog (<i>Litoria raniformis</i>)		
Will the works result in a net reduction in the number and/or diversity of water bodies available to an important population?	Negligible	The Project would not remove any waterbodies for an important population.

Significant impact criteria	Likelihood of significant impact	Justification
Will the works result in the permanent removal or degradation of terrestrial habitat (for example between ponds, drainage lines or other temporary/permanent habitat) within 200 m of a waterbody in temperate regions, or 350 m in semi-arid regions, that results in the loss or overwintering opportunities for an important population?	Low	Although the works would not result in a permanent removal or degradation of terrestrial habitat, works may result in a temporary degradation of terrestrial habitat. Impacts mitigated using MM-FF01 Unplanned vegetation loss, MM-FF02 Aquatic fauna impacts, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF08 Injury and/or disturbance to fauna, MM-FF11 Growling Grass Frog, and MM-FF15 Lighting impacts to fauna & MM-FF16 Dust impacts to flora/fauna.
Will the works result in alterations to wetland hydrology, diversity and structure (for example any changes to timing, duration or frequency of flood events that leads to a decrease in habitat quality)?	Low	It is unlikely that works would result in permanent alterations to wetland hydrology, diversity and structure that would lead to a decrease in habitat quality. Stream habitat in the Western Outfall Drain would be reinstated following pipe construction. Impacts mitigated using Aquatic fauna impacts, MM-FF11 Growling Grass Frog.
Will the works involve alteration of aquatic vegetation diversity or structure that leads to a decrease in habitat quality?	Low	The Project would not impact on aquatic vegetation diversity or structure that leads to a decrease in habitat quality. The instream habitat in the Western Outfall Drain would be reinstated and banks would be restabilised following construction. No permanent removal of habitat would occur. Impacts would be mitigated using MM-FF01 Unplanned vegetation loss, MM-FF02 Aquatic fauna impacts.
Will works result in construction of physical barriers to movement between water bodies, such as roads or buildings?	Low	The Project would not install physical barriers to movement between habitat or waterbodies.
Will the works result in removal or alteration of terrestrial or aquatic habitat corridors (including alteration of connectivity during flood events)?	Low	The Project would not remove habitat corridors, and would temporary alter instream habitat (as a corridor in itself). However, the stream would be remediated and stabilised following construction. Pathogens and diseases would be mitigated with vehicle / construction hygiene controls. Impacts would be mitigated using MM-FF02 Aquatic fauna impacts, MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness, MM-FF11 Growling Grass Frog, MM-FF13 Surface water sedimentation and runoff, and MM-FF14 Surface water contamination.
Will the works result in introduction of predatory fish or disease agents?	Negligible	Pathogens and diseases would be mitigated with vehicle / construction hygiene controls. Impacts mitigated using MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF04 Contractor awareness.

A7.2 Migratory species (terrestrial/intertidal species)

Significant impact criteria 1.1	Likelihood of significant impact	Justification
Significant impact guidelines 1.1 (migratory species)		
Will the proposed action substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species?	Rare	<p>The Western Port Ramsar Site is important habitat for migratory species. The Project would not involve removal of mangroves, saltmarsh or seagrass beds or physical disturbance of intertidal flats.</p> <p>The Project does not involve any construction works that would cause physical disturbance to Western Port as Project activities that would occur on the FSRU and transfer pipeline avoid surface impacts to the Western Port Ramsar site.</p> <p>The marine impact assessment found there would be no trophic impacts arising from any water or chlorine discharge from the FSRU.</p> <p>Project impacts mitigated by MM-FF12 Migratory birds, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination.</p>
Will the action result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?	Rare	<p>Standard biosecurity control measures for overland pipelines would be incorporated into the EMP. Discharge of ballast waters is prohibited in port waters (PoHDA, 2017).</p> <p>Impacts from land-based works mitigated by MM-FF03 Invasive weeds, pests, pathogens and waste.</p>
Will the action seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species?	Rare	<p>The Pipeline alignment avoids all intertidal mudflat and shorebird roosting areas, and does not result in surface disturbance to the Ramsar wetland. Direct effects on waterbirds are unlikely given the lack of primary foraging habitat and roosting habitat adjacent to the existing jetty.</p> <p>Project impacts mitigated by MM-FF03 Invasive weeds, pests, pathogens and waste, MM-FF12 Migratory birds, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination, MM-FF08 Injury and/or disturbance to fauna, MM-FF15 Lighting impacts to fauna.</p>
Background paper to EPBC Act policy statement 3.21 - Significant Impact on migratory shorebirds		
Will the proposed action result in the loss (for example, clearing, infilling or draining) of important habitat for migratory shorebirds?	Rare	<p>The Western Port Ramsar Site is important habitat for migratory species. The Project would not involve removal of mangroves, saltmarsh or seagrass beds or physical disturbance of intertidal flats.</p> <p>The marine impact assessment found there would be no indirect loss of habitat through operation of the FSRU.</p>

Significant impact criteria 1.1	Likelihood of significant impact	Justification
Will the action result in the degradation of important habitat leading to a substantial reduction in migratory shorebirds using the site?	Rare	<p>The Project would not involve removal of mangroves, saltmarsh or seagrass beds or physical disturbance of intertidal flats. These important shorebird habitats would not be directly impacted. Shorebird usage of the intertidal and mangrove areas nearby is not significant. These areas are not noted as important roosting habitat or primary foraging habitat.</p> <p>Indirect impacts to habitat through operation of the FSRU is not addressed within this report.</p>
Will the action result in an increased disturbance leading to substantial reduction in migratory shorebirds using important habitat?	Rare	The level of disturbance from the Project to migratory species would not substantially increase existing disturbance levels within the Ramsar site, particularly for areas of foraging and roosting importance.
Will the action result in direct mortality of birds leading to a substantial reduction in migratory shorebirds using important habitat?	Rare	The Project would not result in direct mortality of birds which leads to a substantial reduction in migratory shorebirds using important habitat, as the area adjacent to the existing jetty is not noted as primary foraging habitat or roosting habitat. Impact pathways leading to direct mortality are highly unlikely.

A7.3 Western Port Ramsar site

Significant impact criteria	Likelihood of significant impact	Justification
Significant impact guidelines 1.1 (Ramsar wetlands)		
Will the action lead to areas of the wetland being destroyed or substantially modified?	<p>Rare; No areas of the Western Port Ramsar site will be destroyed or substantially modified.</p> <p>The Project will not involve removal of mangroves, saltmarsh or seagrass beds or physical disturbance of intertidal flats.</p>	<p>The Project does not involve any construction works that would cause physical disturbance to Western Port as Project activities that would occur on the FSRU and transfer pipeline avoid surface impacts to the Ramsar site.</p> <p>The marine impact assessment found there would be no trophic impacts arising from any water or chlorine discharge from the FSRU.</p>
Will the works lead to a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland?	<p>Rare; No substantial and measurable change to the hydrological regime of the Western Port Ramsar site is expected to occur as a result of the project.</p>	<p>The movement of water through the Western Port Ramsar site is dominated by semi-diurnal tides, and neither evaporation nor freshwater inputs are sufficient to affect flushing or to generate strong or persistent estuarine circulation patterns (Lee 2011). There is no plausible risk that the Project would cause a substantial or measurable change to tidal patterns which dominate the hydrological regime of the Western Port Ramsar site.</p>
Will the works result in changes to the habitat or lifecycle of native species, including invertebrate fauna and fish species that are currently dependent on the wetland?	<p>Rare; Native species dependent on Western Port are not expected to be significantly impacted.</p>	<p>The pipeline alignment avoids all intertidal mudflat and shorebird roosting areas, and does not result in surface disturbance to the Ramsar wetland. Significant and Direct impacts to waterbirds are unlikely given the lack of primary foraging habitat and roosting habitat adjacent to the existing jetty. Marine assessments have concluded that there would be no impacts to aquatic fauna, seagrass, mangroves and saltmarsh</p>
Will the works result in a substantial and measurable change in the water quality of the wetland - for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health?	<p>Rare; There will be no substantial and measurable change to the water quality of Western Port.</p>	<p>The water quality of Western Port Ramsar site is primarily controlled by extensive tidal flushing, residence time of water, resuspension of sediments by tidal movement and importation of nutrients and pollutants in river discharge during periods of above average rainfall (Lee 2011). Controls would be in place to avoid runoff and control sediment as part of the Gas Import Jetty Works EMP and Pipeline Works CEMP.</p> <p>The marine impact assessment found there would be no trophic impacts arising from any water or chlorine discharge from the FSRU.</p>
Will the works result in the introduction of an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland?	<p>Rare; The works will not result in the introduction of an invasive species that is harmful to the ecological character of the wetland.</p>	<p>Standard biosecurity control measures for overland pipelines would be incorporated into the CEMP. Discharge of ballast waters is prohibited in port waters (PoHDA, 2017).</p>

A7.4 Grey-headed Flying Fox

Significant impact criteria	Likelihood of significant impact	Justification
Significant Impact Guidelines 1.1 (vulnerable species)		
Will the action lead to a long term decrease in the size of an important population?	Negligible	The site does not contain an 'important population' of Grey-headed Flying-fox (GHFF) as defined by the significant impact guidelines and the Project would not remove habitat that provides a critical resources for GHFF.
Will the action reduce the area of occupancy of an important population?	Negligible	There is no capacity to reduce the area of occupancy of an important population.
Will the works fragment an existing population into two or more populations?	Negligible	The site does not contain a population of GHFF.
Will the works adversely affect habitat critical to the survival of a species?	Negligible	<p>Habitat critical to the survival of a species is defined by DoE (2013) as areas that are necessary for essential activities (e.g. foraging, breeding, roosting, or dispersal), for the long-term maintenance of the species, maintaining genetic diversity and long term evolutionary development, and/or the recovery of the species.</p> <p>In the Referral guideline for management actions in grey-headed and spectacled flying-fox camps, importance is placed on the use of flying-fox camps as a means of determining if a significant impact is required. No camps of this species are being dispersed or impacted, therefore it is considered unlikely that suitable foraging habitat being removed for the development constitutes habitat critical to the survival of the species (Commonwealth 2015).</p> <p>No specific mitigation measures proposed but, to mitigate impacts to the species generally works have been designed to minimise disturbance to suitable habitat, i.e. retention of eucalypt species. Provide information to contractors through site inductions.</p>
Will the works disrupt the breeding cycle of an important population?	Negligible	The site does not contain a population of GHFF.
Will the works modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Negligible	Works would remove a small amount of potential habitat for the species. However, this can be considered negligible in the context of the population as a whole and a significant impact is unlikely. Eucalypts would be retained where possible to minimise the impact.
Will the works result in the introduction and establishment of invasive species that are harmful to the vulnerable species?	Negligible	Works have no capacity to introduce invasive species that are harmful to GHFF.
Will the works introduce disease that may cause the species to decline?	Negligible	The works have no capacity to result in the introduction of disease to the population.
Will the works interfere substantially with the recovery of the species?	Negligible	The works have no capacity to affect recovery of the species

Significant impact criteria	Likelihood of significant impact	Justification
Referral guideline for management actions in grey-headed and spectacled flying-fox camps		
Habitat is not a camp for this species, or the spectacled flying-fox, therefore this policy document is not applicable.	Negligible	N/A

A7.5 Southern Brown Bandicoot

Significant impact criteria (Endangered species)	Likelihood of significant impact	Justification
Significant Impact Guidelines 1.1 (endangered and critically endangered species)		
Will the action lead to a long-term decrease in the size of a population?	Negligible	No, the short temporal duration of the Project would not lead to a decrease in the population size, MM-FF09 Southern Brown Bandicoot is designed specifically to avoid and minimise impacts to this species
Will the action reduce the area of occupancy of the species?	Negligible	No. The Project would temporarily fragment habitat, however there would be no permanent or long-term reduction in area of occupancy.
Will the works fragment an existing population into two or more populations?	Negligible	There is minor capacity for localised and short-term reduction in habitat connectivity due to the loss of native vegetation resulting from the installation of the proposed pipeline. The draft referral guidelines for Southern Brown Bandicoot (DSEWPC 2011) outline that suitable dense vegetation cover is required for species dispersal. No specific mitigation measures are proposed, as likelihood is low, however we recommend replacing native vegetation, specifically shade tolerant shrubs/grasses in the 0.2-1 m height class, in order to increase habitat corridor functionality after shading has impacted native vegetation. Residual impacts are lower, as functionality of corridor is improved.
Will the works adversely affect habitat critical to the survival of the species?	Negligible	Habitat critical to the survival of a species is defined by DoE (2013) as areas that are necessary for essential activities (e.g. foraging, breeding, roosting, or dispersal), for the long-term maintenance of the species, maintaining genetic diversity and long term evolutionary development, and/or the recovery of the species. The Project would not have long-term impacts on Southern Brown Bandicoot habitat, and is unlikely to affect habitat critical to the survival of the species. Impacts are mitigated by avoiding areas of occupancy and by implementation of MM-FF01 Unplanned vegetation loss, MM-FF05 Site Rehabilitation, MM-FF08 Injury and/or disturbance to fauna, MM-FF09 Southern Brown Bandicoot, MM-FF15 Lighting impacts to fauna & MM-FF16 Dust impacts to flora/fauna.
Will the works disrupt the breeding cycle of a population?	Negligible	Southern Brown Bandicoot are polyoestrous, as such the species breeds seasonally or all year round, depending on location. The peak season occurs between spring and mid-summer (DSE 2010). The minor temporal nature of the proposed development has no capacity to disrupt the breeding cycle of local Southern Brown Bandicoot if present.
Will the works modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Negligible	Works would remove a small amount of habitat for the species (1.1 ha). However, this can be considered negligible in the context of the population. The habitat to be removed is not ideal habitat as defined by DSEWPC (2011). On the whole, the Project is unlikely to produce a significant impact on the quality or extent of

Significant impact criteria (Endangered species)	Likelihood of significant impact	Justification
<p>Will the works result in the introduction and establishment of invasive species that are harmful to the endangered species?</p> <p>Will the works introduce disease that may cause the species to decline?</p> <p>Will the works interfere with the recovery of the species?</p>		<p>habitat such that Southern Brown Bandicoot is likely to decline.</p> <p>No specific mitigation measures are proposed, however, we recommend replanting lost native vegetation within the 0.2 – 1 m height class to achieve 50-80% vegetation cover to aid dispersal across the pipeline corridor which would further reduce the residual risk of significant impact.</p>
	Negligible	<p>Works are unlikely to introduce invasive species that are harmful to Southern Brown Bandicoot. No specific mitigation measures are required.</p>
	Negligible	<p>There is no realistic capacity for the works to introduce disease to the population. No specific mitigation measures are required.</p>
	Negligible	<p>No. The Project would temporarily fragment habitat, however there would be no permanent or long-term barriers to movement such that the existing population is fragmented. Habitat would be rehabilitated / stabilised following trenching. Impacts are mitigated using MM-FF01 Unplanned vegetation loss, MM-FF04 Contractor awareness.</p>
Draft referral guidelines for the endangered Southern Brown Bandicoot (eastern), <i>Isoodon obesulus obesulus</i>.		
Assessed at Section 7.1.3.1		

A7.6 Dwarf Galaxias

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Significant Impact Guidelines 1.1 (vulnerable species)		
Will the action lead to a long term decrease in the size of an important population?	Negligible	The Project is unlikely to lead to a long term decrease in the size of an important population as it would only temporarily impact on habitat. Impacts are mitigated by avoiding areas of occupancy and by implementation of MM-FF02 Aquatic fauna impacts, MM-FF04 Contractor awareness, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination, MM-FF08 Injury and/or disturbance to fauna, MM-FF15 Lighting impacts to fauna & MM-FF16 Dust impacts to flora/fauna.
Will the action reduce the area of occupancy of an important population?	Negligible	The proposed works would not result in a significant long-term reduction in habitat availability (and therefore area of occupancy) for the population. As the action is not likely to lead to a long term decrease in the population or result in a reduction in the area of occupancy.
Will the works fragment an existing population into two or more populations?	Negligible	The Project would not result in long term barriers to movement such that the existing population is fragmented. No permanent barriers to movement would be constructed.
Will the works adversely affect habitat critical to the survival of a species?	Negligible	Habitat critical to the survival of a species is defined by DoE (2013) as areas that are necessary for essential activities (e.g. foraging, breeding, roosting, or dispersal), for the long-term maintenance of the species, maintaining genetic diversity and long term evolutionary development, and/or the recovery of the species. The Project would not have long-term impacts on Dwarf Galaxias habitat, and is unlikely to affect habitat critical to the survival of the species. Impacts are mitigated by avoiding areas of occupancy and by implementation of MM-FF02 Aquatic fauna impacts, MM-FF08 Injury and/or disturbance to fauna, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination, MM-FF15 Lighting impacts to fauna & MM-FF16 Dust impacts to flora/fauna.
Will the works disrupt the breeding cycle of an important population?	Negligible	The works are highly localised in the context of the amount of habitat available in the surrounding area. The amount of habitat disturbance is negligible such that there is no capacity to disrupt the species breeding cycle. The Project would implement erosion and sedimentation controls in accordance with the Environmental Guidelines for Major Construction Sites (EPA 1996).
Will the works modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Negligible	The works are short-term and highly localised in the context of the amount of habitat available in the surrounding area. The amount of habitat disturbance is negligible such that there is no capacity to cause the species to decline.

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Will the works result in the introduction and establishment of invasive species that are harmful to the vulnerable species?	Negligible	It is unlikely that the works would result in the introduction of invasive organisms to the site (e.g. predatory fishes or weeds) which are harmful to the Dwarf Galaxias. Implementation of MM-FF03 would mitigate risks associated with this criteria.
Will the works introduce disease that may cause the species to decline?	Negligible	It is unlikely that the works would result in the introduction of novel pathogens to the site that would cause a decline in the Dwarf Galaxias population. Implementation of MM-FF03 Invasive weeds, pests, pathogens and waste would mitigate risks associated with this criteria.
Will the works interfere substantially with the recovery of the species?	Negligible	The proposed works are highly localised and impacts would be minimal if any. There is no capacity that the works would interfere with the recovery of the species as population declines would not result from the works.

A7.7 Australian Grayling

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Significant Impact Guidelines 1.1 (vulnerable species)		
Will the action lead to a long term decrease in the size of an important population?	Negligible	The Project is unlikely to lead to a long term decrease in the size of an important population as it would only temporarily impact on habitat. Impacts are mitigated by avoiding areas of occupancy and by implementation of MM-FF02 Aquatic fauna impacts, MM-FF04 Contractor awareness, MM-FF08 Injury and/or disturbance to fauna, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination, MM-FF15 Lighting impacts to fauna & MM-FF16 Dust impacts to flora/fauna.
Will the action reduce the area of occupancy of an important population?	Negligible	The proposed works would not result in a significant long-term reduction in habitat availability (and therefore area of occupancy) for the population. As the action is not likely to lead to a long term decrease in the population or result in a reduction in the area of occupancy.
Will the works fragment an existing population into two or more populations?	Negligible	The Project would not result in long term barriers to movement such that the existing population is fragmented. No permanent barriers to movement would be constructed.
Will the works adversely affect habitat critical to the survival of a species?	Negligible	Habitat critical to the survival of a species is defined by DoE (2013) as areas that are necessary for essential activities (e.g. foraging, breeding, roosting, or dispersal), for the long-term maintenance of the species, maintaining genetic diversity and long term evolutionary development, and/or the recovery of the species. The Project would not have long-term impacts on Australian Grayling habitat, and is unlikely to affect habitat critical to the survival of the species. Impacts are mitigated by avoiding areas of occupancy and by implementation of MM-FF02 Aquatic fauna impacts, MM-FF08 Injury and/or disturbance to fauna, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination, MM-FF15 Lighting impacts to fauna & MM-FF16 Dust impacts to flora/fauna.
Will the works disrupt the breeding cycle of an important population?	Negligible	The works are highly localised in the context of the amount of habitat available in the surrounding area. The amount of habitat disturbance is negligible such that there is no capacity to disrupt the species breeding cycle. The works would implement erosion and sedimentation controls in accordance with the Environmental Guidelines for Major Construction Sites (EPA 1996).
Will the works modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Negligible	The works are short-term and highly localised in the context of the amount of habitat available in the surrounding area. The amount of habitat disturbance is negligible such that there is no capacity to cause the species to decline.

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Will the works result in the introduction and establishment of invasive species that are harmful to the vulnerable species?	Negligible	It is unlikely that the works would result in the introduction of invasive organisms to the site (e.g. predatory fishes or weeds) which are harmful to the Australian Grayling. Implementation of MM-FF03 Invasive weeds, pests, pathogens and waste would mitigate risks associated with this criteria.
Will the works introduce disease that may cause the species to decline?	Negligible	It is unlikely that the works would result in the introduction of novel pathogens to the site that would cause a decline in the Australian Grayling population. Implementation of MM-FF03 Invasive weeds, pests, pathogens and waste would mitigate risks associated with this criteria.
Will the works interfere substantially with the recovery of the species?	Negligible	The proposed works are highly localised and impacts would be minimal if any. There is no capacity that the works would interfere with the recovery of the species as population declines would not result from the works.

A7.8 Swift Parrot

Significant impact criteria	Likelihood of significant impact	Justification
Significant Impact Guidelines 1.1 (endangered and critically endangered species)		
Will the action lead to a long-term decrease in the size of a population?	Negligible	The site does not contain or support a population of Swift Parrot (SP). No specific mitigation measures proposed.
Will the action reduce the area of occupancy of the species?	Negligible	SP is a migratory species and would not need to occupy the study area long-term. The study area would instead provide SP with foraging and perching, of which the adjacent landscape provides ample opportunity.
Will the works fragment an existing population into two or more populations?	Negligible	The site does not contain a population of SP.
Will the works adversely affect habitat critical to the survival of the species?	Negligible	Habitat critical to the survival of a species is defined by DoE (2013) as areas that are necessary for essential activities (e.g. foraging, breeding, roosting, or dispersal), for the long-term maintenance of the species, maintaining genetic diversity and long term evolutionary development, and/or the recovery of the species. The habitat within the study area was not considered critical to the survival of SP and given the abundance of Eucalypts in the surrounding landscape, impacts to foraging by SP were considered negligible. No specific mitigation measures proposed but, to mitigate impacts to the species generally works have been designed to minimise disturbance to suitable habitat, i.e. retention of eucalypt species. Provide information to contractors through site inductions. Works unlikely to adversely affect habitat critical to the survival of the species.
Will the works disrupt the breeding cycle of a population?	Negligible	The site does not contain or support a population of SP.
Will the works modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Negligible	Works would remove a small amount of potential habitat for the species. However, this can be considered negligible in the context of the population as a whole and a significant impact is unlikely.
Will the works result in the introduction and establishment of invasive species that are harmful to the endangered species?	Negligible	Works have no capacity to introduce invasive species that are harmful to SP.
Will the works introduce disease that may cause the species to decline?	Negligible	The works have no capacity to result in the introduction of disease to the population. No specific mitigation measures are proposed.
Will the works interfere with the recovery of the species?	Negligible	The works have no capacity to affect recovery of the species. No specific mitigation measures are proposed.

A7.9 River Swamp Wallaby-grass

Significant impact criteria	Likelihood of significant impact	Justification
Significant Impact Guidelines 1.1 (vulnerable species)		
Will the action lead to a long term decrease in the size of an important population?	Negligible	Targeted survey recorded River Swamp Wallaby-grass (RSWG) at one location within the proposed alignment. Impacts are mitigated by avoiding areas of occupancy and by implementation of MM-FF02 Aquatic fauna impacts, MM-FF04 Contractor awareness, MM-FF08 Injury and/or disturbance to fauna, MM-FF13 Surface water sedimentation and runoff, MM-FF14 Surface water contamination, MM-FF15 Lighting impacts to fauna & MM-FF16 Dust impacts to flora/fauna.
Will the action reduce the area of occupancy of an important population?	Negligible	No. Recorded population has been avoided.
Will the works fragment an existing population into two or more populations?	Negligible	The Project would not fragment any populations.
Will the works adversely affect habitat critical to the survival of a species?	Negligible	No. Impacts are mitigated by avoiding areas of occupancy.
Will the works disrupt the breeding cycle of an important population?	Negligible	No. Impacts are mitigated by avoiding areas of occupancy.
Will the works modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Negligible	The works are highly localised in the context of the amount of habitat available in the surrounding area. The amount of habitat disturbance is negligible such that there is no mechanism to cause a decline of the species.
Will the works result in the introduction and establishment of invasive species that are harmful to the vulnerable species?	Negligible	It is unlikely that the works would result in the introduction of invasive organisms to the site (e.g. predatory fishes or weeds) which are harmful to the species. There is potential for weeds to be transported into the site on plant/machinery used in the vicinity of the species habitat. Implementation of erosion and sedimentation controls in accordance with the Environmental Guidelines for Major Construction Sites (EPA 1996), which would reduce likelihood of weed seeds or propagules entering the habitat. MM-FF03 Invasive weeds, pests, pathogens and waste would mitigate risk of this criteria impacting the species.
Will the works introduce disease that may cause the species to decline?	Negligible	It is unlikely that the works would result in the introduction of novel pathogens to the site that would cause a decline in the RSWG. There is potential for pathogens to be transported into the site on plant/machinery that may have unknown impacts to RSWG. MM-FF03 Invasive weeds, pests, pathogens and waste would mitigate risk of this criteria impacting the species.

Significant impact criteria	Likelihood of significant impact	Justification
Will the works interfere substantially with the recovery of the species?	Negligible	It is unlikely that the works would interfere with the recovery of the species as population declines are not likely to result from the works. Impacts are mitigated by avoiding areas of occupancy.

Appendix 8 Avoid and minimise mitigation measures – Pipeline Works

Source: APA

KP start	KP finish	Feature	Design response	Mitigation provided
0.80	1.00	Native vegetation	HDD	Area of Damp Heathy Woodland avoided.
1.16	1.80	Merran's Sun-orchid population Native vegetation	HDD for approx 650 m	Avoid impacts on Merran's Sun-orchid, Pallid Sun-orchid and Gaping Sun-orchid. Area of Damp Heathy Woodland avoided.
1.80	1.90	Native vegetation Woolleys Road	Bore	Avoid disturbance to Woolleys Road. Area of Damp Heathy Woodland avoided.
2.20	2.25	Southern Toadlet habitat	ROW width reduced to 20 m	Avoid dam providing habitat for Southern Toadlet
3.20	3.50	Native vegetation Dams	ROW width reduced to 20 m	Avoid farm dams. Minimise disturbance of native vegetation.
3.87	3.92	Warringine Park	ROW width reduced to 20 m	Warringine Park - avoid impact on native vegetation
3.97	4.36	Westernport Ramsar site Warringine Park	HDD	Avoid impacts to Westernport Ramsar Site and Warringine Park in this location
4.40	4.60	Warringine Park	ROW width reduced to 20 m	Minimise impacts to Warringine Park in this location
4.68	4.95	Warringine Park Warringine Creek	HDD	Avoid surface disturbance to Warringine Park. Avoid disturbance to Warringine Creek.
5.00	6.03	Stony Point Rail Line	HDD	Avoid disruption to rail line. Any habitat present? Following the rail easement significantly reduces impacts to the township of Hastings

KP start	KP finish	Feature	Design response	Mitigation provided
6.45	6.85	Stony Point Rail Line	HDD	Avoid disruption to rail line. Any habitat present? Following the rail easement significantly reduces impacts to the township of Hastings
6.95	7.35	Kings Creek and associated tributary Stony Point Rail Line	HDD	Avoid disruption to Stony Point Rail Line. Avoid disturbance to Kings Creek and associated tributary. Avoid Swampy Riparian Woodland to west of rail easement. Following the rail easement significantly reduces impacts to the township of Hastings
7.35	8.45	Stony Point Rail Line Native vegetation	ROW width reduced to 20 m	Following the rail easement significantly reduces impacts to the township of Hastings Reduce clearing of Grassy Woodland
8.55	9.00	Stony Point Rail Line Native vegetation	ROW width reduced to 25 m	Minimise disturbance to landowner and native vegetation
9.00	9.10	Stony Point Rail Line Existing pipelines Scattered trees	Bore	Avoid disruption to Stony Point Rail Line and existing hydrocarbon pipelines. Avoid disturbance to scattered trees Avoid disturbance of Stony Point Rail Line, Frankston-Flinders Road and native vegetation
13.30	13.70	Swamp Wallaby-grass population Watercourse	HDD	Avoid disturbance to a population of Swamp Wallaby-grass Avoid disturbance to unnamed watercourse
13.72	14.40	Native vegetation	ROW width reduced to 20 m	Minimise disturbance to Heathy Woodland
18.78	19.38	Watson Creek Unnamed watercourse Western Port Ramsar Site Native vegetation	HDD	Avoid impacts to Westernport Ramsar Site, Watson Creek, unnamed tributary, heathy woodland and other native vegetation in this location

KP start	KP finish	Feature	Design response	Mitigation provided
20.10	20.10	Farm dam	Alignment	Minimise impacts to proposed farm dam at landowner request
20.90	21.25	Langwarrin Creek Native vegetation	HDD	Avoid impacts to Langwarrin Creek, scattered trees and other native vegetation in this location
21.66	21.75	Existing vegetation	ROW width reduced to 20 m	Avoid disturbance to existing planted mature trees.
22.53	22.96	Wetland complex Potential habitat for Growling Grass Frog	HDD	Avoid impacts to a wetland complex which provides potential habitat for Growling Grass Frog
28.2	28.23	Residence Dam	ROW width reduced to 20 m and 10 m	Minimise disturbance near residence and to dam at request of landowner
33.40	33.61	Muddy Gates Drain Muddy Gates Lane Leongatha Rail Line and easement Southern Brown Bandicoot assumed present Potential habitat for Swamp Fireweed and Swamp Everlasting	HDD	Avoid impacts to Muddy Gates Drain, Muddy Gates Lane and the Leongatha Rail Line and easement. This would avoid impacts to assumed habitat for Southern Brown Bandicoot, and potential habitat for the Swamp Fireweed and Swamp Everlasting.
33.62	34.31	Southern Brown Bandicoot present, recorded in planted vegetation along fenceline on southern side of Manks Road	ROW width reduced to between 25 and 15 m.	Minimise impacts to planted vegetation along fenceline on southern side of Manks Road which provides known habitat for the Southern Brown Bandicoot
34.31	34.35	Manks Road Southern Brown Bandicoot assumed present	Bore	Minimise impacts to vegetation on southern side of Manks Road which provides assumed habitat for Southern Brown Bandicoot

KP start	KP finish	Feature	Design response	Mitigation provided
35.08	35.10	Farm dam	ROW width reduced to 20 m	Avoid direct impacts to farm dam
35.36	35.40	Tooradin Station Road Southern Brown Bandicoot recorded near fallen pine tree in a heavily grassed roadside plantation	Bore with access track reduce to 10 m width	Avoid trenching impacts to Tooradin Station Road. Fallen pine tree avoided however access requirements to private property would result in disturbance to adjacent Southern Brown Bandicoot habitat for an access track of 10 m in width.
37.17	37.22	Tooradin Inlet Drain Southern Brown Bandicoot recorded in blackberries and Phalaris on top of drain bank to south of impact area	ROW width reduced to 20 m	ROW reduced to 20 m in area of Southern Brown Bandicoot habitat. Avoidance not feasible as access is required to facilitate construction and Southern Brown Bandicoot habitat creates a long linear barrier perpendicular to the pipeline route.
37.49	37.54	Ridgeways Drain Southern Brown Bandicoot assumed present in hawthorn hedge with blackberries	ROW width reduced to 20 m	ROW reduced to 20 m in area of Southern Brown Bandicoot habitat. Avoidance not feasible as access is required to facilitate construction and Southern Brown Bandicoot habitat creates a long linear barrier perpendicular to the pipeline route.
38.85	38.90	Dalmore Road Dalmore Drain	Bore and ROW width reduced to between 20 and 15 m.	Avoid trenching impacts to Dalmore Road
40.00	40.30	Known habitat for Southern Brown Bandicoot and Growling Grass Frog Major drain - Cardinia Creek	HDD	Avoid impacts to Cardinia Creek and associated vegetation on the banks of the drain. Avoids known habitat for Southern Brown Bandicoot and Growling Grass Frog.
40.88	41.30	Major drain - Toomuc Creek, Deep Creek Desalination Pipeline Ballarto Road Known habitat for Southern Brown Bandicoot and Growling	HDD	Avoid impacts to Toomuc Creek, Deep Creek and associated vegetation on the banks of the drain. Avoids desalination pipeline. Avoids known habitat for Southern Brown Bandicoot and Growling Grass Frog. Avoids potential habitat for Dwarf Galaxias and Australian Grayling.

KP start	KP finish	Feature	Design response	Mitigation provided
43.42		Grass Frog Potential habitat for Dwarf Galaxias and Australian Grayling		
	43.42	A narrow strip of dense vegetation along a paddock drain. Potential Southern Brown Bandicoot habitat.	ROW width reduced to 20 m	Minimises impact on potential Southern Brown Bandicoot habitat
45.25	45.27	Hagelthornes Drain Dwarf Galaxias potential habitat	ROW width reduced to 20 m	Minimise impact on drain and potential Southern Brown Bandicoot habitat
46.00	46.05	Planted native trees	ROW width reduced to 20 m	Avoid impacts to planted native trees
46.51	46.66	Koo Wee Rup Rd Southern Brown Bandicoot known habitat	HDD	HDD of Koo Wee Rup Road and area of planned road widening. Avoidance of Southern Brown Bandicoot habitat in road reserve.
49.16	49.41	Major drain - Pakenham Creek Southern Brown Bandicoot potential habitat Dwarf Galaxias potential habitat	HDD	Avoid impacts to Pakenham Creek and associated vegetation on the banks of the drain. Avoids potential habitat for Southern Brown Bandicoot and Growing Grass Frog.
54.65	54.67	Unnamed watercourse	ROW width reduced to 20 m	Reduce impacts to watercourse
54.72	54.84	Native vegetation	ROW width reduced to 20 m	Reduce impacts to planted native vegetation at request of landowner

Gas Import Jetty and Pipeline Project

www.gasimportprojectvictoria.com.au

General and Gas Import Jetty enquiries
1800 039 600
AGLcommunity@agl.com.au

Pipeline enquiries
1800 531 811
cribpointpakenham@apa.com.au

