**Chapter 7**

**Terrestrial and freshwater biodiversity**

**This chapter discusses the potential terrestrial and freshwater biodiversity impacts associated with the construction and operation of the Gas Import Jetty and Pipeline Project (the Project). This chapter is based on the impact assessment presented in EES Technical Report B:** *Terrestrial and freshwater biodiversity impact assessment***.**



# **Overview**

Terrestrial ecology is the study of land-based organisms and how they interact with each other and their surroundings. It is important to understand how individual flora and fauna species rely on their environment and how that environment responds to change, including species composition, vegetative cover, hydrology and geomorphology.

The value that is placed on terrestrial and freshwater biodiversity is recognised through the legislation and policies which are designed to conserve native flora, fauna, habitat and ecological communities. In particular, this includes the E*nvironment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), which protects internationally and nationally important flora, fauna and ecological communicates defined as matters of national environmental significance, and the *Flora and Fauna Guarantee Act 1988* (Vic) (FFG Act), which provides for the protection of Victorian flora, fauna and associated habitats. All legislation relevant to terrestrial ecology is discussed further in Section 3 of EES Technical Report B: *Terrestrial and freshwater biodiversity impact assessment*.

Understanding the existing ecological values that require protection enables the Project’s design to be refined and construction methods developed to avoid or minimise impacts to terrestrial and freshwater biodiversity. Potential impacts to terrestrial ecology may include removal of habitat, harm or mortality of individuals, degradation or modification of habitat and disruption to an ecosystem that may further exacerbate these impacts.

In 1982, a significant portion of Western Port was designated as a wetland of international importance under the Ramsar Convention on Wetlands of International Importance, with special recognition as waterfowl habitat. The Western Port Ecological Character Description recognises waterbirds as a critical component of the Ramsar site, with three of the five criteria required to satisfy the listing of the Ramsar site directly related to waterbirds within the site. It is important to understand if the Project could impact the ecological character of the Ramsar site or other ecological values within the study area. This would also inform the management and mitigation of terrestrial and freshwater biodiversity impacts during both the construction and operation of the Project.

The key statutory approvals required for the Project to manage any terrestrial ecology or freshwater biodiversity impacts that may arise from the construction and operation of the Project are:

* Pipeline Licence under the *Pipelines Act 2005* (Vic)

for the Pipeline Works

* EPBC Act approval for each of the Pipeline Works and the Gas Import Jetty Works
* Incorporated Document, applied pursuant to a Planning Scheme Amendment, for the Gas Import Jetty Works including the FSRU
* consent under the *Marine and Coastal Act 2018* (Vic) for components of each of the Pipeline Works and Gas Import Jetty Works.

Potential impacts to the Western Port Ramsar site are also discussed in **Chapter 6** *Marine biodiversity* and **Chapter 8** *Surface water.*

# **EES evaluation objective**

The scoping requirements for the EES set out the following relevant draft evaluation objectives:

##### Biodiversity – To avoid, minimise or offset potential adverse effects on native flora and fauna and their habitats, especially listed threatened 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.**

To assess the potential impact of the Project on land- based and aquatic (freshwater) flora and fauna values, a terrestrial and freshwater biodiversity impact assessment was undertaken.

# **Me****thodology**

The approach adopted for the terrestrial and freshwater biodiversity impact assessment involved the following key tasks:

* a review of relevant legislation and policy at Commonwealth, state and local levels
* a desktop review of relevant biodiversity databases including:
  + Victorian Biodiversity Atlas (Victorian Department

of Environment, Land, Water and Planning

[DELWP])

* + Protected Matters Search Tool (PMST) for matters protected by the EPBC Act (Commonwealth

Department of Environment and Energy [DoEE])

* + NatureKit (DELWP)
  + Groundwater Dependent Ecosystems Atlas (Commonwealth Bureau of Meteorology)
* a desktop review of existing assessment reports, including the following previous field based ecological investigations:
  + Crib Point to Pakenham: Dwarf Galaxias targeted surveys (Biosis, 2019)
  + Crib Point Pakenham pipeline: Flora survey report

for River Swamp Wallaby-grass (Biosis, 2019)

* + Crib Point Pakenham Pipeline: Flora survey report (Biosis, 2019)
  + Flora and Fauna Assessment – Crib Point Pakenham Pipeline Project Monarc Environmental,

2018)

* + Southern Brown Bandicoot Targeted Survey Report Monarc Environmental, 2018)
  + Growling Grass Frog Targeted Survey Report Monarc Environmental, 2018)
  + Aquatic Survey Report. Crib Point Pakenham Pipeline Project Monarc Environmental, 2018)
  + Swamp Skink Targeted Survey Report Monarc Environmental, 2018)
  + Southern Toadlet Targeted Survey Report (Monarc Environmental, 2018)
  + Groundwater impact assessment (AECOM, 2019)
  + Noise and vibration impact assessment (AECOM, 2019)
  + Flora and fauna assessment. AGL Gas Import Jetty Project (Jacobs, 2018)
* review and consideration of relevant stakeholder input collected as part of engagement activities carried out by AGL and APA
* a field-based Vegetation Quality Assessment (VQA) was undertaken for all 87 patches of native vegetation impacted by the Project works
* site investigations to assess fauna values, based on the types and qualities of habitat(s) present. fauna species were recorded with a view of characterising the values of the site, not to provide a survey of fauna with potential to utilise the site over time.
* characterisation of existing flora and fauna values
* assessment of terrestrial and freshwater biodiversity impacts during construction and operation of the Project
* a risk assessment as described in **Chapter 5** *Key approvals and assessment framework*, to inform the impact assessment and development of additional mitigation measures
* development of mitigation measures in response to the terrestrial and freshwater biodiversity impact assessment.

# **Study area**

The study area for this assessment is consistent with the defined Project Area outlined in **Chapter 4** *Project description*, which includes the pipeline right of way (ROW) and alignment options, the Pakenham Delivery Facility, the End of Line Scraper Station (EOLSS), mainline valves (MLVs), pipe stringing areas and the area required for the Gas Import Jetty Works. The study area for this assessment also includes adjacent exposed intertidal and coastal habitats at Crib Point (see [**Figure 7-5**](#_bookmark8)), in order to assess potential impacts on this habitat type and the species that use them (such as shorebirds).

In addition, the Project search area refers to the defined Project Area with a five-kilometre buffer, which has been used to conduct database searches and determine significant species, migratory species and ecological communities within the broader area of the Project.

In some instances, and consistent with the way the Project is described in **Chapter 4** *Project description*, this chapter refers to the Pipeline Works and the Gas Import Jetty Works, where potential impacts or mitigation are specific to a particular part of the Project. The extent of the Gas Import Jetty Works is shown in [**Figure 7-4**](#_bookmark7) and the extent of the Pipeline Works is shown in [**Figure 7-6**](#_bookmark11)and [**Figure 7-14**](#_bookmark19).

# **Existing conditions**

The existing conditions for each set of works are outlined in **Section** [**7.5.1**](#_bookmark1) (*Gas Import Jetty Works*) and **Section**

[**7.5.2**](#_bookmark9) (*Pipeline Works*) of this chapter. A combination of previous ecological assessments and additional site investigations where necessary have informed the existing conditions. These previous assessments are summarised in EES Technical Report B: *Terrestrial and freshwater biodiversity impact assessment.*

## **Gas** **Import Jetty Works**

This section outlines the existing conditions for the Gas

Import Jetty Works relating to flora and fauna values.

### Flora values of the Gas Import Jetty Works

A total of 274 flora species were recorded within the Project Area, comprising 186 indigenous species and 88 introduced species. Previous assessments considered the Project study area as a whole, and therefore the number of flora species recorded within the Gas Import Jetty Works area specifically has not been determined. However, flora species present within the Gas Import Jetty Works area are associated with coastal and near- coastal habitats. Eight large trees and two scattered trees are located within the Gas Import Jetty Works area.

Vegetation within the Gas Import Jetty Works is restricted to the area of the proposed Crib Point Receiving Facility, on land currently owned by the Port of Hastings Development Authority (PoHDA). During the EES process, PoHDA undertook fire management works to manage potential bushfire risks to the site associated with the existing use of Crib Point Jetty for petroleum imports. This involved clearing of vegetation around the Crib Point Jetty, including the location of the proposed Crib Point Receiving Facility, to reduce the risk of fire. This assessment has assumed that the vegetation had not been removed and this has been taken into account when assessing potential impacts and determining native vegetation offset requirements (see **Section** [**7.12.2**](#_bookmark37)).



**EVCs, large trees and scattered trees**

**Ecological Vegetation Class (EVC): the standard classification system for vegetation types in Victoria. EVCs are described through a combination of floristics, lifeforms and ecological characteristics, and through an inferred fidelity to particular environmental attributes**

**Large tree: A large tree is defined as a living tree of any species that has a diameter at breast height over bark (DBHOB) equal to or greater than 2.5 metres**

**Scattered tree: a native canopy tree that does not form part of a patch.**

Native vegetation in the Gas Import Jetty Works area is significantly degraded as the area is heavily modified, with vegetation comprising mostly of regrowth from removal decades ago. While there is an abundance of Australian-native planted shrubs and trees, there is also an abundance of invasive weeds.

Two Ecological Vegetation Classes (EVCs) are present

within the Gas Import Jetty Works Area:

* Swamp Scrub (EVC 53)
* Heathy Woodland (EVC 48).

The extent of these two EVCs is shown in [**Figure 7-1**](#_bookmark2). Swamp Scrub has a bioregional conservation status of ‘Endangered’. Only a very small area of this EVC (approximately 0.030 hectares) is present in the north- eastern corner of the Gas Import Jetty Works area. It is considered to be of low quality and does not contain any emergent eucalypts. The area supports a low diversity of native flora and has a moderate cover of weeds.

Heathy Woodland has a bioregional conservation status of ‘Least concern’ and covers an extent of 1.573 hectares within the Gas Import Jetty Works. The habitat zone that runs adjacent to The Esplanade is of moderate diversity with a relatively intact canopy that is patchy in places. A number of introduced weeds are present within this habitat zone which become more prevalent along the road verge. Organic litter is prevalent throughout the area. There are places of native weed infestations, in particular Bluebell Creeper *Billardierei heterophylla*. A number of large trees supporting hollows are also present in the area.

**Figure 7-1:** EVCs within the Gas Import Jetty Works area

Noxious weeds are introduced plants that are listed under the *Catchment and Land Protection Act 1994* (Vic) (CaLP Act) and are classified based on region and the level of action required to control or prevent their spread. Under the CaLP Act 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, dependent on their regional classification.

A total of five noxious weeds were identified within the Gas Import Jetty Works Area:

* Bridal Creeper *Asparagus asparagoides*

(regionally restricted)

* Soursob *Oxalis pes-caprae* (regionally restricted)
* Spear Thistle *Crirsium vulgare*

(regionally controlled)

* Flax-leaf Broom *Genista linifolia*

(regionally controlled)

* Blackberry *Rubus anglocandicans*

(regionally controlled).

These weeds are sporadic within the area and are predominantly found along The Esplanade road verge.

### Fauna values of the Gas Import Jetty Works

Eight terrestrial fauna species were observed within the Gas Import Jetty Works area during field surveys. These were all bird species using habitats associated with the Crib Point Jetty and were observed flying over, perching or roosting on the existing Jetty Infrastructure. Wader and waterbird surveys undertaken in March 2019 and August 2019 recorded several waders and waterbirds foraging at high tide and low tide shoreline areas within Hasting’s Bight, including Caspian Tern *Hydroprogne caspia*, Little Egret *Egretta garzetta nigripes*, and Eastern Great Egret *Ardea modesta*.



**Roosting and foraging**

**Roosting: roosting sites are places where birds or**

**fowls can settle or rest safely, particularly at night**

**Foraging: foraging is the act of searching for and gathering food, either for immediate consumption or for future storage**

These surveys in March and August were undertaken to gain an understanding of how certain birds use Western Port outside the main migratory season (November to February). The results show that some bird species that were present at important roost sites and foraging areas in Hastings Bight were not present at the Crib Point Foreshore during surveys. However, this does not necessarily indicate that species would not use Crib Point Foreshore.

Wader and waterbird surveys undertaken in January and February 2020 were timed to coincide with the presence of migratory shorebirds. Of the four surveys undertaken at high tide, only one survey detected one resident species (Pied Oystercatcher *Haematopus longirostris)* using habitat on Woolleys Beach to the immediate north of the Gas Import Jetty Works area. During the four low tide surveys undertaken, two migratory shorebird species were recorded. One Eastern Curlew *Numenius madagascariensis* was observed foraging at Hastings Bight, approximately 2.5 kilometres north of the Crib Point Jetty, and five Red-necked Stints *Calidris ruficollis* were observed foraging at low tide on Woolleys Beach immediately north of the Gas Import Jetty Works area.

Terrestrial fauna habitats include areas of native vegetation around the proposed Crib Point Receiving Facility and along The Esplanade road reserve. The existing jetty provides roosting and perching habitat for some waterbird species. Adjacent to the Gas Import Jetty Works area, coastal mudflats at Woolleys Beach also support foraging habitat for waders and waterbirds.

### Significant species within the Gas Import Jetty Works area

A desktop review identified a list of significant species recorded or predicted to occur within five kilometres of the Project Area. Of the species recorded or predicted to occur within the Project search area, 42 are considered to have a medium or higher likelihood of occurring within the Gas Import Jetty Works area (including Woolleys Beach immediately adjacent). These comprise:

* 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 (so the combined sum of the above list totals more than 42). A summary of these species is provided in

[**Table 7-1**](#_bookmark3) with an indication of habitat or site features relevant to each species.

**Table 7-1:** Significant species recorded or likely to occur within the Gas Import Jetty Works area (Including Woolleys Beach)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Common name** | **Conservation status** | |  | **Areas of importance within the Gas Import Jetty Works area (including Woolleys Beach)** |
|  | **EPBC** | **DELWP** | **FFG** |
| **EPBC Act-listed threatened species** | | | | |
| Fairy Tern | VU | e | L | Western Port and Crib Point Jetty area |
| 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 |  | 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 | V, Mi | v | L | Aerial species that would occur over most habitat types |
| **FFG Act-listed threatened species** | | | | |
| Merran’s Sun-orchid |  | e | L | Potential habitat south of the Crib Point Jetty adjacent to  Woolleys Beach Reserve |
| 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 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) |

#### 

**Areas of importance within the Gas Import Jetty Works area (including Woolleys Beach)**

**FFG**

**EPBC DELWP**

**Conservation status**

**Common name**

##### DELWP Advisory-listed rare or threatened species

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Marsh Sun-orchid |  | e | I | Potential habitat south of the Crib Point Jetty, adjacent to  Woolleys Beach Reserve |
| Pallid Sun-orchid |  | e | I | Potential habitat south of the Crib Point Jetty, adjacent to  Woolleys Beach Reserve |
| Gaping Sun-orchid |  | e |  | Potential habitat south of the Crib Point Jetty, adjacent to  Woolleys Beach Reserve |
| Crested Sun-orchid |  | r |  | Potential habitat south of the Crib Point Jetty, adjacent to  Woolleys Beach Reserve |
| Crimson Sun-orchid |  | v |  | Potential habitat south of the 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 would occur over most habitat types | |
| Arctic Jaeger | Mi |  | Western Port | |
| Crested Tern | Mi |  | Western Port and Crib Point Jetty area | |
| 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 use vegetation in the Gas Import Jetty Works area  during migration | |
| Satin Flycatcher | Mi |  | May use vegetation in the Gas Import Jetty Works 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. Species with a DELWP status of nt are not considered significant.**

### Listed ecological communities

Initial desktop assessments identified two ecological communities listed under the EPBC Act and one listed under the FFG Act as having potential to occur within the Gas Import Jetty Works area. Natural Damp Grassland of the Victorian Coastal Plains (Critically Endangered) and Subtropical and Temperate Coastal Saltmarsh (vulnerable) are listed under the EPBC Act. Plains Grassland (South Gippsland) is listed under the FFG Act. Surveys carried out as part of this assessment confirmed that none of these communities are present within the Gas Import Jetty Works area.

### Western Port Ramsar site

The Western Port Ramsar site encompasses most of Western Port, excluding the land areas of French Island and Phillip Island, as shown in [**Figure 7-2**](#_bookmark5) . As a wetland of international importance, the Western Port Ramsar site supports four types of wetland that cover different areas:

* marine subtidal aquatic beds (15,000 hectares)
* intertidal mud, sand or salt flats (27,000 hectares)
* intertidal marshes (1,144 hectares)
* intertidal forested wetland (1,700 hectares).

Waterbirds are identified as a key ecological component of the Ramsar site, with many of the wader and waterbird species that use Western Port protected under international agreements for the protection of migratory birds. The extensive shoreline, shallow and intertidal environments that Western Port provides are the most important and valuable attributes for waterbird species using the site.



**Western Port Ramsar site**

**Western Port occupies approximately 59,950 hectares comprising 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 significance and given special recognition as Waterfowl Habitat under the Ramsar Convention.**

**Waterbirds have been identified by the Western Port Ecological Character Description (ECD) as a critical component of the Ramsar site. Three of the five criteria required to satisfy the listing of the site under the Ramsar Convention in 1982 directly relate to waterbirds within the site.**

The physical attributes of Western Port have a significant effect on habitat distributions. The physical nature of these habitats determine the kind organisms present and the main ecological processes. Melbourne Water*1* (2018) identified six major habitats of Western Port based on these physical characteristics as outlined in [**Table 7-2**](#_bookmark4)and shown in [**Figure 7-2**](#_bookmark5).

1. Melbourne Water 2018. *Understanding the Western Port Environment: a summary of research findings from the Western Port Environmental Research Program 2011-2017 and priorities for future research*, Melbourne Water, Melbourne. Menkhorst P, Rogers D & Stamation K 2014. Waterbird surveys of the Port of Hastings and north-west Western Port, 2014, Unpublished Client Report for the Port of Hastings Development Authority, Victorian Government Department of Environment and Primary Industries Arthur Rylah Institute for Environmental Research, Melbourne.

**Table 7-2:** Habitats of Western Port

|  |  |
| --- | --- |
| **Habitat** | **Description** |
| Water column | The water column is inhabited by multiple organisms, including phytoplankton, zooplankton, jellyfish and a  range of larger vertebrate species. |
| Mud | Mud in Western Port is the prevailing habitat in Western Port, comprising intertidal and subtidal soft sediments covering about two thirds of the bay. This area has increased following the loss of seagrass beds. The intertidal flats are important foraging grounds for shorebirds. Western Port has 27,000 hectares of intertidal mudflats. |
| Seagrasses | Seagrasses provide a role as ecosystem engineers, as they are involved with the movement of sediments, nutrient and energy transfer and provide habitat for animals. Seagrasses are considered intricately linked with protecting the health of Western Port. Two genera are present; *Zostera* and *Amphibolis*. There has been extensive loss of these seagrasses in areas where water quality is poor, particularly in the eastern section  of the bay. The extent of marine subtidal aquatic beds (underwater vegetation, principally seagrass) totals 15,000 hectares (Hale, 2016). |
| Mangroves | Mangroves persist in large numbers throughout most of the Western Port shoreline. Changes in the overall distribution of mangroves has seen communities of mangroves encroach on saltmarsh communities in some locations. Melbourne Water (2011) estimates the extent of mangroves at 1,800 hectares. |
| Saltmarshes | Saltmarshes are found around much of the coast of Western Port, generally between the mangrove fringe on the seaward side, and terrestrial vegetation such as Swamp Scrub. Saltmarsh is vulnerable to sea level rise and other consequences of climate change, especially rising air and water temperatures.  The following coastal saltmarsh Ecological Vegetation Community (EVCs) comprise 2,266 hectares within  Western Port:   1. Wet Saltmarsh Herbland 2. Wet Saltmarsh Shrubland 3. Coastal Tussock Saltmarsh 4. Coastal Dry Saltmarsh 5. Coastal Aggregate Saltmarsh   Western Port also supports 108 hectares of Estuarine Wetland. |
| Rocky reefs | 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. |

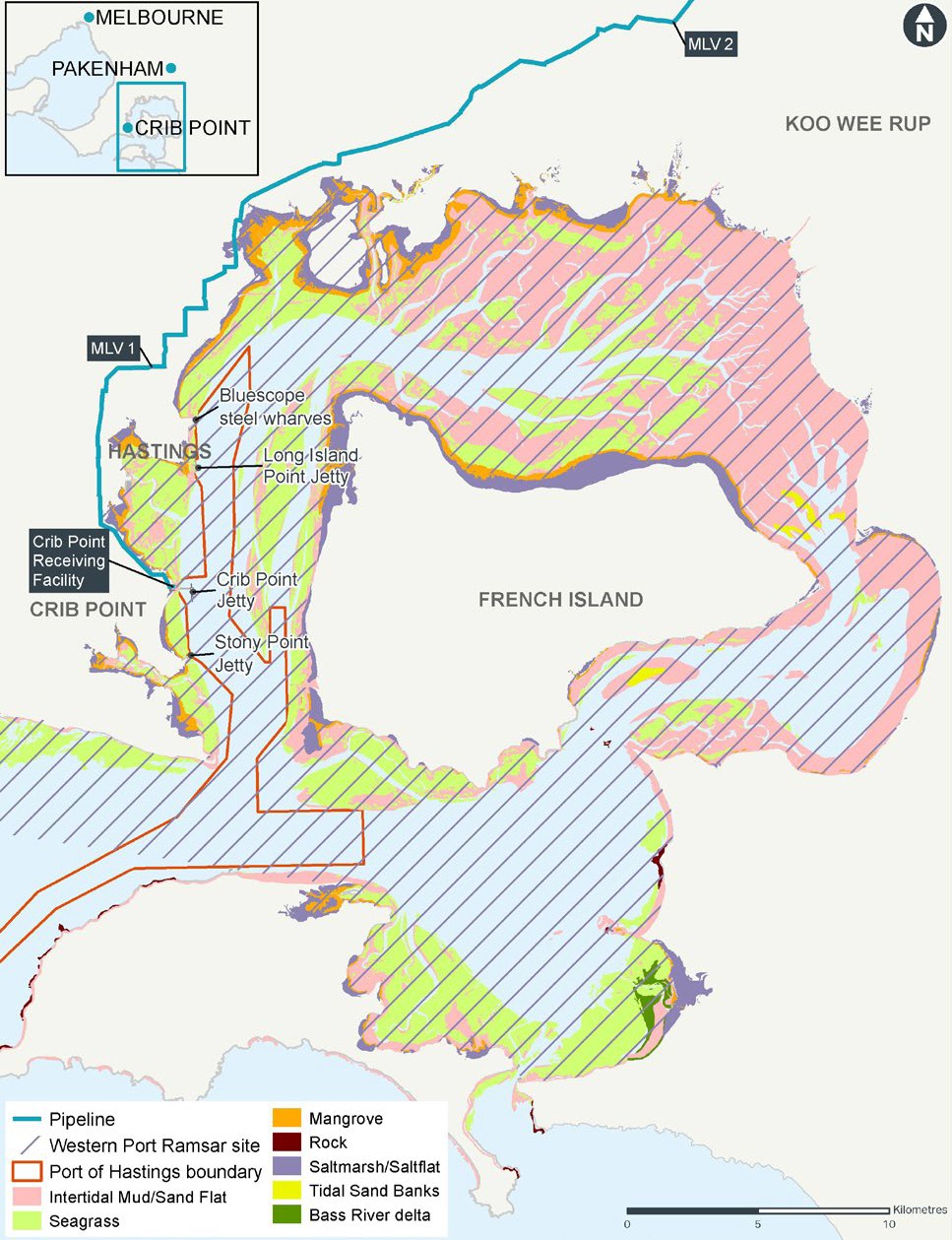
As shown in [**Figure 7-2**](#_bookmark5), the most extensive habitats are the unvegetated soft sediments, mostly the wide-spread areas of intertidal mudflats, as well as the fringing areas of mangroves and saltmarsh. Some areas of the intertidal flats are covered by seagrass, but seagrass areas are more extensive below the low tide level. Intertidal rocky reefs are sparse in Western Port, and occupy a small area confined to the south-west section of the bay.

### Waders and waterbirds

Most waterbirds that use Western Port are nomadic or migratory, with only a small number of species being sedentary. The abundance and spatial and temporal use of the Western Port Ramsar site by waterbirds is influenced by an array of factors that are mostly external to Western Port.

Other than a few sedentary species such as the Hooded Plover *Thinornis rubricollis*, almost all waterbirds using Western Port have nomadic ability meaning they have substantial capacity to make large-scale movements to take advantage of suitable resources. In addition to the nomadic ability of most waterbirds, a large portion are also migratory, making regular movements often along defined flyways between areas where they breed, and areas used during the non-breeding period of the year.

Many species have specific annual routines with their migrations being highly predictable. The majority of shorebirds using Western Port are Holarctic species that breed in high latitudes of the northern hemisphere and are found in southern Australia during the austral spring- summer. In comparison, many pelagic birds including petrels, shearwaters, albatrosses and some terns breed on islands in the Southern Ocean and are present in southern Australia water only during austral winter.

**Figure 7-2:** Western Port

Ramsar site major habitats.

Major habitats are derived from Melbourne Water 2018. Understanding the Western Port Environment: a summary of research findings from the Western Port Environmental Research Program 2011-2017 and priorities for future research

A total of 115 waterbird species that are considered critical to the character of the Ramsar site have been recorded within the Western Port Ramsar site. Population trends of 39 species have been observed between 1973 and 2015 : 22 of these species have been observed to be in decline; 15 species have remained stable; and two species have increased in population (Pied Oystercatcher and Red-necked Avocet) (Loyn et. al., in Melbourne Water, 2018). The intertidal mudflats in Western Port are an important habitat for migratory and resident shorebirds who use this area for foraging and the adjacent higher areas for roosting. Important wader and waterbird habitat including roost sites and primary and secondary foraging habitats within Western Port are shown in [**Figure 7-3**](#_bookmark6).



*(source: Western Port Welcomes Waterbirds: waterbird usage of Western Port. Arthur Rylah Institute for Environmental Research Technical Report Series No. 222)*

**Figure 7-3:** Important wader and

waterbird habitat in Western Port

### Western Port Ramsar values within the Gas Import Jetty Works area

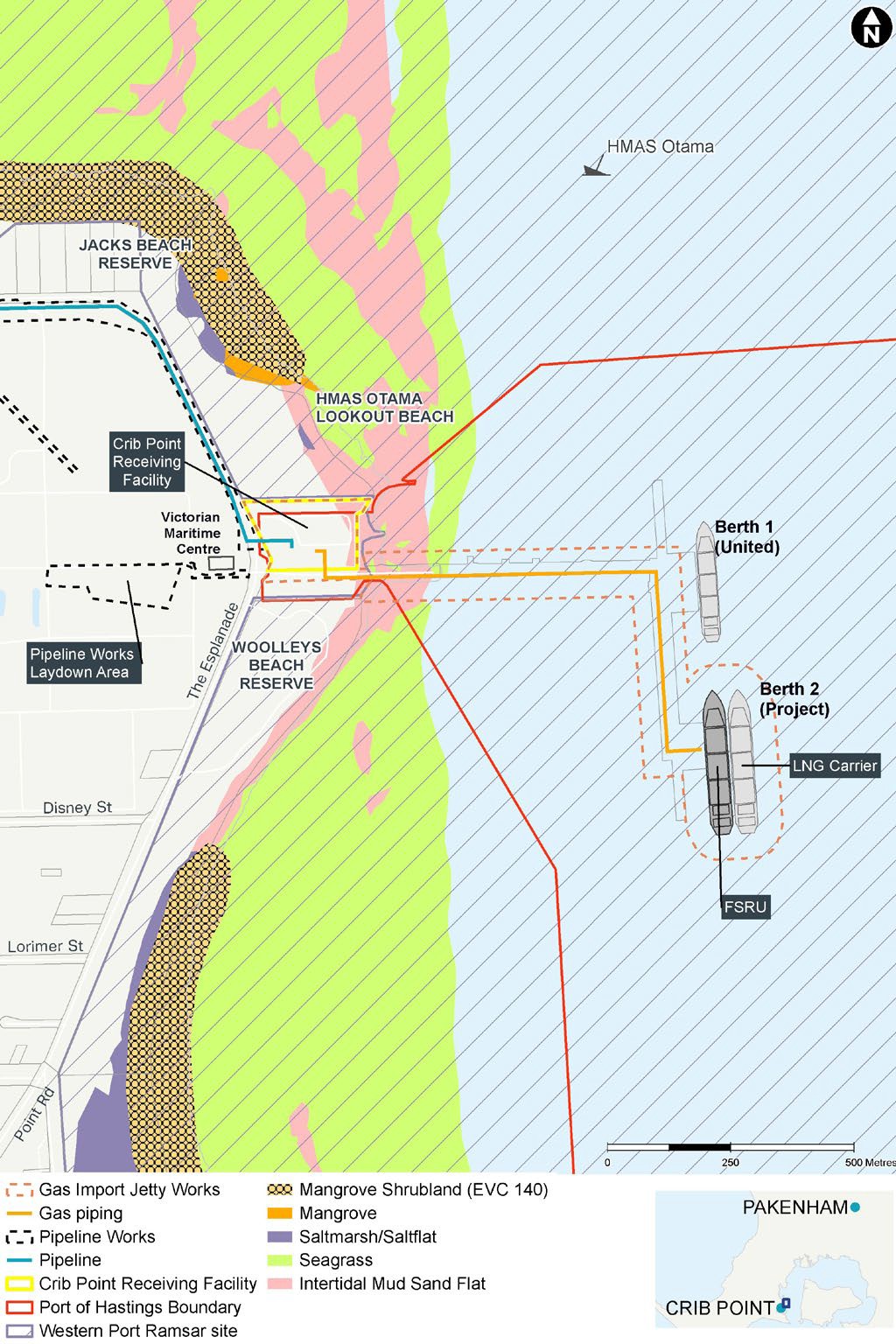
The Western Port Ramsar site includes the Crib Point Foreshore and the area corresponding with the Crib Point Jetty, with the FSRU proposed to be located within the deep-water channel at least 500 metres offshore from the intertidal mudflat areas (see [**Figure 7-4**](#_bookmark7)). The proposed Crib Point Receiving Facility would be located outside of the Western Port Ramsar site. The shoreline to the north of the Crib Point Jetty contains scattered occurrences of White Mangrove, while further north along Woolleys Beach and closer to Jack’s Beach (around 250 metres north of the Gas Import Jetty Works), there are pockets of Mangrove Shrubland EVC, as shown in [**Figure 7-4**](#_bookmark7).

The National Vegetation Information Management (NVIM) system models the area at Crib Point as having Coastal Saltmarsh or Mangrove EVCs, but field assessments by Biosis did not identify those EVCs in the area. Wader and waterbird surveys undertaken by Biosis in 2019 and 2020, combined with data collected as part of the Shorebirds 2020 program which includes migratory birds, did not highlight any significant usage by waders and waterbirds of habitats within the immediate vicinity of the Crib Point Jetty.

Roosting sites and primary and secondary foraging habitat for waders and waterbirds in proximity to the Gas Import Jetty Works are shown in [**Figure 7-5**](#_bookmark8).

To the south of the Crib Point Jetty, secondary foraging habitat extends for approximately two kilometres south to Stony Point. To the north of the Crib Point 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, beginning approximately 250 to 300 metres north of the nearest part of the Crib Point Jetty.

The closest identified wader and waterbird roosting sites to the Crib Point Jetty are south of Long Island Point (approximately 3.8 kilometres north of the Crib Point Jetty) and between Fairhaven and Tankerton Pier on French Island (approximately four kilometres south-east of the Crib Point Jetty).

**Figure 7-4:** Western Port Ramsar values surrounding the Gas Import Jetty Works

**Figure 7-5:** Foraging habitat within proximity to the Gas Import Jetty Works

## **Pipeline Works**

This section outlines the existing conditions for the

Pipeline Works relating to flora and fauna values.

### Flora values of the Pipeline Works

The Pipeline Works area contains a variety of habitat types and supports a large proportion of the 186 indigenous and 88 introduced flora species recorded within the Project Area, particularly species associated with cleared agricultural land, aquatic systems, riparian vegetation and EVCs that do not occur in the Gas Import Jetty Works area.

A total of 11 EVCs were recorded within patches of the

Pipeline Works area, comprising a combined extent of

12.3 hectares as shown in [**Figure 7-12**](#_bookmark14). In addition, a total of 79 scattered trees and 48 large canopy trees were recorded within the Pipeline Works area that form part of these EVCs. [**Table 7-3**](#_bookmark10) outlines the extent of each EVC recorded including patch trees (large trees only) and scattered trees.

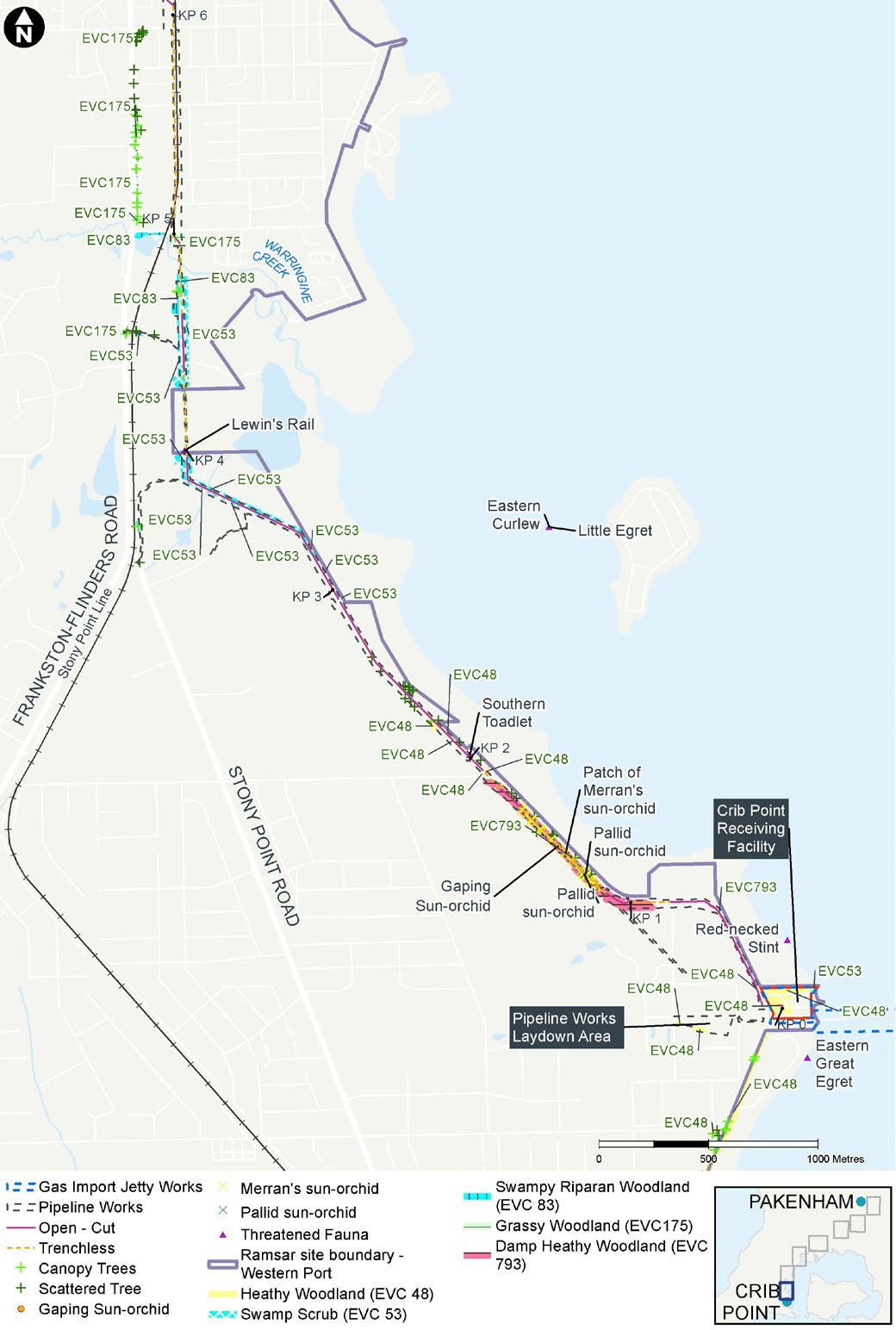
**Table 7-3:** Details of EVC patches and trees recorded within the Pipeline Works area

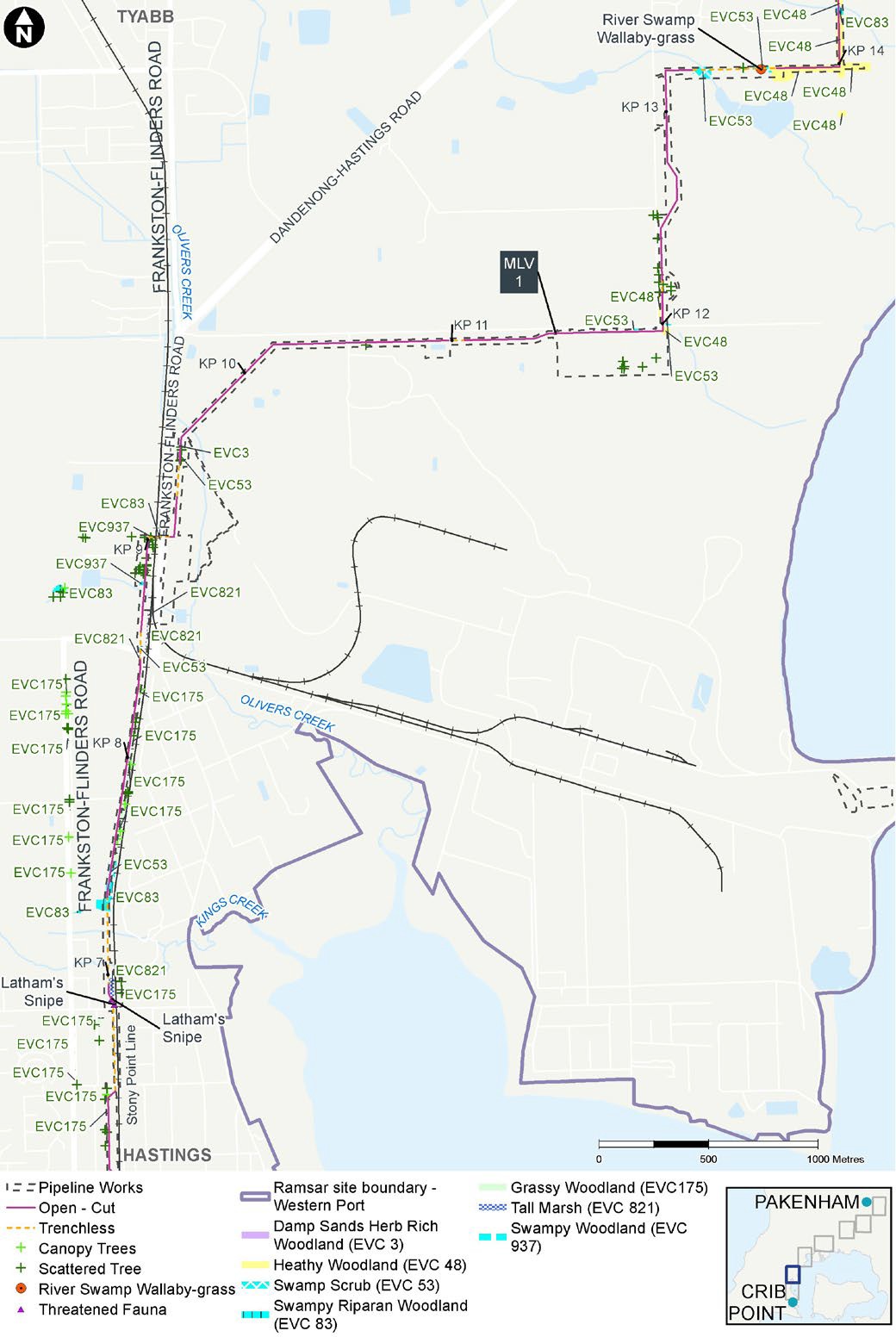
|  |  |  |  |
| --- | --- | --- | --- |
| **EVC** | **Bioregional conservation status** | **Patch trees (large trees only)** | **No. of scattered trees** |
| Aquatic Herbland (EVC 653) | Least concern | 0 | 0 |
| Coastal Saltmarsh (EVC 009) | Least concern | 0 | 0 |
| Swamp Scrub (EVC 053) | Endangered | 0 | 3 large, 22 small |
| Swampy Riparian Woodland (EVC 083) | Endangered | 8 | 0 |
| Tall Marsh (EVC 821) | Least concern | 0 | 0 |
| Heathy Woodland (EVC 048) | Least concern | 30 | 16 large, 9 small |
| Estuarine Scrub (EVC 953) | Endangered | 0 | 0 |
| Grassy Woodland (EVC 175) | Endangered | 6 | 7 large, 7 small |
| Damp Sands Herb-rich Woodland (EVC  003) | Vulnerable | 0 | 2 large, 6 small |
| Damp Heathy Woodland (EVC 793) | Vulnerable | 4 | 0 |
| Swampy Woodland (EVC 937) | Endangered | 0 | 1 large, 6 small |

The vegetation along the length of the proposed pipeline alignment has been assessed as being generally of low quality. North of South Boundary Road East (Kilometre Point (KP) 20), the landscape is extensively modified due to historical clearing of land for agriculture (see [**Figure**](#_bookmark12)[**7-8**](#_bookmark12)). As a result, most habitat zones support low quality vegetation that has recolonised peripheral areas such as along fence and drainage lines. South of KP 20, while still highly modified, there are remnants of native vegetation that support a moderate diversity of native flora and large trees. As the proposed pipeline alignment closely follows existing pipeline easements where possible, much of the vegetation has already been partially cleared or impacted by previous pipeline construction activities.

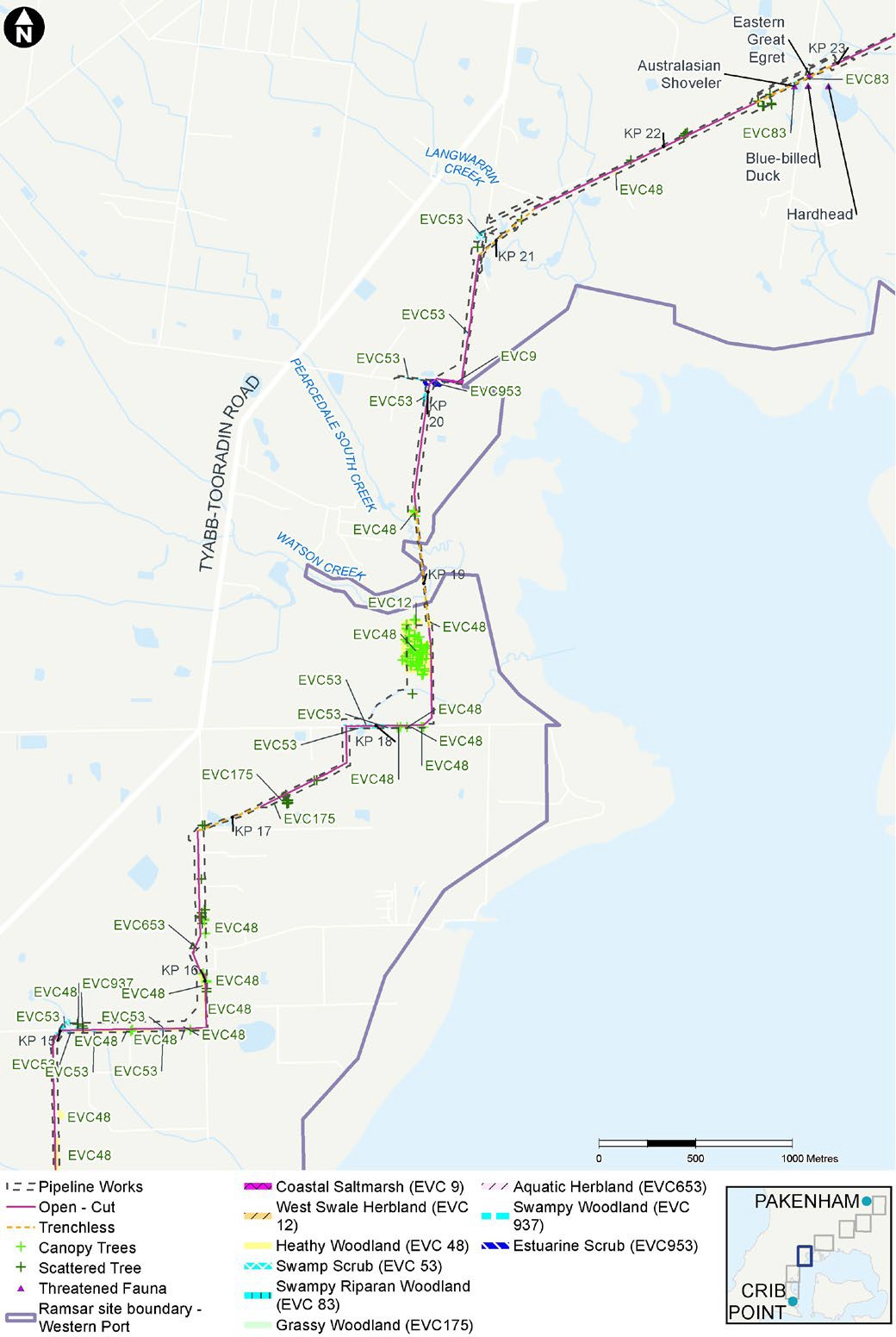
The vast majority of the Pipeline Works area supports non-native vegetation, with much of the area supporting moderate to high levels of weeds, especially Blackberry (*Rubus fruticosus* spp. *agg*) and agricultural pasture grasses. A total of 15 noxious weeds were identified within the Pipeline Works area, many of them prolific and spread widely throughout the area, particularly Blackberry.

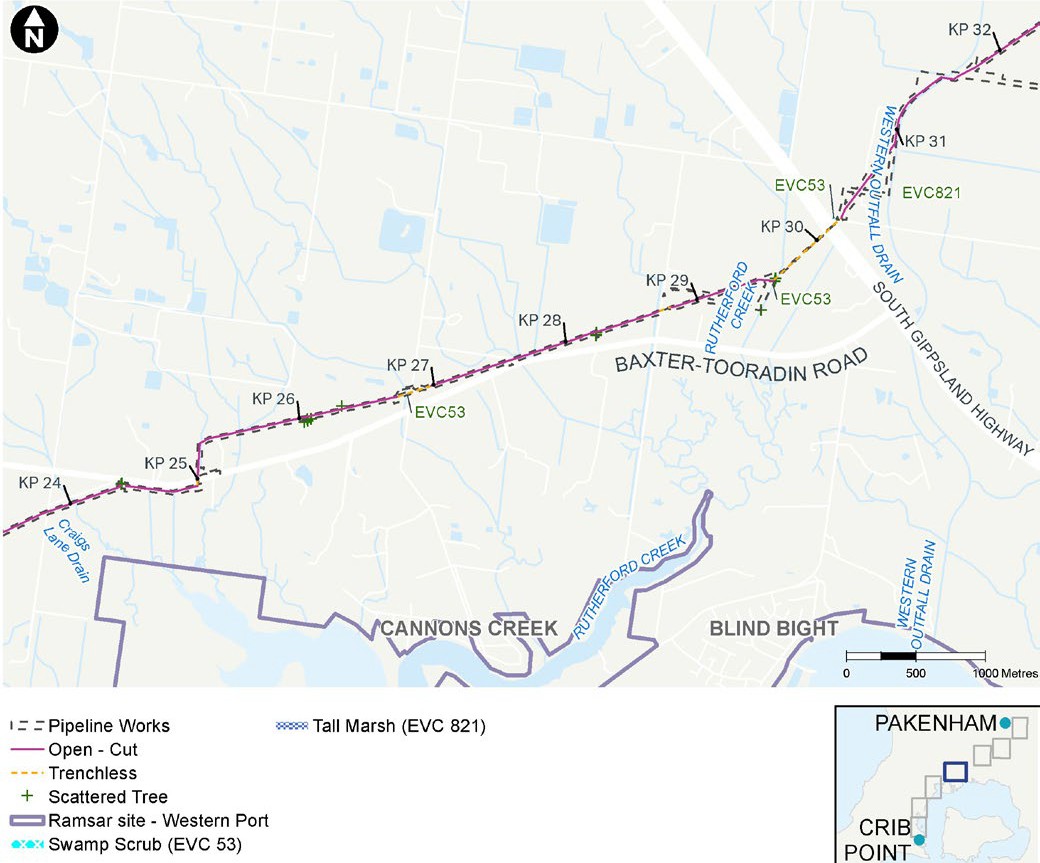
**Figure 7-6:** Ecological values within the Pipeline Works area

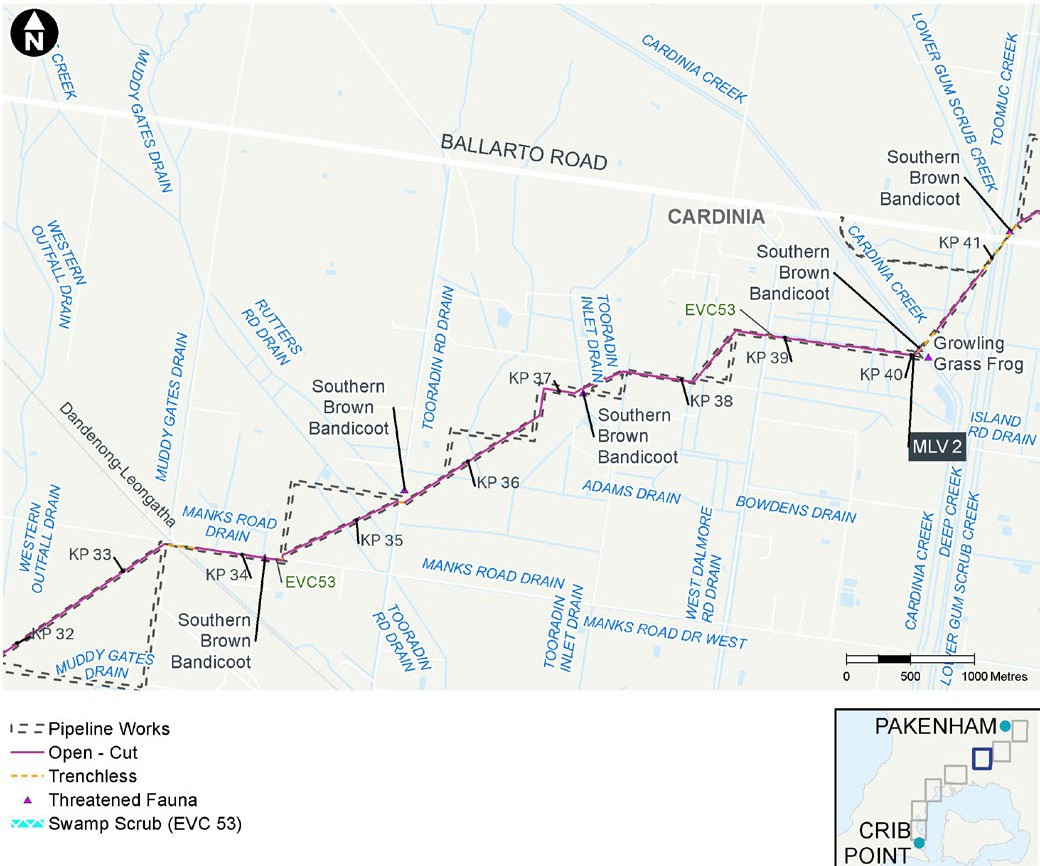


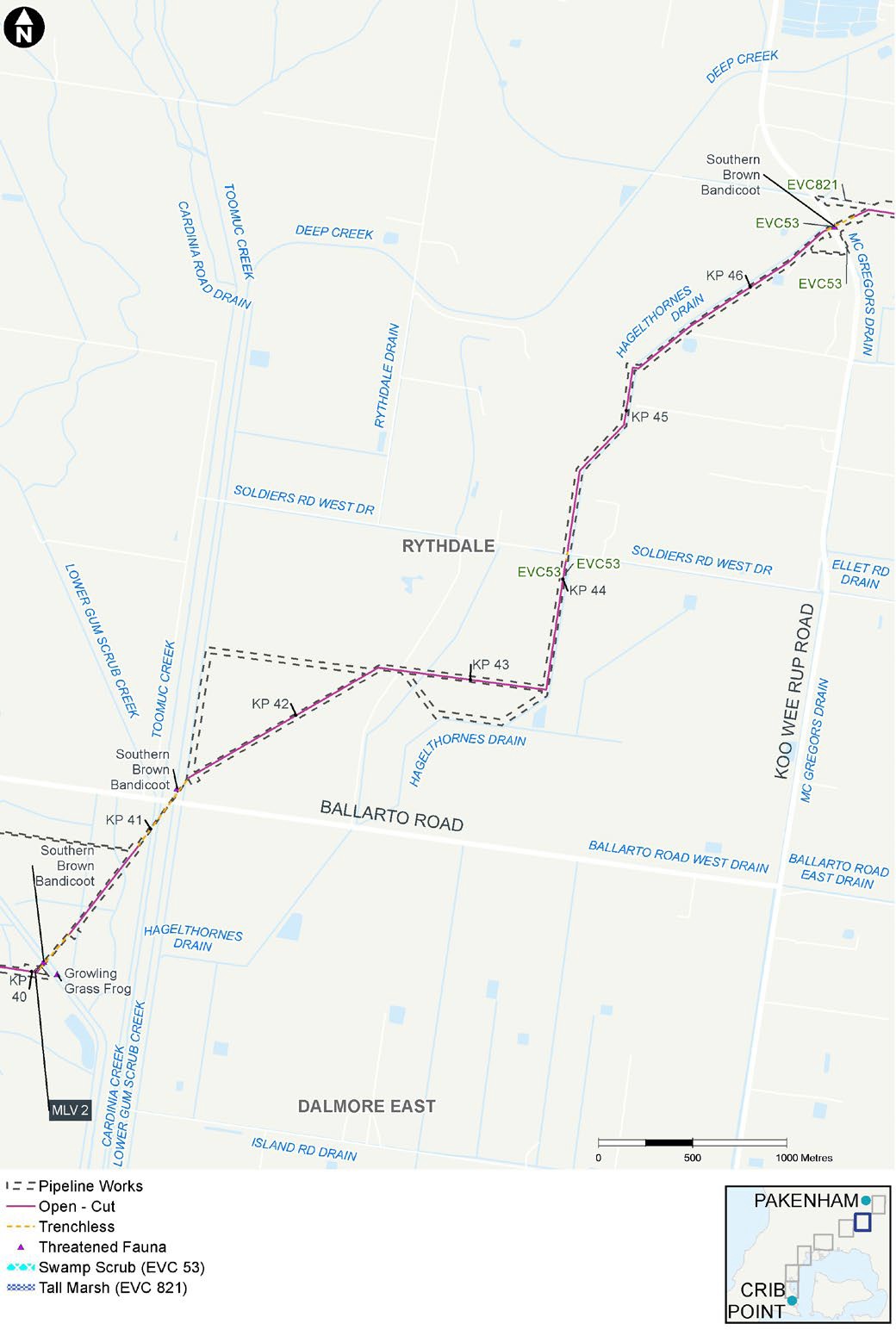
**Figure 7-7:** Ecological values within the Pipeline Works area

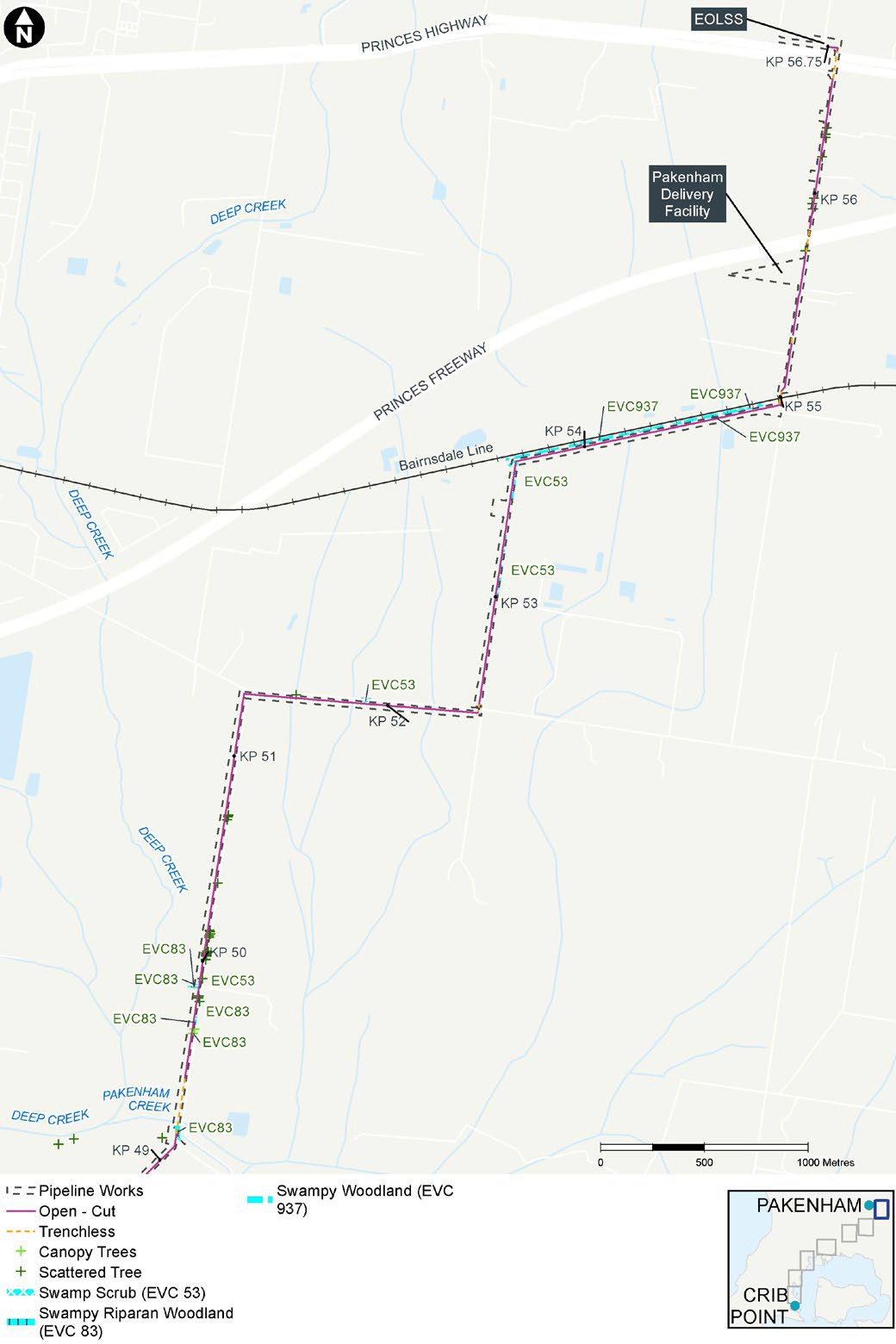
**Figure 7-8:** Ecological values within the Pipeline Works area



**Figure 7-9:** Ecological values within the Pipeline Works area

**Figure 7-10:** Ecological values within the Pipeline Works area

**Figure 7-11:** Ecological values within the Pipeline Works area

**Figure 7-12:** Ecological values within the Pipeline Works area

### Fauna values of the Pipeline Works

A total of 143 fauna species were recorded in the Pipeline Works area. A full list of recorded fauna species is provided in EES Technical Report B *Terrestrial and freshwater biodiversity impact assessment*. [**Table 7-4**](#_bookmark15)outlines the fauna recorded during field investigations carried out for the Project.

**Table 7-4:** Native and introduced fauna records from within the Pipeline Works area

|  |  |  |  |
| --- | --- | --- | --- |
| **Species group** | **Native species** | **Introduced species** | **Total** |
| Aquatic invertebrate | 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** |

Fauna habitat within the Pipeline Works area 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.

Fauna habitat within the Pipeline Works generally corresponds with the EVCs identified in [**Table 7-3**](#_bookmark10)However, the waterways, cleared agricultural lands and thickets of introduced vegetation also provide habitat for fauna, notably the Southern Brown Bandicoot.

A number of EPBC Act-listed species use habitats within the Pipeline Works study area. Southern Brown Bandicoot are typically associated with habitat that provides a dense cover from 0.2 metres to one metre high, regardless of whether the vegetation is native or introduced. Suitable habitat for this species is extensive between South Gippsland Highway (KP 30) (refer to [**Figure 7-9**](#_bookmark13)) and the End of Line Scraper Station (EOLSS). Records of Southern Brown Bandicoot and other significant species are shown in [**Figure 7-13**](#_bookmark18).

Growling Grass Frogs use farm dams and slow-moving waterways with some emergent vegetation. Records of Growling Grass Frog within five kilometres of the Project Area are shown in [**Figure 7-13**](#_bookmark18).

Australian Grayling prefer larger waterways with natural characteristics, with its distribution in the Pipeline Works limited to Cardinia Creek and Lower Gum Scrub Creek. Dwarf Galaxias can persist in most aquatic habitats. Waterways and waterbodies that are considered to contain suitable habitat for Dwarf Galaxias, Australian Grayling and Growling Grass Frog are outlined in [**Table 7-5**](#_bookmark16) and shown in Appendix A of EES Technical Report C: *Surface water impact assessment.*

**Table 7-5:** Important waterways or waterbodies within the Pipeline Works area

|  |  |  |  |
| --- | --- | --- | --- |
| **Waterway/waterbody** | **Location** | **Suitable species habitat** | **Construction**  **methodology** |
| Warringine Creek | KP 4.85 | Dwarf Galaxias | HDD |
| Watson Creek | KP 18.9 | Dwarf Galaxias | HDD |
| Pearcedale South Creek | KP 19.2 | Dwarf Galaxias | HDD |
| Langwarrin Creek | KP 21 | Dwarf Galaxias | HDD |
| Lachies Marsh | KP 21.1 | Dwarf Galaxias | HDD |
| Farm Dam | KP 21.55 | Dwarf Galaxias, Growling Grass Frog | Avoided |
| Craigs Lane Drain | KP 23.83 | Dwarf Galaxias | Trench |
| Western Outfall Drain | KP 31.54 | Dwarf Galaxias, Growling Grass Frog | Trench |
| Tooradin Inlet Drain | KP 37.2 | Dwarf Galaxias | Trench |
| Cardinia Creek | KP 40.1 | Dwarf Galaxias, Australian Grayling, Growling Grass Frog | HDD |
| Lower Gum Scrub Creek | KP 41 | Dwarf Galaxias, Australian Grayling, Growling Grass Frog | HDD |
| Toomuc Creek | KP 41.07 | Dwarf Galaxias | HDD |
| Deep Creek | KP 41.2 | Dwarf Galaxias | HDD |
| Hagelthornes Drain | KP 45.25 | Dwarf Galaxias | Trench |
| Pakenham Creek | KP 49.22 | Dwarf Galaxias | HDD |

While habitat south of Watson Creek (KP 19) (refer to [**Figure 7-8**](#_bookmark12)) is fragmented, it has a much higher level of connectivity to larger patches of native vegetation than more isolated patches in the northern section of the Pipeline Works. North of Watson Creek (KP 19) habitats are much more fragmented. Connection is generally by thin linear strips of vegetation along paddock edges or within road reserves and drains. Due to the high fragmentation of habitat in the northern portion of the Pipeline Works (between Watson Creek and the EOLSS), habitat connectivity is low and reliant upon scattered trees, areas of native vegetation, thick low lying introduced vegetation and drains within paddocks.

Five invasive animals were recorded during field assessments within the Pipeline Works area. These are Red Fox *Vulpes Vulpes*, European Rabbit *Oryctolagus cuniculus*, European Hare *Lepus europeaus*, Cat *Felis catus* and Goat *Capra hircus*.

### Significant species within the Pipeline Works area

A desktop review produced a list of significant species recorded or predicted to occur within five kilometres of the Pipeline Works area. Of the species recorded or predicted to occur within the Pipeline Works area, 36 are considered to have a medium or higher likelihood of occurring. These comprise:

* eight EPBC Act-listed threatened species
* 19 FFG Act-listed species
* 30 DELWP Advisory-listed rare or threatened

species

* Five EPBC Act-listed migratory species.

Species may fall into more than one category of legislative listing (so the combined sum of the above numbers totals more than 36). A summary of these species is provided in [**Table 7-6**](#_bookmark17) with an indication of habitat or site features relevant to each species. Records of EPBC Act-listed species and FFG Act-listed species within five kilometres of the Project Area are shown in [**Figure 7-13**](#_bookmark18).

**Table 7-6:** Significant species recorded or with a medium or higher likelihood of occurrence within the Pipeline Works area

(species name and locations in **bold** denotes those species recorded and where, within the Pipeline Works area)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Common name** | **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 |  |  | **KP 13.6 (Tyabb).** |
| Swift Parrot | CR | e | L | Planted and remnant eucalypts over the entire Project 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 road crossings and creek crossings that contain weedy dense weedy vegetation contain suitable habitat. |
| Grey-headed Flying- fox | VU | v | L | Planted and remnant flowering eucalypts. A camp was recorded in 2014 at HMAS Cerberus, approximately 3 km south-west of the Project Area, and has been noted to be present between January and April of each year since 2014, except for 2020. This species is therefore likely to utilise trees in the Project 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 (40.1)** and Lower Gum Scrub Creek. Note that farm dam at KP  21.55 is outside the study area. |
| Australian Grayling | VU | v | L | Cardinia Creek and Lower Gum Scrub Creek. |
| Dwarf Galaxias | VU | e | L | Several waterways and farm dams (see Table 25). |
| White-throated  Needletail | V | 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 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 100m east of KP7.3 and  a vegetated farm dam near KP21.5, KP28.2. |
| **Blue-billed Duck** |  | e | L | Wetlands, including farm dam at KP 28.1, and **Lachies Marsh (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. |

I

Refer to [**Figure 7-6**](#_bookmark11) to [**Figure 7-12**](#_bookmark14) for KP reference locations.

#### 

**Areas where species were recorded or are likely to occur within the Pipeline Works Study Area**

**FFG**

**EPBC DELWP**

**Conservation status**

**Common name**

Chestnut-rumped

Heathwren

v L Woodland habitat 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 Warringine Park, Watson Creek, KP 13.3-KP

14.3 in low-lying areas, and at KP 20.2, KP 21, and KP 22.74.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DELWP Advisory-listed rare or threatened species** | | | | |
| Austral Crane’s-bill | v | |  | Grassy Woodland EVCs. |
| 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 at Crib Point adjacent to Woolleys Beach Reserve. |
| **Pallid Sun-orchid** | e | | I | Low-lying areas **between KP 1.13 and KP 1.7**, at Crib Point  adjacent to Woolleys Beach Reserve. |
| **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. Most observations have been predominantly near Kings Creek in Hastings Foreshore Reserve and Warringine Creek within Warringine Park. |
| **Southern Toadlet** | v | |  | Moist soaks and depressions in a variety of habitats from Crib Point to Hastings North. Recorded at **KP 2.2.** |
| **EPBC Act-listed migratory species** | | | | |
| **Latham’s Snipe** | Mi | nt | Vegetated freshwater wetlands at KP21.1, KP21.5, KP28.2. Recorded by Biosis south of Kings Creek in Hastings **KP 6.8.** | |
| Fork-tailed Swift | Mi |  | Aerial species that would occur over most habitat types. | |
| Rufous Fantail | Mi |  | Forested and woodland areas but would also occur in open and coastal environments during migration. | |
| Satin Flycatcher | Mi |  |  | |

**Table note**: 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. Species name in **bold** denotes those recorded within study area.

Places where species were recorded are in **bold**.

Refer to [**Figure 7-6**](#_bookmark11) to [**Figure 7-12**](#_bookmark14) for KP reference locations.

### Listed ecological communities

Initial desktop assessments identified three EPBC Act- listed and two FFG Act-listed ecological communities as having the potential to occur within the Pipeline Works study area. Only one of these communities was recorded within the Pipeline Works; Subtropical and Temperate Coastal Saltmarsh, which is listed as vulnerable under the EPBC Act. This ecological community was recorded within the pipeline alignment near South Boundary Road East (KP 20.2), as shown in [**Figure 7-13**](#_bookmark18).

As this community is listed as vulnerable, it is not considered a Matter of National Environmental Significance for the purposes of the EPBC Act.

While not identified by the Protected Matters Search Tool (PMST), a report by Ecology Australia (2018) 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 in Somerville (KP 16.1). A site assessment undertaken by Biosis in January 2020 confirmed 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 less than 0.1 hectares in extent. The wetland is located outside the Pipeline Works construction footprint.

**Figure 7-13:** Significant species and ecological communities recorded within the Pipeline Works area

### Western Port Ramsar values surrounding the Pipeline Works area

Avoiding direct impacts on the Western Port Ramsar site was a key consideration when developing the pipeline alignment.

There are two sections where the pipeline would be horizontally directionally drilled (HDD) beneath the Western Port Ramsar site: [**Figure 7-14**](#_bookmark19):

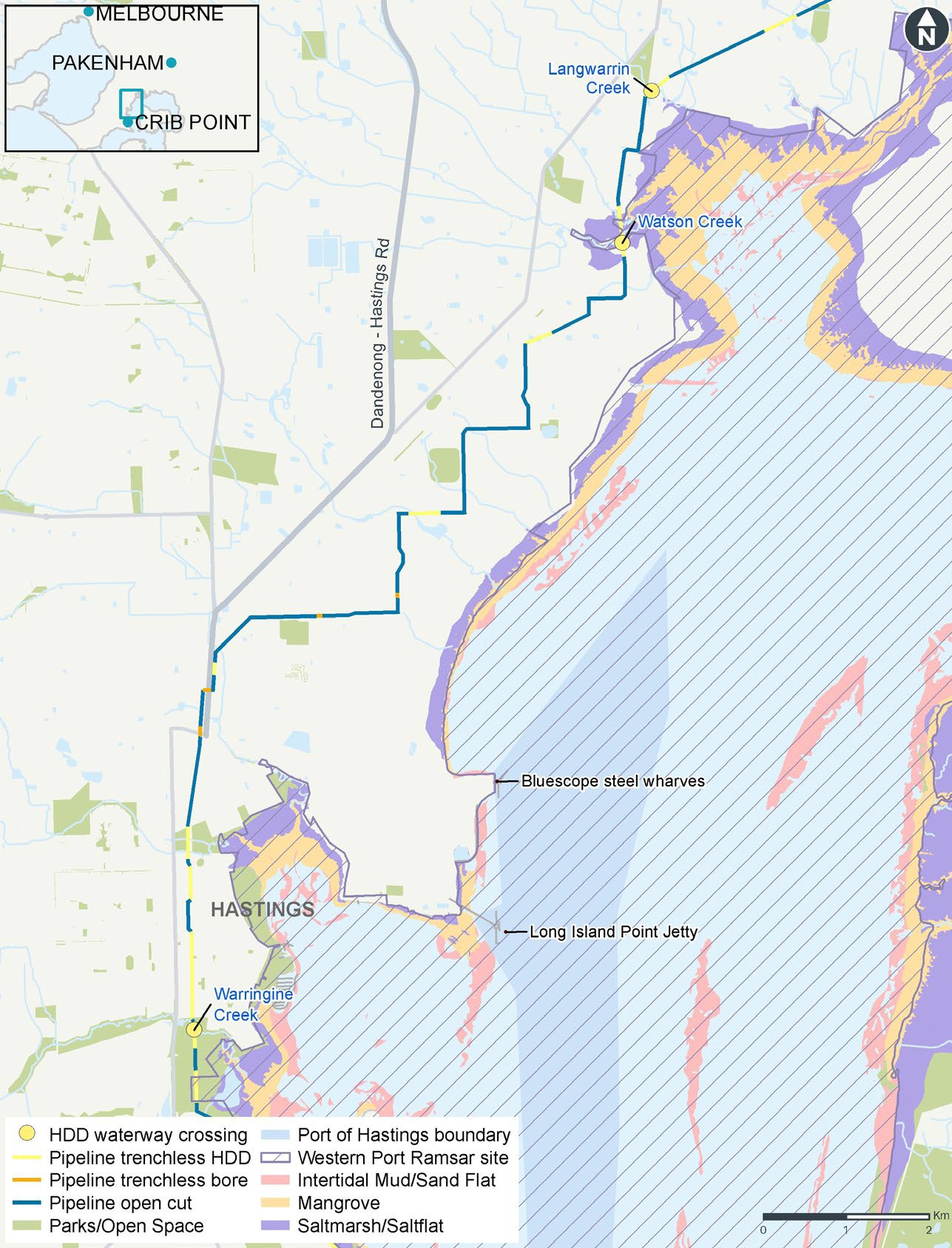
* Warringine Park, and
* Watson Creek including a small unnamed tributary located 100 metres north of Watson Creek (see [**Figure 7-8**](#_bookmark12)).

Due to the proximity of Langwarrin Creek to saltmarshes in the Western Port Ramsar site (see [**Figure 7-8**](#_bookmark12)), HDD would be used as the construction method for the crossing of this creek. This would mitigate the potential risks of erosion and water quality impacts associated with open trenching at this creek crossing.

Warringine Park is partly included in the Western Port Ramsar site where it intersects with the Pipeline Works between KP4 and KP4.3, as shown in [**Figure 7-14**](#_bookmark19). This specific component of Western Port is designated as ‘other public land’ 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 salt-tolerant vegetation that is present in more coastal and saline areas.

Waterbirds and waders are expected to use Watson Creek and the unnamed waterway occasionally, but these areas do not support primary or secondary feeding habitat, as shown in [**Figure 7-5**](#_bookmark8). The habitat within Warringine Park where HDD would occur does not support waterfowl or waders, and predominantly supports the regrowth of Common Reed *Phragmites australis* and *cumbungi Typha* spp. It is unlikely that migratory waders would use any areas within the Pipeline Works as foraging or dispersal habitat.

**Figure 7-14:** Western Port Ramsar values surrounding the Pipeline Works



# **Risk assessment**

The risk assessment identified the risks to terrestrial and freshwater biodiversity during construction and operation of the Project in accordance with the method described in **Chapter 5** *Key approvals and assessment framework.* This included consideration of the environmental, social, economic and health and safety consequences of each risk and their likelihood of occurring.

The initial risk ratings presented in [**Table 7-6**](#_bookmark17) 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 a similar type, scale and complexity. Risk ratings were applied to each of the identified risk pathways assuming these mitigation measures were in place. Where initial risk ratings were categorised as medium or higher, additional mitigation measures were developed to lower the risk.

Construction works associated with the Project resulting in the removal of native vegetation and threatened flora species, ultimately impacting the species itself and habitat for flora and fauna, have been assigned a likelihood rating of almost certain where these events are planned to occur as a result of the Project (Risk IDs FF1, FF2 , FF7, FF10 and FF13). Other key risks identified (medium or higher rating) associated with construction of the Project include the invasion of environmental weeds and pathogens, habitat fragmentation, impacts to ecosystem function and dust, noise and vibration impacts to flora and fauna (Risk IDs FF6, FF11, FF12, FF14, FF16, FF21, FF23 and FF25).

All terrestrial and freshwater biodiversity risks associated with the Project’s operation are rated as low or very low.

Site selection, including for the pipeline route and alignment and the selection of Crib Point for the FSRU and associated aspects of the Gas Import Jetty Works, is a key initial mitigation measure for avoiding potential terrestrial and freshwater biodiversity impacts.

The pipeline alignment identification and selection requirements are set out in Australian and New Zealand Standards AS/NZ 2885.1: 2018 Pipelines - Gas and Liquid Petroleum Design and Construction. These requirements formed part of the detailed assessment process undertaken to determine the proposed pipeline alignment between the Crib Point Jetty and connection to the VTS in Pakenham.

APA selected the pipeline alignment based on several environmental, social and economic values taking into consideration the key constraints and opportunities afforded by existing and proposed land use and infrastructure. The pipeline alignment has been developed in consultation with landholders and other stakeholders, with reference to the overarching considerations of public safety, and potential environmental, social and economic impacts.

The Crib Point Jetty and immediately adjacent landside area was selected as the proposed location for the Gas Import Jetty Works. This option makes use of the existing, available infrastructure in a contextually appropriate setting (Port zoning and adjacent to the former BP refinery land). Potential environmental impacts would be avoided as there is no requirement for dredging to make the berth suitable for use by the FSRU and the LNG carriers, and the use of the already highly disturbed landside footprint at Crib Point. The proximity of the Crib Point Jetty allows for connection of a new supply source into the Victorian gas market, ensuring security and reliability of gas supply to south-eastern markets.

Pipeline route and alignment selection and site selection for the Gas Import Jetty Works are initial mitigation measures for relevant risk pathways and are described in more detail in **Chapter 2** *Project rationale* and **Chapter 3** *Project development*.

[**Table 7-7**](#_bookmark20) summarises the terrestrial and freshwater biodiversity risks identified. A complete risk register, including the likelihood and consequence of each risk pathway, is located in EES Attachment III *Environmental risk report*. Construction impacts for terrestrial biodiversity are discussed in **Section** [**7.7**](#_bookmark21) below and operation impacts are discussed in **Section** [**7.8**](#_bookmark31).

Mitigation measures for terrestrial and freshwater biodiversity impacts are presented in **Section** [**7.11**](#_bookmark34)(Mitigation measures) and in **Chapter 25** *Environmental Management Framework*.

**Table 7-7:** Risks – Terrestrial and freshwater biodiversity (refer to [**Figure 7-6**](#_bookmark11) to [**Figure 7-12**](#_bookmark14) for KP locations)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |

##### Construction

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| FF1 | Gas Import Jetty Works and Pipeline Works | Direct loss of native vegetation during construction | 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.  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.  Avoid, minimise and offset of native vegetation in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017).  Pipeline designed with HDD in further locations (including Watson Creek, KP22.5, KP20.93), as well as a ROW reduction in multiple locations. | High | **MM-FF01**  Unplanned vegetation loss  **MM-FF05** Site  rehabilitation | High |
| FF2 | Gas Import Jetty Works and Pipeline Works | Removal of native vegetation during construction impacts habitat for threatened fauna detected  Excluding Southern Brown Bandicoot and Growling 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.  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. Pipeline designed with HDD in further locations (including Watson Creek, KP22.5, KP20.93) as well as a ROW reduction in multiple locations. | Medium | **MM-FF01**  Unplanned vegetation loss  **MM-FF03**  Invasive weeds, pests, pathogens and waste  **MM-FF04**  Contractor awareness  **MM-FF05** Site  rehabilitation | Medium |

**7-32**

Terrestrial and freshwater biodiversity – Chapter 7

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF3 | Gas Import Jetty Works and Pipeline Works | 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.  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.  Pipeline designed with HDD in areas of dense vegetation. | Medium | **MM-FF01**  Unplanned vegetation loss  **MM-FF03**  Invasive weeds, pests, pathogens and waste  **MM-FF04**  Contractor awareness  **MM-FF05** Site  rehabilitation | Low |
| FF4 | Gas Import Jetty Works and Pipeline Works | 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.  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. | Medium | **MM-FF01**  Unplanned vegetation loss  **MM-FF05** Site  rehabilitation  **MM-FF06**  Topsoil rehabilitation  **MM-FF15**  Lighting impacts to fauna | Medium |
| FF5 | Gas Import Jetty Works and Pipeline Works | 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 (see Risk ID FF13). | 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.  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. | Medium | **MM-FF01**  Unplanned vegetation loss  **MM-FF05** Site  rehabilitation  **MM-FF06**  Topsoil rehabilitation | Low |

Gas Import Jetty and Pipeline Project EES | Volume 2

**7-33**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF6 | Gas Import Jetty Works and Pipeline Works | 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.  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. | Low | **MM-FF01**  Unplanned vegetation loss | Low |
| FF7 | Gas Import Jetty and Pipeline Works | Construction activities physically injure 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.  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. | Low | **MM-FF08**  Injury and/or disturbance to fauna | Low |
| FF8 | Pipeline  Works | Fauna becoming trapped in open trenches during construction causing injury or death | 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. | Low | **MM-FF07**  Trench entrapment  **MM-FF09d**  Southern Brown Bandicoot | Low |
| FF9 | Pipeline  Works | 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). | High | **MM-FF04**  Contractor awareness  **MM-FF09**  Southern Brown Bandicoot | Medium |

**7-34**

Terrestrial and freshwater biodiversity – Chapter 7

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF10 | Pipeline  Works | Removal of habitat or introduction of Chytrid fungus resulting in impact to Growling 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 Growling Grass Frog resulted in narrowing of Right of Way or HDD at KP22.5, KP23.5, KP28.2 and from KP 34.6  to KP 35, HDD from KP 22.5 - KP 22.9, and at Cardinia Creek South and Pakenham Creek. | Medium | **MM-FF03**  Invasive weeds, pests, pathogens and waste  **MM-FF04**  Contractor awareness  **MM-FF11**  Growling Grass Frog | Low |
| FF11 | Pipeline  Works | 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. | Medium | **MM-FF02**  Aquatic fauna impacts  **MM-FF03**  Invasive weeds, pests, pathogens and waste  **MM-FF04**  Contractor awareness | Low |
| FF12 | Pipeline  Works | 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 per cent) of habitat and most (between 83.7 per cent and 88.2 per cent) of individuals of this species, including HDD and reduction in ROW between KP 1.1 to KP 1.6. | Very high | Pipeline alignment altered to avoid all habitat and individuals, as well as HDD between KP  1.13 and KP  1.7  **MM-FF10**  Merran’s Sun- orchid, Pallid Sun-orchid and Gaping Sun-orchid | Very low |

Gas Import Jetty and Pipeline Project EES | Volume 2

**7-35**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF13 | Pipeline  Works | Construction activities impacting on individuals, or habitat of Gaping Sun-orchid and Pallid 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.  CEMP for Pipeline Works (Mitigation measures: MM-FF01, MM-FF04, MM-FF05, MM-FF06,  MM-FF10). Species habitat benefits from  mitigation for Merran’s Sun-orchid. | High | **MM-FF10**  Merran’s Sun- orchid, Pallid Sun-orchid and Gaping Sun-orchid. Pipeline alignment altered to avoid all habitat and individuals., as well as HDD between KP  1.13 and KP  1.7 | Very low |
| FF14 | Pipeline  Works | Removal of habitat for or impact on 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. | Low | **MM-FF01**  Unplanned vegetation loss  **MM-FF04**  Contractor awareness  **MM-FF05** Site  rehabilitation | Low |
| FF15 | Gas Import Jetty Works and Pipeline Works | 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.  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. | Medium | **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 | Low |

**7-36**

Terrestrial and freshwater biodiversity – Chapter 7

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF16 | Gas Import Jetty Works and Pipeline Works | 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.  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. | Low | **MM-FF03**  Invasive weeds, pests, pathogens and waste  **MM-FF04**  Contractor awareness  **MM-FF05** Site  rehabilitation  **MM-FF06**  Topsoil rehabilitation | Low |
| FF17 | Gas Import Jetty Works and Pipeline Works | Loss/damage to vegetation outside of the construction footprint | As a minimum the Pipeline Works will comply withAS2885.1-2012 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.  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. | Low | **MM-FF01**  Unplanned vegetation loss  **MM-FF04**  Contractor awareness | Very low |

Gas Import Jetty and Pipeline Project EES | Volume 2

**7-37**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF18 | Gas Import Jetty Works and Pipeline Works | Construction activities impact on waders and waterbirds | As a minimum the Pipeline Works will 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.  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. | Low | **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 | Very low |

**7-38**

Terrestrial and freshwater biodiversity – Chapter 7

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF19 | Gas Import Jetty Works and Pipeline Works | Construction activities impact on the character of Western Port Ramsar site | As a minimum the Pipeline Works will 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.  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. | Medium | **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 | Very low |
| FF20 | Gas Import Jetty Works and Pipeline Works | Construction noise and vibration impacts on fauna (excluding waders and waterbirds) Assessed in EES Technical Report H: *Noise and Vibration* (Risk ID NV2) | As a minimum the Project will 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 Victoria publication 1254 – *Noise control guidelines* (2008).  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. | Medium | **MM-FF08**  Injury and/or disturbance to fauna | Low |

Gas Import Jetty and Pipeline Project EES | Volume 2

**7-39**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF21 | Pipeline  Works | Construction activities impacting on the surface expression of GDE’s (i.e all  areas of Swamp Scrub and Heathy Woodland) | Minimising dewatering activities in accordance with mitigation measures listed in **Chapter 9** *Groundwater* (MM-HG01) | Low |  | Low |
| FF22 | Pipeline  Works | Night lighting causing abandonment of affected habitats. Stress/ displacement  of native fauna and disruption of  ecosystem function |  | Medium | **MM-FF15**  Lighting impacts to fauna | Low |
| FF23 | Gas Import Jetty Works and Pipeline Works | A spill of hazardous materials associated results in contaminated discharge to surface water | **MM-FF14** Surface water contamination | Low |  | Low |
| FF24 | Gas Import Jetty Works and Pipeline Works | Dust from construction activities impact on flora/fauna | No initial mitigation measures identified | Medium | **MM-FF16**  Dust impacts  to flora/fauna | Low |

**Operation**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| FF O1 | Gas Import Jetty Works | Operational activities including noise, dust and lighting impact  on waders and waterbirds | No initial mitigation measures identified | Low | **MM-FF08**  Injury and/or disturbance to fauna  **MM-FF15**  Lighting impacts to fauna | Very low |
| FF O2 | Pipeline  Works | Operational activities including noise, dust and lighting impacts on waders and waterbirds | No initial mitigation measures identified | Very low | No additional mitigation measures identified | Very low |
| FF O3 | Gas Import Jetty Works and Pipeline Works | Operational activities resulting in noise, dust and lighting impacting on native flora and fauna | No initial mitigation measures identified | Low | No additional mitigation measures identified | Low |

**7-40**

Terrestrial and freshwater biodiversity – Chapter 7

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF O4 | Gas Import Jetty Works and Pipeline Works | Operational activities impact on surface water, GDEs and/or habitat (excluding Western Port) | No initial mitigation measures identified | Low | **MM-FF02**  Aquatic fauna impacts  **MM-FF14**  Surface water contamination | Very low |
| FF O5 | Gas Import Jetty Works and Pipeline Works | Operational activities result in impacts from weeds, pathogens and  pests (including edge effects) on terrestrial  ecosystem function | No initial mitigation measures identified | Low | **MM-FF01**  Unplanned vegetation loss  **MM-FF03**  Invasive weeds, pests, pathogens and waste  **MM-FF04**  Contractor awareness | Very low |
| FF O6 | Gas Import Jetty Works | Operational activities impact on the Ecological Character of Western Port Ramsar site | Use six port design and maintain discharge velocity during FSRU operation in accordance with mitigation measures listed in **Chapter 6** *Marine biodiversity* (MM-ME03). | Very low | **MM-FF04**  Contractor awareness  **MM-FF08**  Injury and/or disturbance to fauna  **MM-FF12**  Migratory birds  **MM-FF15**  Lighting impacts to fauna Operate at lower gas production rate in accordance with mitigation measures listed in **Chapter**  **6** *Marine*  *biodiversity*  (**MM-ME02**) | Very low |

Gas Import Jetty and Pipeline Project EES | Volume 2

**7-41**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Risk ID** | **Works area** | **Risk pathway** | **Initial mitigation measures** | **Initial risk rating** | **Additional mitigation measures** | **Residual risk rating** |
| FF O7 | Pipeline  Works | Operational activities impact on the character of Western Port Ramsar site | No initial mitigation measures identified | Very low | No additional mitigation measures identified | Very low |
| FF O8 | Gas Import Jetty Woks and Pipeline Works | Operational activities result in unplanned clearing of native vegetation.  Native vegetation protections reduced in an easement | No initial mitigation measures identified | Medium | **MM-FF01**  Unplanned vegetation loss | Low |

* 1. **Cons****truction impacts**

This section discusses the potential impacts on terrestrial and freshwater biodiversity during construction of the Project.

* + 1. **Native** **vegetation and habitat**

**loss/modification**

A total of 16.955 hectares of native vegetation is proposed to be removed for the Project, comprising:

* 15.352 hectares (Pipeline Works)
* 1.603 hectares (Gas Import Jetty Works).

These calculations are based on site assessment information collected by Monarc Environmental and Biosis in relation to the potential impact area (construction footprint), the EnSym Native Vegetation Removal Reports (NVRRs) for the Pipeline Works and Gas Import Jetty Works.

Patch vegetation loss and scattered tree loss were combined to identify an extent of proposed removal as per the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017).

As outlined in **Section** [**7.5.1**](#_bookmark1), native vegetation within the Gas Import Jetty Works has been cleared as part of fire management works undertaken by PoHDA. AGL has committed to offsetting this vegetation even though it has been removed.

The Project would have the following direct impacts on native vegetation:

* 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, 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.

Most of the native vegetation proposed to be removed occurs in the southern half of the Project Area, in areas around Crib Point (KP0.5 - KP1.9) (refer to [**Figure 7-6**](#_bookmark11)), 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 and within Warringine Park 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 removed throughout the Project Area. While all patches of native vegetation are moderately or highly disturbed, they provide a range of habitat values for native fauna.

### Loss of native vegetation (Risk ID FF1, FF4 and FF17)

The direct loss of native vegetation would involve the removal or modification of 16.955 hectares of native vegetation, which consists of the area covered by patch native vegetation and large patch trees (14.477 hectares), 79 scattered trees and the removal of individuals, or habitat for, significant flora species. The Project would impact 115 habitat zones which comprise 11 EVCs.

Impacts on native vegetation as a result of the Gas Import Jetty Works and the Pipeline Works are outlined in [**Table 7-8**](#_bookmark23) and [**Table 7-9**](#_bookmark24) respectively.

**Table 7-8:** 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 7-9:** 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 |
| Small scattered tree loss | 50 |
| 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 |
| 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 |

[**Table 7-10**](#_bookmark25) provides the percentage of proposed habitat loss of total extant native vegetation area by suburb. In the broader geographic context, the percentage loss of patch native vegetation as a result of the Project is relatively small compared to existing native vegetation extent, with the highest proposed patch loss expected for Crib Point as shown in [**Table 7-10**](#_bookmark25) (1.61 per cent of existing native vegetation).

Calculation of existing native vegetation outside the Project construction footprint is based on data collected from Mornington Peninsula Shire vegetation modelling as well as a restricted area of 2011 DELWP extant vegetation modelling and further supplemented by DELWP 2005 extant vegetation layer where required.

**Table 7-10:** Habitat patch loss in geographic context

|  |  |  |  |
| --- | --- | --- | --- |
| **Suburb** | **Existing native vegetation area (ha)** | **Habitat loss area** | **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 |
| 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 |

Construction of the Project is expected to result in direct loss of native vegetation. Design development has aimed to avoid and minimise impacts on native vegetation where practicable. To avoid and minimise further losses during construction, measures would be taken to avoid unintended vegetation loss outside the construction footprint through demarcation of the approved vegetation clearing extent (see mitigation measure MM-FF01) and facilitating contractor awareness (see mitigation measure MM-FF04). Rehabilitation measures would also be undertaken such as returning habitat features to the ROW (see mitigation measure MM-FF05). In the unlikely event that clearing of native vegetation outside of the construction footprint is required during the construction and/or operational phase, the area cleared would be the minimum necessary to complete the work and would be assessed and offset in accordance with the Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017a).

The loss of native vegetation and associated biodiversity values from Project construction and operation would be compensated for through the procurement of offsets. Removal of native vegetation would be compensated through general and species offsets in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017) which is an Incorporated Document within the Victoria Planning Provisions under Clause 52.17 (Native Vegetation). Offsets proposed for the Project are outlined in **Section** [**7.12**](#_bookmark36).

### Listed ecological communities

The Project Area contains one EPBC Act-listed ecological community (subtropical and temperate saltmarsh), which occurs in one location at KP 20.2 (refer to [**Figure**](#_bookmark12)[**7-8**](#_bookmark12)), near South Boundary Road East, Pearcedale. This community is listed as Vulnerable and is not considered a Matter of National Environmental Significance for the purposes of the EPBC Act.

The Project Area does not contain and is considered unlikely to impact any FFG Act-listed ecological communities.

### Injury to fauna (Risk ID FF7 and FF8)

During construction of the pipeline and removal of native vegetation, there is the potential for fauna to be harmed by plant and equipment or fall into open trenches. By implementing measures to identify and remove fauna before construction starts (including clearing of vegetation) and undertaking inspections for entrapped fauna, the risk of fauna becoming injured or trapped is low (see mitigation measures MM-FF07, MM-FF08 and MM-FF09d). Opportunities for fauna to egress the trench such as ramped trench plugs or other appropriate mechanisms and installation of fauna shelter devices, such as sawdust filled bags would assist in minimising risk of injury to fauna from entrapment.

### Habitat fragmentation (Risk ID FF9 and FF15)

The pipeline alignment and the siting of the Crib Point Receiving Facility has sought to avoid extant areas of native vegetation as far as practicable. Some unavoidable loss of native vegetation is proposed which may result in habitat fragmentation. Potential impacts caused by habitat fragmentation include loss of connectivity and disruption to the local ecosystem through genetic isolation and edge effects, which can impact most flora and fauna that use the ROW (see [**Table 7-6**](#_bookmark17) for these species). Edge effects relate to changed environmental conditions along edges of fragmented habitat, which can promote the growth of different vegetation including weeds and allow invasion of other animal species.

Habitat fragmentation and associated genetic isolation and edge effects are likely to occur at affected areas of native vegetation containing trees or large shrubs such as areas of Swamp Scrub, Swampy Riparian Woodland, Grass Woodland or Damp Sands Herb-rich Woodlands. This includes areas north of Kings Creek within Hastings, immediately south of Watson Creek and through some waterway crossings.

The implementation of appropriate mitigation measures including management of invasive weeds and pests and rehabilitation of areas affected by fragmentation (see mitigation measures MM-FF03, MM-FF04, MM-FF05 and MM-FF06) has resulted in the risk being rated as low with the potential for minor impacts.

#### 

There is the possibility the Pipeline Works could result in temporary habitat fragmentation for the Southern Brown Bandicoot as many remaining remnants of habitat are narrow and isolated. The fragmentation of some habitat and dispersal corridors is expected to occur, where local populations may be temporarily separated from their regular resources. This loss of connectivity may increase the effects of predators on species moving between isolated fragments of habitat. As this impact would only be temporary during the construction period and effective habitat would be reinstated, this is not considered a long-term or significant impact (see mitigation measure MM-FF05).

**What is habitat fragmentation?**

**Habitat fragmentation is the division of a single area of habitat into two or more smaller areas. The resulting area can often be inhospitable to the species that would have once utilised the area. The creation of these smaller habitats is likely to impact species and its conditions, as well as the quality of the remaining habitat. However, responses to habitat fragmentation from various species can often be subtle or difficult to detect.**

**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 typically accompanied by fragmentation and poses an additional threat to biodiversity. Fragmentation may impact species due to barrier effects, genetic isolation and edge effects.**

Much of the Southern Brown Bandicoot habitat with suitable cover that would remain throughout the former Koo Wee Rup swamp occurs in linear habitats, requiring the need for rapid reinstatement of habitat during construction. Surrounding fertile and productive agricultural landscape are thought to provide other habitat attributes, such as high soil productivity and prey availability, that allow the species to persist in linear remnants. While appropriate cover is considered an important factor in the persistence of this species in the agricultural and peri-urban landscape, Southern Brown Bandicoot is expected to be able to cope with surrounding vegetation clearance and management undertaken for agricultural purposes given its persistence in these environments, including movement through cleared areas and foraging in open environments.

While the temporary removal of bandicoot habitat is

expected to occur, the consequence would be minor as appropriate mitigation measures would reduce short term impacts as much as practicable. These mitigation measures include ensuring all Project personnel are inducted and aware of specific areas of habitat and reinstating dense groundcover and suitable native shrubs or vegetation as soon as practicable (see mitigation measures MM-F04 and MM-F09).

## **Leaks and spills (Risk ID FF23)**

Construction of the Pipeline Works would involve vehicles and machinery that have the potential to inadvertently spill hazardous materials within terrestrial or aquatic habitats. The likelihood and volume of spillage for any 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 Construction Environmental Management Plan (CEMP) outlining standard best practice, including measures for preparedness and spill response, which would reduce the consequence of this risk (see mitigation measure MM-FF14).

Construction activities associated with the Gas Import Jetty Works would involve fitting the marine loading arms and gas piping on the Crib Point Jetty to transfer gas from the FSRU to facilities on the shore. Works would occur over a short period and involve jetty works, vehicles and workboats and associated hydraulic fluids, lubricants and diesel. It is considered unlikely that spills would occur and any spills would most likely be small to negligible and contained before reaching the marine environment. It is therefore unlikely that chemical leaks or spills associated with construction of the Gas Import Jetty Works pose a significant risk to waterbirds of Western Port and it is considered a low risk.

Habitat and fauna within the vicinity of the Crib Point Receiving Facility have the potential to be impacted by spills or leaks from construction activities. However, as the site is highly disturbed and native vegetation within the site is highly degraded, impacts would be minimal and localised in scale. It is therefore considered a low risk.

## **Noise** **and vibration (Risk ID**

**FF20 and FF18)**

Many animals rely on acoustic signals and sounds to communicate, navigate, find food and avoid danger. Human-made noise can alter the behaviour of animals or interfere with normal functioning as well as impact health, reproduction, survivorship, habitat use, distribution and abundance. Some birds have now begun to alter their call frequencies and timing to be heard over anthropogenic noise.

Construction activities associated with the Pipeline Works would produce short-term noise levels with potential to impact on some fauna.



**Common noise outputs**

**Freight train at 15 metres: 80 dB(A)**

**Motorcycle at 7.5 metres: 90 dB(A)**

**Air conditioning unit at 30 metres: 60 dB(A)**

Varying levels of on-going ambient or periodic loud noises already occur at certain areas within the Project Area associated with existing land use activities. Examples of these include: Crib Point Jetty is used by marine vessels and visited by vehicles periodically, Warringine Park is near urban roads and a train corridor and Kings Creek is traversed by a train line and surrounded by urban infrastructure. Threatened fauna including the Growling Grass Frog and Southern Brown Bandicoot frequently occur within urban or semi-urban environments that are subject to a range of noises and so are likely to have adapted to anthropogenic noises within the landscape.

Noise from construction may cause a short-term reduction in use of some areas of habitat by some species, with these species seeking alternative habitat for the period during which construction is occurring nearby. However, construction noise is unlikely to significantly impact on any component or function of ecosystems beyond the construction period.

Noise levels associated with HDD are expected to be some of the highest during construction. The noise assessment models prepared for the EES (see EES Technical Report H: *Noise and vibration impact assessment*) shows that for HDD works, noise beyond approximately 250 to 300 metres of the HDD location would be less than 50 decibels, which is lower than normal human speech.

The predicted noise levels for construction were used to assess potential impacts on fauna and important habitats such as wader and waterbird habitat at Western Port, as shown in [**Figure 7-5**](#_bookmark8). All but one of the proposed HDD locations would be at least 700 metres from primary foraging habitat for waterbirds. There is one HDD location (KP 1.7) (refer to [**Figure 7-6**](#_bookmark11)) proposed approximately 250 metres from primary foraging habitat at Jacks Beach, Crib Point, as shown in [**Figure 7-5**](#_bookmark8)**.** As outlined in **Section** [**7.7.8**](#_bookmark28), this HDD at KP 1.7 is proposed to avoid direct impacts to a population of Merran’s Sun- orchid. The predicted noise levels from this HDD would be unlikely to exceed 60 dB(A) within the primary foraging habitat.

Secondary foraging habitat is located within 150 metres of two proposed HDD locations, KP 1.7 (Crib Point) and KP 4.37 (Warringine Park). Noise modelling at these HDD locations suggests there may be times where noise levels at these areas of secondary foraging habitat would be between 55 and 70 dB(A). This would be a short- term, but unavoidable impact for two to four weeks that may cause temporary disturbance to waterbirds that use these areas of habitat. The predicted noise levels are not high enough to directly impact on any species, instead they may cause individuals to temporarily 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 three kilometres (see [**Figure 7-5**](#_bookmark8)). At those distances, there is no realistic potential for HDD generate noise to affect waterbirds using foraging habitat or the roost areas.

Given that the noise modelling indicates that noise from particularly loud construction works such as HDD would reduce to levels equivalent to or less than normal human speech within around 250 to 300 metres from the source, there is no realistic potential for noise from HDD construction to affect waterbirds using foraging habitat or roost areas.

Surveys carried out for the Project found very few shorebirds or other waterbirds in the vicinity of the Crib Point Jetty. A number of common avian species, including; Pied Cormorant, Little Pied Cormorant, Black Cormorant and Silver Gull, use the pipe infrastructure on the jetty despite the existing noise from current ship movements and other human activities. However, up to 22 species of waders/water birds have the potential to use the area surrounding the Crib Point Jetty, although the assessment indicates this area is not significantly used by these species.

Habitat values for waders and waterbirds are mapped in [**Figure 7-3**](#_bookmark6) and [**Figure 7-5**](#_bookmark8), with the closest mapped primary foraging habitat beginning approximately 250 to 300 metres north of the nearest part of the Crib Point Jetty. Noise modelling was undertaken at Woolleys Beach Reserve and HMAS Otama Lookout Beach (see [**Figure 7-4**](#_bookmark7)), both of which are adjacent to secondary foraging habitat and are closer to the Crib Point Jetty than any primary foraging habitat.

It’s important to note when interpreting construction noise modelling predictions that the noise assessment provides a ‘realistic worst case’ noise impact assessment for construction scenarios based on proposed works within a 15-minute period. This is typically associated with works located within the nearest site area to a particular receiver. In reality at any particular location, the potential construction noise impacts can vary greatly depending on factors including:

* the position of the works within the construction site and distance to the nearest sensitive receiver
* the overall duration of the works
* the intensity of the noise levels
* the time at which the works are undertaken
* the number of concurrent activities underway at the same time
* the character of the noise.

Noise levels at sensitive receivers including wader and waterbird habitats can be significantly lower than the worst-case scenario when the construction works move to a more distant location within a works area.

At Woolleys Beach (east of the Crib Point Jetty), the predicted range of construction noise is between 55 and 64 dB(A). At HMAS Otama Lookout Beach (250 metres north of the Crib Point Jetty), the predicted range of construction noise is between 55 and 66 dB(A). These noise levels are predicted to occur at parts of secondary foraging habitat closest to the Crib Point Jetty and would reduce at greater distances.

A previous assessment of road traffic noise on Australian wetlands birds, including some migratory birds that use Western Port, found no detectable correlation between the highest noise measurement of 62 dB(A) and wetland- site occupancy (Phoenix Environmental Sciences, 2011). It is therefore unlikely that waders/waterbirds that may use the surrounding area at Crib Point would be adversely impacted by noise from the Project.

Predicted noise levels for construction activities associated with the Gas Import Jetty Works at the Crib Point Jetty are not expected to have a measurable effect on the use of foraging habitat by any species of waterbird that uses Western Port.

Roost sites used by waterbirds in proximity to the Gas Import Jetty Works are shown in [**Figure 7-3**](#_bookmark6) and [**Figure**](#_bookmark8)[**7-5**](#_bookmark8). The roost sites closest to the Crib Point Jetty are Long Island Point in the north of Hastings Bight and between Fairhaven and Tankerton Pier on French Island (east of Crib Point). These sites are more than 3.5 kilometres from the Crib Point Jetty. Noise from construction activities at Crib Point is very unlikely to be able to be heard at these locations given the way in which construction noise is modelled to decrease over a relatively short distance (ie to around the level of normal human conversation over around 250 to 300 metres from the noise source). It is therefore unlikely that noise from construction would be loud enough to impact on identified roost sites.

A number of common waterbirds use the existing Crib Point Jetty for roosting and are known to continue roosting while ships are berthed at Berth 1, which is currently used for importing petroleum. As waterbirds are actively using this non-natural habitat, it is considered unlikely these species would be adversely impacted by the presence of the FSRU at Berth 2 or additional shipping.

With the implementation of construction noise management techniques and adherence to noise guidelines (see mitigation measures MM-FF08), it is likely that noise outputs from the Project’s construction would not be sufficient to impact any migratory roost sites or primary feeding habitats. As discussed in **Section**

* + 1. , there is little empirical evidence that the area of Woolleys Beach close to Crib Point Jetty is significantly used by shorebirds or other waterbirds. Nonetheless, up to 22 species of such species are considered to have some potential to use the area. Short periods of higher intensity noise or brief periods where several pieces of noisy plant and equipment are operating concurrently at the proposed location of the Crib Point Receiving Facility are unlikely to cause significant disturbance to any species using the secondary foraging habitat at this location.

## **Artificial lighting (Risk ID FF22)**

Lighting would be required for Project construction activities that would occur during periods of low light or where night time works are required, including horizontal directional drillings, works at road crossings and responding to unforeseen emergencies.

As the majority of construction would be restricted to between 6am and 6pm on weekdays and between 6am and 3pm on Saturdays, the requirement for artificial lighting would be minimal. However, some construction activities, such as HDD, would require 24-hour lighting for the duration of the activity. Construction lighting would be task-specific and focussed on the construction works area and ancillary areas and is unlikely to light up areas of unaffected potential habitat in the vicinity.

Most fauna including Southern Brown Bandicoot and Growling Grass Frog may exhibit behavioural responses to artificial lighting that alter or inhibit foraging, breeding or predator evasion. However, the drilling period of a HDD during which lighting would be required would generally be around two to four weeks depending on ground conditions and the length of the drill. Artificial lighting over this period is unlikely to result in permanent or significant impacts on individuals or populations of affected fauna.

The *National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds* were developed with the aim of managing artificial light impacts on wildlife, such that wildlife is:

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

Light generated during construction would be managed in general accordance with the guidance measures described in the *National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds*. to ensure any potential impacts to fauna are minimal (see mitigation measure MM-FF15). 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.

## **Dust (Risk ID FF24)**

Vehicle movements, earthworks and the use of machinery can increase the level of mobilised dust that may impact native flora, fauna and surface water ecosystems. Dust settling on vegetation can affect photosynthesis capability and fauna that breathe in dust may suffer from respiratory impacts. Dust settling within or in proximity to waterbodies has the potential to cause deterioration of water quality. Due to the linear progression of the pipeline construction, the risk of dust impacting on ecosystem function is low with the implementation of dust suppression techniques (see mitigation measure MM-FF16).

## **Hydrological or hydrogeological change**

Temporary changes in hydrological regimes may occur within a number of creeks, rivers or waterways during construction of the Pipeline Works, including:

* loss of riparian vegetation that would filter water,

including sediment deposits

* loss of vegetation that would slow and regulate

water flow

* dewatering of trenches and bell holes without sediment control measures.

Hydrological and hydrogeological changes have the potential to impact waterways and significant biodiversity values including Dwarf Galaxias and Australian Grayling (see Risk ID FF12), Growling Grass Frog (see Risk ID FF11), waders and waterbirds (see Risk ID FF 19) Western Port Ramsar site (see Risk ID FF20) and Groundwater Dependent Ecosystems (see Risk ID FF22).

Naturally occurring riparian vegetation can serve multiple functions including the filtering and uptake of water flowing across or through top-soil and can act as a physical barrier that impedes and slows water movements.

At each waterway crossing that would be open trenched, no vegetation would be present within the ROW during and following construction. Without the use of effective erosion and sedimentation controls, rainfall could result in minor increases in sedimentation within waterways, including Western Port. However, as the Pipeline Works is long and linear, the risk of impact is considered to be low with appropriate mitigation. These mitigation measures include the construction of trenches in no flow or low flow conditions and not during rainfall events, the use of geofabrics to prevent erosion and scour and the reinstatement of riparian zones immediately after pipeline installation and commissioning (see mitigation measures MM-FF13 and MM-FF14).

Drawdown of groundwater can occur as a result of intensive groundwater pumping and can adversely affect biodiversity through the ecophysiological performance of woody vegetation. However, as the Pipeline Works would utilise HDD under all heavily wooded waterways, the risk of impact is considered to be low. Potential impacts associated with groundwater drawdown are discussed further in **Chapter 9** *Groundwater* and are considered to be minor and localised.

As outlined in **Section** [**7.5.2**](#_bookmark9) a number of waterways and waterbodies within the Pipeline Works area provide suitable habitat for Dwarf Galaxias, Australian Grayling and/or Growling Grass Frog. Impacts on these species are unlikely due to the localised scale of watercourse trenching, the negligible impacts of drawdown and short construction timeframes.

### Groundwater Dependent Ecosystems (GDEs) (Risk ID FF21)

Construction activities can result in changes to groundwater conditions which can subsequently impact GDEs. Abstraction of groundwater can lead to a decline in groundwater level and reduce the rates of groundwater discharge and changes in land use can result in reduced recharge rates. While dewatering of the trench during pipeline construction has the potential to temporarily reduce groundwater levels, limiting dewatering activities in trenches to two days or less where practicable means that impacts to GDEs are anticipated to be negligible (see mitigation measures outlined in **Chapter 9** *Groundwater)*. Potential impacts on GDEs are further discussed in **Chapter 9** *Groundwater* and are considered to be minor and localised.

## **Inv****asion from weeds, pests and**

**diseases (Risk ID FF16)**

Construction activities associated with the Project may lead to the modification of habitats and native vegetation through the invasion of weeds, pests and diseases. Weeds are considered to be any species that are not native to the area.

The presence of weeds varies throughout the pipeline alignment, including pasture weeds from agricultural land use and sporadic occurrences of noxious weeds. Given the predominantly weedy state of the northern section of the alignment, the clearing of introduced flora is unlikely to result in adverse impacts within the ROW. However, in southern areas of the pipeline alignment such as Warringine Park or south of Crib Point, there is a greater risk of weeds recolonising the ROW and subsequently dispersing into adjacent native vegetation. Due to the level of compaction the ROW would sustain, it is highly likely that areas that once contained native vegetation would be colonised by species able to grow more readily within compacted soils.

Construction of the pipeline also has the potential to contribute to the spread of known pathogens of flora and fauna, such as Cinnamon Fungus *Phytopthora cinnamomi* and Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis*. However, these pathogens are widespread within the landscape and are already present within the Pipeline Works area.

With the implementation of appropriate mitigation measures, including top-soil and site rehabilitation, management of weeds post-construction and utilising controls to minimise the spread of disease, the risk is considered to be low (see mitigation measures MM-FF03, MM-FF04, MM-FF05 and MM-FF06).

## **Significant species**

The section outlines the potential impacts from construction of the Project on significant species that are known to occur or are likely to occur within the study area. Significant species include those listed under the EPBC Act, FFG Act or found on the DELWP Advisory List for rare or threatened species.

### Removal of habitat for detected threatened fauna (Risk ID FF2)

Construction activities would result in the removal of native vegetation that provides habitat for threatened fauna that have been recorded within the Project Area, including Lewin’s Rail, Eastern Great Egret and Blue- billed Duck. All three species are listed under the FFG Act. Records of these species are shown in [**Figure 7-13**](#_bookmark18).

It is likely that Lewin’s Rail and Eastern Great Egret would temporarily lose small areas of suitable foraging or dispersal habitat within areas of agricultural land that becomes seasonally inundated due to this land being used for construction of the pipeline. Noise and vibration impacts as well as lighting impacts from HDD may also temporarily displace these species from the immediate vicinity of the construction works. These impacts are considered unavoidable and are short term. There are no foreseeable permanent impacts on populations of the species or harm to individuals.

Blue-billed duck is almost wholly aquatic and prefers open or densely vegetated wetlands. This species has 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. They are a highly mobile species within south-eastern Australia with significant capacity to disperse widely in response to changes in environmental conditions. This species may experience temporary displacement for the duration of construction works, although no medium- or long-term impacts are likely.

The pipeline would be constructed progressively as is common for linear projects of this nature. This means that impacts on potential habitat for these species would be temporary. Once construction was complete and the trench was backfilled and rehabilitated the habitat would be available for use again.

Impacts to these species’ habitat would be further mitigated through measures such as the demarcation of approved vegetation clearing, ensuring Project personnel are inducted and aware of areas of threatened fauna habitat and site rehabilitation and the reinstatement of habitat features removed during construction (see mitigation measures MM-FF01, MM-FF04 and MM- FF05). With these measures in place, the potential impact on habitat for Lewin’s Rail, Eastern Great Egret and Blue- billed Duck is considered minor.

Construction activities associated with the Pipeline Works are likely to have a localised impact on Glossy Grass Skink through mortality of individuals and removal of habitat within the ROW (where suitable habitat exists). Glossy Grass Skink has been observed predominantly within Coastal Saltmarsh near Kings Creek within Hastings Foreshore Reserve and Warringine Creek within Warringine Park. Other areas of observations include drainage lines that run through farmland south of Pakenham and the Princes Highway, between Toomuc Creek and the Pakenham Water Recycling Plant. The reinstatement of habitat following completion of works would allow this species to recolonise these areas and recover following construction (see mitigation measure MM-FF05). The Pipeline Works would likely impact the Southern Toadlet in the short-medium term due to the fragmentation of habitat. Impacts to this species may also be experienced at a localised scale although as above, they would be expected to recolonise affected areas once construction was complete and following reinstatement.

### Removal of habitat for undetected threatened fauna (Risk ID FF3)

Construction activities associated with the Project would result in the removal of native vegetation, which may impact habitat for threatened fauna species that have not been recorded or identified within the Project Area, but are considered likely to occur. These species include Swamp Skink, Powerful Owl, Chestnut-rumped Heathwren, White-throated Needletail, Orange-bellied Parrot, Swift Parrot and Grey-headed Flying Fox.

Swamp Skink prefer habitats such as densely vegetated swamps and associated watercourses, wet heaths, sedgelands and salt marshes. This species has been recorded in several locations within 100 metres of the Pipeline Works area, notably around Hastings including Warringine Park and Kings Creek. Targeted surveys were undertaken at Warringine Park (KP 4.1 and KP 4.88) and South Boundary Road East, Pearcedale (KP 20.3) (refer to [**Figure 7-8**](#_bookmark12)), although no Swamp Skinks were recorded. Despite not being recorded, it is considered likely that this species is present within areas of the Pipeline Works within low lying areas of Warringine Park, Kings Creek and Watson Creek.

HDD would be used for constructing the pipeline through Watsons Creek, Kings Creek and Warringine Park, to avoid and minimise potential impacts on Swamp Skink and Glossy Grass Skink in these areas of suitable habitat. The Pipeline Works would likely have a localised impact on individuals and populations within the ROW in other areas of suitable habitat such as in Hastings railway corridor alignment. However, impacts would likely be short term with opportunity for the species to recolonise once vegetation was re-established within the ROW. A specific protocol for the clearing of Swamp Skink and Glossy Grass Skink habitat would be developed in consultation with Mornington Peninsula Shire (see mitigation measure MM-FF08).

It is likely the Powerful Owl would lose a minor amount of foraging habitat, particularly in the vicinity of Watson Creek, where a number of large trees are present, many of which provide hollows. None of these hollows are likely to be large enough to provide suitable breeding sites for this species, although, many appear suitable for prey species such as Brush-tailed Possums. A number of large hollow bearing trees would remain within the area with impacts to this species unlikely.

Chestnut-rumped Heathwren prefers heath, forest and woodland habitat with a dense, shrubby understorey. This species may be impacted by habitat removal, although not likely long-term due to the abundance of coastal habitat to remain around impact areas. This species may also be locally displaced from noise, vibration and lighting.

White-throated Needletail has 47 previous records within the 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 in the study area. The Project is therefore not considered to impact White-throated Needletail.

The Orange-bellied Parrot was once more common within Coastal Saltmarsh areas along the Victorian coastline, but a decline in recent decades has resulted in a population of less than 60 remaining in the wild. This species is not likely to regularly visit Western Port with no records for the past 20 years. The Pipeline Works would unlikely impact this species, as only a small area of potential habitat (less than 0.05 hectares) would be removed. 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. Project construction activities are unlikely to affect the viability of these recently released birds due to the negligible effect on potential habitat as noted above.

Swift Parrot is listed as Critically Endangered and Grey- headed Flying-fox is listed as vulnerable under the EPBC Act and both are listed as threatened under the FFG Act. Both species have suitable foraging habitat available within the Project Area where eucalyptus species are present, including Heathy Woodland and Grassy Woodland, as well as scattered trees across the length of the Project. However, Swift Parrot nor Grey- headed Flying-fox have been recorded within the Project Area, with preferable habitat for the Swift Parrot more concentrated in other regions of Victoria and more widely in south-eastern Australia. Given these species are highly mobile, and in the context of available foraging resources in the landscape, the potential impact of habitat removal is negligible. Any impacts would likely be short term and would unlikely result in harm to individuals, or populations as a whole.

Impacts to habitat of undetected threatened fauna would be further mitigated through measures including the demarcation of approved vegetation clearing, ensuring Project personnel are inducted and aware of areas of threatened fauna habitat and the reinstatement of habitat features removed during construction such as hollow logs (see mitigation measures MM-FF1, MM-FF4 and MM-FF5). With these measures in place, the risk of habitat removal impacting undetected species with the potential to occur in the Project Area is low.

### Removal of undetected threatened flora and/or threatened flora habitat (Risk ID FF5)

Construction activities associated with the Project may result in the removal of threatened flora and/or habitat that potentially support threatened flora not identified within the study area but considered likely to occur. These species include Marsh Sun-orchid, Austral Crane’s-bill, Crested Sun-orchid, Crimson Sun-orchid and Creeping Rush. All these species are included on the DELWP Advisory List.

There is suitable habitat for Marsh Sun-orchid within the study area in the Crib Point vicinity (adjacent to Woolleys Road, Crib Point) which is expected to be disturbed during construction. Crimson Sun-orchid also has suitable habitat adjacent to Crib Point and Woolleys Road and is likely to sustain a minor loss in potential habitat. Crested Sun-orchid are found in many habitats including swamps, heathland on sandy soil and woodlands.

Suitable habitat for these species is likely to be present in similar areas containing Merran’s Sun-orchid. As HDD would be used through this habitat area, impacts to these species would be avoided. Additional mitigation measures also include the use of drilling mud spill kits in the unlikely event of a mud spill, restricting vehicle access to areas outside the known orchid habitat area and regular visual inspections of the return line during drilling (see mitigation measures MM-FF10).

Individual specimens of Austral Crane’s-bill may be lost during construction of the Pipeline Works despite not being recorded within the pipeline alignment. Creeping Rush was also not recorded but may occur within the Project Area. Potential losses of individuals of these species are unlikely to result in impacts at population and local scales.

Potential impacts on these undetected species and undetected habitat can be further mitigated through measures such as the demarcation of approved vegetation clearing, site rehabilitation to reinstate habitat features and topsoil rehabilitation (see mitigation measures MM- FF1, MM-FF5 and MM-FF6). With the implementation of additional mitigation, the risk of impacting undetected threatened flora is reduced from medium to low.

### Southern Brown Bandicoot (Risk ID FF9)

Southern Brown Bandicoot is protected under the FFG Act and is listed as Endangered under the EPBC Act. The presence of 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. Habitats in these locations are varied, ranging from relatively intact Heathy Woodland, to degraded Swamp Scrub as well as exclusively exotic vegetation. Degraded Swamp Scrub forms most of the habitat within the Project Area.

The Pipeline Works would involve removing known and/ or assumed habitat for Southern Brown Bandicoot at 19 locations totalling 1.1 hectares, as shown in [**Figure**](#_bookmark18)[**7-13**](#_bookmark18). This would predominantly occur through linear habitats along farmland fence-lines or drain lines. Impacts associated with fragmentation of Southern Brown Bandicoot habitat are discussed in **Section**

[**7.7.1**](#_bookmark22) above. The EPBC Act d*raft referral guidelines for the endangered Southern Brown Bandicoot (eastern) Isoodon obesulus obesulus* (2011) set out criteria used to determine if there is a high risk of a significant impact to the species from a proposed action.

The Pipeline Works has a low likelihood of triggering any of these criteria, particularly in the medium to long term, and the Project is considered unlikely to have a significant impact on Southern Brown Bandicoot. Mitigation measures would be implemented to minimise potential impacts to individuals where possible, including maintaining dispersal corridor functionality. Other mitigation includes ensuring all Project personnel are inducted and aware of Southern Brown Bandicoot habitat areas as well as the reinstatement of vegetation structure and groundcover at locations of known habitat (see mitigation measures FF-MM04 and FF-MM09).

### Growling Grass Frog (Risk ID FF10)

Growling Grass Frog is listed as vulnerable under the EPBC Act and is listed under the FFG Act. It has been detected within the Project Area at Cardinia Creek (see [**Figure 7-13**](#_bookmark18)) and is also assumed to be present within connected waterways near Ballarto Road and Lower Gum Scrub Creek. There have been a total of 185 recordings within five kilometres of the Pipeline Works area.

No Growling Grass Frog habitat is proposed to be permanently removed, with the Pipeline Works unlikely to have a significant impact on Growling Grass Frog. Disturbance is likely to occur at some locations from nearby construction activities, although these impacts would be short term. Implementation of additional mitigation measures would reduce the risk of impact to this species from medium to low. These measures include the implementation of biosecurity management risks (primarily to mitigate introduction/spread of chytrid fungus – see **Section** [**7.7.7**](#_bookmark27)), ensuring all Project personnel are inducted and aware of Growling Grass Frog habitat and relocating individuals if they are found incidentally or during pre-construction surveys within or adjacent to the construction footprint (see mitigation measure MM-FF03, MM-FF04 and MM-FF11).

### Dwarf Galaxias and Australian Grayling (Risk ID FF11)

Dwarf Galaxias and Australian Grayling are listed as vulnerable under the EPBC Act and are listed under the FFG Act. Dwarf Galaxias typically inhabit still water, often less than 30 centimetres in depth with abundant aquatic vegetation. Australian Grayling generally inhabits rivers and streams with a cool, clear, moderate flow and a gravel substrate. Suitable habitat for these species within the Pipeline Works is outlined in [**Table 7-5**](#_bookmark16) and shown in [**Figure 7-13**](#_bookmark18). Neither species were recorded during targeted surveys, however, it is considered highly likely they are present within areas containing suitable habitat. The nearest known adult Grayling population is in the Bunyip River which opens to Western Port approximately 28 kilometres from Crib Point along the Upper North Arm channel. It is likely that Australian Grayling eggs and juveniles disperse from April to July from the Bunyip River mouth throughout Western Port and Bass Strait via the Western and Eastern Entrances, and that juveniles migrate from Bass Strait to eastern and northern Western Port streams (the Bass, Lang Lang and Bunyip rivers) in spring and early summer.

While targeted surveys undertaken as part of the terrestrial and freshwater biodiversity impact assessment did not record either of these species, one retropinnid juvenile was collected during the 12-month fish larval sampling program in North Arm as part of the marine biodiversity impact assessment undertaken for this EES (see **Chapter 6** *Marine biodiversity*). This was most likely a juvenile Australian Grayling migrating towards freshwater after a winter period of marine residency. Further discussion on potential impacts on Australian Grayling from the operation of the FSRU is provided in **Section 6.2** of **Chapter 6** *Marine biodiversity.*

HDD for the construction of the pipeline is proposed at major waterways where there is likely suitable habitat for these species, including at Cardinia Creek, Warringine Creek and Lower Gum Scrub Creek. Proposed open trenching through areas of suitable habitat (Craigs Lane Drain, Western Outfall Drain, Tooradin Inlet Drain and Hagelthornes Drain) may result in short-term impacts to Dwarf Galaxias through habitat fragmentation. However, as the waterway can be resinated quickly and would not physically be blocked, the scale of impact would be small and short-term. Mitigation measures to reduce the impact on Dwarf Galaxias include trenching of watercourse crossings during no or low flow conditions, installation of flow diversion measures and ensuring all Project personnel are inducted on environmental management requirements (see mitigation measure MM-F02 and MM- F04).

Open trench works would unlikely impact Australian Grayling as no potential habitat was identified in waterways where this construction method would be used. HDD is proposed at waterways where Australian Grayling are assumed likely to be present (see [**Table**](#_bookmark16)[**7-5**](#_bookmark16)). With the implementation of additional mitigation measures, the risk of the Pipeline Works impacting Dwarf Galaxias and Australian Grayling is reduced to low.

### Merran’s Sun-orchid (Risk ID FF12)

Merran’s Sun-orchid is listed under the FFG Act and has a recorded population of up to 391 plants between KP1.13 and KP1.7. Initial design of the pipeline through this section proposed the use of both HDD and open cut trenching. This would have resulted in a loss of approximately 13 per cent of the population due to open cut trenching. To reduce this loss of Merran’s Sun-orchid, an HD section approximately 650 metre long would be used to avoid this population, as shown in [**Figure 7-15**](#_bookmark29).

A pipe stringing area would be required to the south of the exit point for this HDD, covering an area of 640 metres by 10 metres. This area would extend into regrowth vegetation and disturbed industrial land on former Western Port Refinery land. A temporary return line would run along the existing cleared easement between the drill entry and exit points which consists of high-density polyethylene (HDPE) piping. This return line would only be used during the drilling and would be located to avoid the orchid population. Once the HDD was complete, the return line would be removed. Remaining individuals within the ROW would be avoided using exclusion fencing where possible.

Design of the pipeline alignment has avoided the potential for any impacts to the known population of Merran’s Sun-orchid during construction of the Pipeline Works. Additional mitigation measures also include the use of drilling mud spill kits in the unlikely event of a mud spill, restricting vehicle access to areas outside the known orchid habitat area and regular visual inspections of the return line during drilling (see mitigation measure MM-FF10). With the pipeline design revision and implementation of subsequent additional mitigation measure, the overall risk of impacting on Merran’s Sun- orchid is reduced from very high to very low.

**Figure 7-15:** Merran’s Sun-orchid population avoided by HDD

### Gaping Sun-orchid and Pallid Sun-orchid (Risk ID FF13)

Gaping Sun-orchid is a DELWP Advisory listed species and is currently only known from Crib Point and French Island where it inhabits near-coastal heathy woodland on seasonally damp sandy soil. Pallid Sun-orchid is also a DELWP Advisory listed species. Targeted surveys identified two individuals of both Gaping Sun-orchid and Pallid Sun-orchid growing with Merran’s Sun-orchid on the existing pipeline easement beside Woolleys Road at KP 1.13 and KP 1.7. These individuals would be avoided with HDD, as shown in [**Figure 7-15**](#_bookmark29). Some areas of suitable habitat for this species co-exists with Merran’s Sun-orchid adjacent to Woolleys Road. Revision of the pipeline alignment and the use of HDD through this section between KP 1.13 and KP 1.7 would avoid any potential impacts to these species or any areas of suitable habitat (see mitigation measure MM-FF10).

### River Swamp Wallaby-grass (Risk ID FF14)

This species is listed as vulnerable under the EPBC Act and has been recorded within the Pipeline Works area. Open trenching was proposed as the construction method through this area, but HDD has since been adopted to avoid impacts to this population. The risk of the Pipeline Works impacting on individuals and population is therefore low.

### Potential impacts on waders and migratory birds

**during construction (Risk ID18)**

An assessment of the Project against the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines and the Thresholds of significant impacts on migratory shorebirds* is outlined in [**Table 7-11**](#_bookmark30). This assessment has been used to determine a likelihood of significant impacts on waders and migratory birds from construction of the Project.

**Table 7-11:** Assessment of the Project against Significant impact guidelines

**Significant impact criteria 1.1 Likelihood of Justification**

**significant**

**impact**

##### 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?

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 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.

The Project does not involve any construction works that would substantially modify, destroy or isolate important habitat for migratory species at Western Port Ramsar site.

The marine impact assessment found that the FSRU would not substantially modify, destroy or isolate an area of important habitat for migratory species. Trophic impacts resulting from entrainment or discharge of cooler water containing residual chlorine are unlikely (see **Chapter 6** *Marine biodiversity*)

Project impacts mitigated by MM-FF12, MM-FF13, MM-FF14.

Rare Standard biosecurity control measures for overland pipelines would be incorporated into the CEMP. Discharge of ballast waters is prohibited in port waters (PoHDA, 2017).

Impacts from land-based works mitigated by MM-FF03.

**Significant impact criteria 1.1 Likelihood of Justification**

**significant**

**impact**

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 The Pipeline alignment avoids all intertidal mudflat and shorebird

roosting areas and would 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 Crib Point Jetty.

Potential impacts from discharges from the FSRU are predicted to be constrained to the Port of Hastings waters including the shipping channel and the berth pockets around Berth 1 and Berth 2. The modelling for discharges indicates that cooler and warmer water

discharges containing residual chlorine would return to ambient within the mixing zone well away from any areas of potentially significant habitat (i.e. mangroves, saltmarsh or seagrass beds or physical disturbance of intertidal flats).

Serious disruptions to the lifecycle of an ecologically significant proportion of the population of a migratory species are therefore unlikely.

Project impacts mitigated by MM-FF03, MM-FF12, MM-FF13, MM-

FF14, MM-FF08, MM-FF15.

##### Background paper to EPBC Act policy statement 3.21 – Significant Impact to migratory shorebirds

|  |  |  |
| --- | --- | --- |
| Will the proposed action result | Rare | The Project would not involve removal of mangroves, saltmarsh or |
| in the loss (for example, clearing, |  | seagrass beds or physical disturbance of intertidal flats. |
| infilling or draining) of important |  |  |
| habitat for migratory shorebirds? |  | There is no proposed direct impacts on important habitat for migratory |
|  |  | shorebirds from project construction. |
| Will the action result in the | Rare | The Project would not involve removal of mangroves, saltmarsh or |
| degradation of important habitat |  | seagrass beds or physical disturbance of intertidal flats. These important |
| leading to a substantial reduction |  | shorebird habitats would not be directly impacted. |
| in migratory shorebirds using |  | There is no foreseeable manner in which the Project would result |
| the site? |  | in degradation of important habitat that would lead to a substantial |
|  |  | reduction in migratory shorebirds using the site. In addition, shorebird |
|  |  | usage of the intertidal and mangrove areas in the vicinity of the Project is |
|  |  | not significant. These areas are not noted as important roosting habitat |
|  |  | or primary foraging habitat. |
| Will the action result in an | Rare | The level of disturbance from the Project to migratory species would not |
| increased disturbance leading |  | substantially increase existing disturbance levels within the Ramsar site, |
| to substantial reduction in |  | particularly for areas of foraging and roosting importance. |
| migratory shorebirds using |  | There may be some temporary disruption during construction to |
| important habitat? |  | secondary habitat in the vicinity of the Crib Point Jetty but this is unlikely |
|  |  | to result in a substantial reduction in migratory shorebird use and any |
|  |  | potential impacts would be temporary. |
| Will the action result in direct | Rare | The Project would not result in direct mortality of birds that leads to a |
| mortality of birds leading to |  | substantial reduction in migratory shorebirds using important habitat, |
| a substantial reduction in |  | as the area adjacent to the existing jetty is not noted as primary foraging |
| migratory shorebirds using |  | habitat or roosting habitat. Impact pathways leading to direct mortality |
| important habitat? |  | are highly unlikely. |

Based on the risk assessment criteria (see **Section**

[**7.3**](#_bookmark0)), the Significant Impact Guidelines and the 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 for the Project is negligible as the likelihood of the Project impacting on habitat or populations of migratory birds is rare.

# **Oper****ation impacts**

This section discusses the potential impacts on terrestrial and freshwater biodiversity during operation of the Project.

## **Noise, vibration and lighting impacts (Risk ID FFO1, FFO2 and FFO3)**

### Noise and vibration

The risk of the Pipeline Works impacting waders and waterbirds or other terrestrial fauna is considered to be very low once operational as the pipeline would be underground and the Pakenham Delivery Facility would be located in cleared agricultural land.

Noise modelling undertaken as part of this EES (see EES Technical Report H: *Noise and vibration impact assessment*) provides predicted noise levels at receptor sites for five potential FSRU and Crib Point Receiving Facility operating scenarios:

* Scenario 1 - LNG carrier berthing (closed loop)
* Scenario 2 - LNG carrier berthed (closed loop)
* Scenario 3 - FSRU operation (closed loop)
* Scenario 4 – LNG carrier berthed (open loop)
* Scenario 5 - LNG carrier berthed and nitrogen

offloading (closed loop)

The reason for selecting modelling scenarios that include the LNG carriers is that in carrying out the operational noise investigations, it was observed that LNG carrier berthing and unloading activities are predicted to be some of the noisier activities at Crib Point. The noise from standard FSRU operations when LNG carriers are not present is predicted to be substantially less than these noise contributions from intermittent LNG carrier activities.

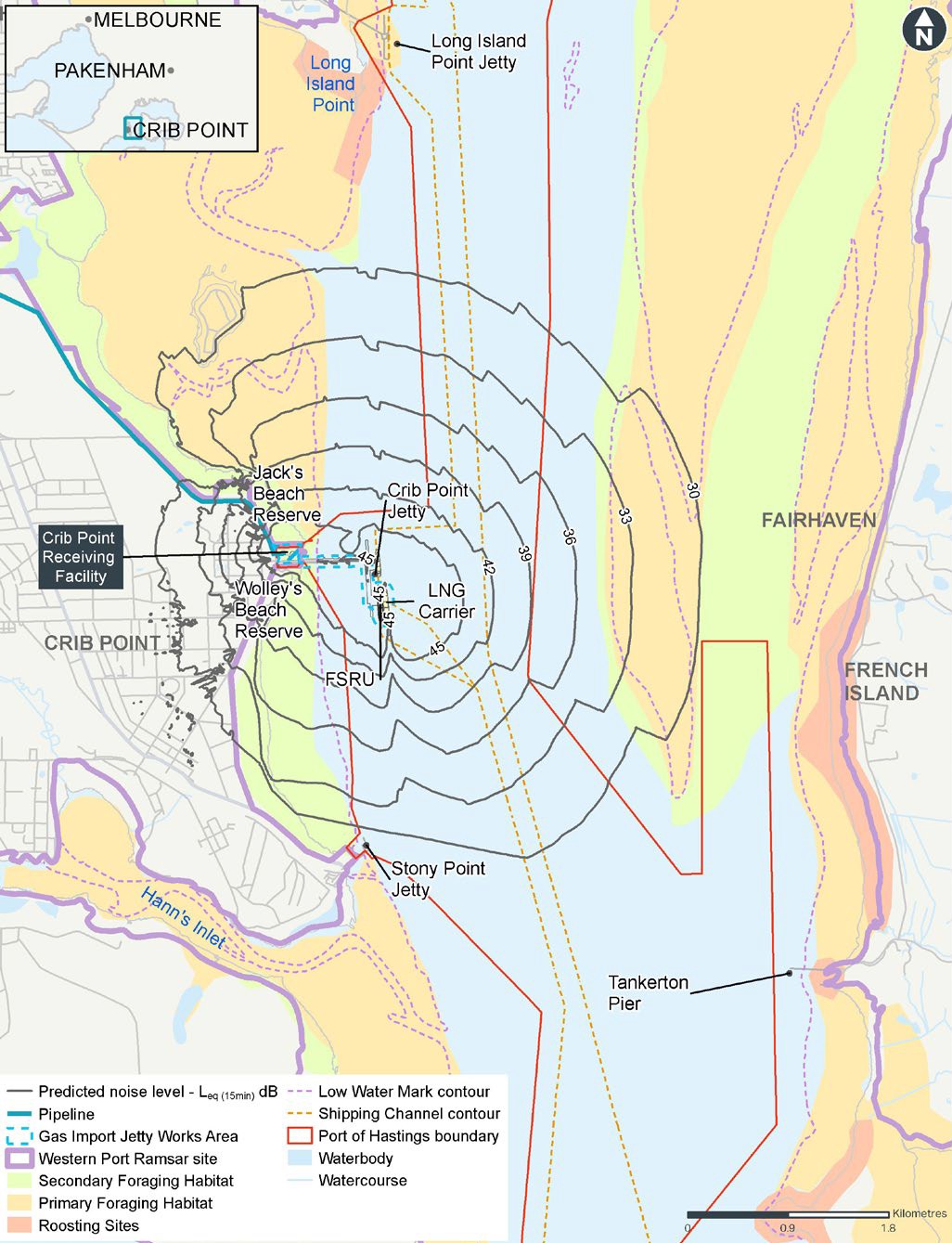
The Project is expected to operate under Scenario 4 during most of its operation, which has the lowest associated noise levels. Scenario 1 would be considered the ‘worst case’ scenario for human amenity due to some noise occurring during night hours. In consideration of operational noise impacts on fauna, Scenario 5 is likely to represent the ‘worst case’ scenario as it has the highest modelled noise levels associated with the offloading of nitrogen at the Crib Point Receiving Facility, although this would only occur during daytime and evenings.

Habitat for waders and waterbirds are mapped in [**Figure**](#_bookmark6)[**7-3**](#_bookmark6)and [**Figure 7-5**](#_bookmark8). Operational noise levels have been modelled at Woolleys Beach and HMAS Otama Lookout Beach for the operating scenarios outlined above. Both of these locations are adjacent to secondary foraging habitat, which is the closest identified waterbird habitat to the FSRU and the Crib Point Receiving Facility.

[**Figure 7-16**](#_bookmark32) shows the predicted noise levels for Scenario 5 which includes operational noise from the FSRU and the Crib Point Receiving Facility. Noise levels are predicted to reach 45 dB(A) at parts of the secondary foraging habitat closest to the FSRU and Crib Point Receiving Facility and would decrease as the distance from the noise source increases. For comparison, 45 dB(A) is comparable to a quiet conversation.

As discussed in **Section** [**7.7.3**](#_bookmark26)above, there is little empirical evidence the area of Woolleys Beach close to Crib Point Jetty is significantly used by shorebirds or other waterbirds. Nonetheless, up to 22 species of these species are considered to have some potential to use the area.

A review of international studies related to noise effects on birds (California Department of Transportation 2016) outlines a number of studies that show the typical human can hear a noise at a much greater distance from a sound source than can the typical bird. The review provides a general guideline indicating that noise in the range of 50-60 dBA is unlikely to noticeably interfere with bird behaviours; for instance, it is unlikely that in this range birds would call more loudly to overcome background noise.

**Figure 7-16:** Predicted noise levels at the Gas Import Jetty Works under operating Scenario 5

It is not expected that predicted noise levels for operational activities associated with the Gas Import Jetty Works would have measurable effects on the use of secondary foraging habitat closest to the Crib Point Jetty by any species of waterbird that uses Western Port. Vessels regularly berth at Berth 1 at the Crib Point Jetty to carry out existing petroleum import operations and there is ship noise and noise on land from pumps that support this activity that form part of the existing conditions at this location.

Roost sites used by waterbirds in proximity to the Gas Import Jetty Works are shown in [**Figure 7-3**](#_bookmark6) and [**Figure**](#_bookmark8)[**7-5**](#_bookmark8)**.** The roost sites closest to the Crib Point Jetty are Long Island Point in the north of Hastings Bight and between Fairhaven and Tankerton Pier on French Island (east of the Crib Point Jetty). These sites are more than

3.5 kilometres from the Crib Point Jetty. Operational noise is highly unlikely to be audible to birds at these and all other known roost sites in Western Port (see [**Figure 7-16**](#_bookmark32)).

To assist with understanding how the predicted noise levels at Crib Point from the operation of the Project may affect waders and waterbirds, representative noise levels were measured at Long Island Point within Western Port, located offshore from the Long Island Point Fractionation Plant north of Crib Point. These noise measurements provide an indication of existing noise conditions from port related activities close to wader and waterbird habitat and are used here to further develop the understanding of how birds that use Western Port respond to industrial and shipping noise. This location is within mapped primary foraging habitat and immediately adjacent to the mapped roosting area (see [**Figure 7-5**](#_bookmark8)).

Noise levels measured at the primary shorebird foraging and roosting habitats at Long Island Point are equal to, and in some cases higher, than operational noise levels predicted to reach the closest extremities of secondary and primary foraging habitats near the Crib Point Jetty. On the basis that these habitats have co-existed with the Long Island Fractionation Plant since 1970, it is considered unlikely that operational noise from the Project would have any measurable impact on roost sites of any migratory species.

Having regard to the modelled noise at Woolleys Beach North and Woolleys Beach South and the low rates of utilisation by waders and waterbirds, it is unlikely that operational noise from the Project would impact on bird utilisation or behaviour at potential habitat in the immediate vicinity of the Project, or further afield.

### Artificial lighting

Operational lighting would be required at the FSRU, Crib Point Receiving Facility and the Pakenham Delivery Facility. Although measurable light spill from these facilities would be minimal as the purpose of this lighting is to aid in the carrying out of tasks at these facilities during low-light and night-time periods, rather than illuminating the areas surrounding them, there is the potential for indirect lighting impacts to occur.

There is existing lighting in the vicinity of the Crib Point and Pakenham facilities including lighting on the Crib Point Jetty and lighting associated with the Pakenham East Rail Depot. Given the proposed Pakenham Delivery Facility would be located immediately adjacent to the existing rail depot and the lack of viable habitat or the presence of significant species in the immediate vicinity, there is a low likelihood of substantial lighting impacts on terrestrial fauna from this facility. The remainder of this section therefore focuses on potential lighting impacts associated with the proposed FSRU and Crib Point Receiving Facility at Crib Point.

The Project would introduce new sources of lighting associated with the FSRU and the Crib Point Receiving Facility that may modify or impact habitat for:

* migratory shorebirds and other waterbirds
* terrestrial fauna adjacent to the Crib Point Receiving Facility
* marine fauna. This is discussed further in **Chapter 6**

*Marine biodiversity*.

Artificial lighting has the potential to affect birds by altering visual cues for orientation, navigation or other purposes, resulting in behavioural responses, which can alter natural distribution and dependencies. 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. These types of changes would typically be experienced at varying levels of severity depending on the scale, magnitude and duration of lighting.

Lighting is currently present on the Crib Point Jetty and at the proposed location of the Crib Point Receiving Facility area, as well as on vessels that use Berth 1 at the Crib Point Jetty for petroleum importation. There is also extensive lighting associated with other areas of Western Port such as Hastings and the Long Island Point Fractionation Plant, as well as on commercial and recreational vessels that use Western Port.

There are 13 jetties around Western Port that cause light spill on the water surface (Flinders, HMAS Cerberus, Stony Point, Crib Point, Long Island Point, BlueScope, Corinella Ferry Terminal, San Remo, New Haven, Rhyll, Rhyll Boat Ramp, Cowes and Carrierston). Taking account of the beam radius and the proportion of the beam on the water surface, it is estimated the surface area of Western Port Bay that is illuminated by light spill from these jetties is around one hectare, well less than one per cent of the total surface area of Western Port.

Lighting associated with the operation of the Crib Point Jetty may impact birds within the vicinity. As outlined in **Section** [**7.7.3**](#_bookmark26) above, there is little empirical evidence that the area of Woolleys Beach close to the Crib Point Jetty is significantly used 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 waterbird species, including; Pied Cormorant, Little Pied Cormorant, Black Cormorant and Silver Gull, use the pipe infrastructure on the jetty despite lighting being present.

Light modelling shows the additional area to be lit by the FSRU equates to about 4,500 m2 (measured from the light source to zero lux, or to the point where no further measurement of the light from the source can be obtained). The area of predicted light spill would be constrained to Western Port waters around the FSRU and part of the Crib Point Jetty.

In the context of these light sources, the permanent lighting associated with the FSRU and Crib Point Receiving Facility would unlikely impact foraging success of birds in Western Port. This is primarily 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 600 metres from the proposed FSRU and sitting well outside the area predicted to be affected by light spill. The known foraging location and roost-site for these same migrating species at Long Island Point is permanently exposed to over one kilometre of the extensively lit Hastings foreshore.

Light levels would be minimised as much as practicable at the Crib Point Receiving Facility and FSRU to reduce any potential or unidentified lighting impacts. In order to limit the potential for lights to attract waterbirds from a distance, all necessary lights would be positioned as low as is practicable.

The operational lighting associated with the FSRU and Crib Point Receiving Facility would unlikely impact terrestrial fauna or the behaviours of birds that are known to use the area around Crib Point including foraging, reproduction and dispersal. Additional mitigation measures would be implemented including adhering to the *National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds*. A monitoring procedure and adaptive management response would also be incorporated into the Operational Environmental Management Plan (OEMP) for the Gas Import Jetty Works to detect and appropriately respond to migratory bird strikes with lighting. Appropriate responses may include the use of red filters on flood lights, use of green lamps, or dimming/reducing lighting at sensitive times (see mitigation measure MM-FF12).

## **Impacts on surface water, GDEs**

**and/or habitat (Risk ID FFO4)**

There is the potential for a leak or spill during operation of the Project that may impact terrestrial biodiversity either directly or through impacts on surface water and groundwater. Spills or leaks would most likely be associated with the Pakenham Delivery Facility, the Crib Point Receiving Facility and the interactions between the FSRU and exchange vessels. It is unlikely that a spill or leak associated with operation of the pipeline would occur.

Spills or leaks at the Pakenham Delivery Facility would unlikely impact native vegetation or significant fauna, as neither are present within the immediate vicinity of the site, and facility design and mitigation measures would incorporate industry standard practices for storage of materials and management of spills. These design and mitigation measures also mean the potential for spills to enter watercourses or impact GDEs is negligible.

The Crib Point Receiving Facility does contain some areas of significantly degraded native vegetation and fauna habitat, although spills or leaks would unlikely extend outside of the operational footprint and would be controlled through industry standard design and management measures.

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. The likelihood of spills during operations is considered unlikely, with any spills likely to be small to negligible, with a resulting consequence of minor. As approximately 150 commercial vessels use Western Port annually as well as numerous recreational vessels, the additional risk posed by LNG carriers during operation of the Project is considered negligible.

Taking account of likelihood and consequence, the risk of spills having adverse impacts on the environmental values of Western Port is considered low. The FSRU and visiting LNG carriers are not crude oil or petroleum product carriers as their cargo is LNG. The vessels would only have small amounts of diesel fuel on board as they are primarily powered by gas. The bunkering storage tanks would have multiple layers of protection such as double hulls and the vessels would have comprehensive bunkering spill measures and emergency plans in place.

The risk of a vessel collision in Western Port is very low with the small volume of ship visits to the port each year and the use of tugs and pilots in the channels. It is considered that the risk of Ramsar values of Western Port being adversely impacted from a spill would be low.

The types of vessels and activities proposed for operation of the FSRU would not likely add to the risks posed by existing operations within Western Port in a manner that would substantially alter the potential for effects on waterbirds that use Western Port. EES Technical Report A Marine biodiversity impact assessment has considered spills from the FSRU and has proposed industry standard mitigation and response measures in the event of a spill, which is outlined in **Chapter 6** *Marine biodiversity*.

Implementation of mitigation would ensure spills and leaks were contained as effectively as possible including minimising the amount of fuels and chemicals stored on site and designing facilities to be in accordance with statutory requirements for storage and handling of hazardous materials (see mitigation measure outlined in **Chapter 8** *Surface water*).

## **Weeds, pathogens and pest**

**animals (Risk ID FFO5)**

Activities associated with operation of the Project, in particular the periodic traversing of the pipeline alignment for maintenance checks, may result in the transportation of invasive weed species or pathogens into, between or from the study area. Invasive weeds such as Bathurst Burr *Xanthium spinosum* or pathogens such as Chytrid fungus or Phytophthora fungus 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 study area, invasive weed spread would unlikely result in irreversible damage, although they may result in problematic infestations at a localised scale that would require control. Pathogens are harder to control, and once spread, would likely persist within the area. With the implementation of mitigation measures, the risk associated with invasive pests and diseases is considered to be very low. All vehicles, equipment and materials arriving on site would be inspected and certified and all Project personnel would be inducted to ensure they are aware of environmental management requirements (see mitigation measures MM-FF03 and MM-FF04).

# **Character of Western Port Ramsar site (Risk ID FF19, FFO6 and FFO7)**

The Western Port Ecological Character Description (ECD)2 outlines the critical components, processes and services for the Western Port Ramsar site. Western Port has eight critical components and processes: wetland bathymetry; geomorphology and sedimentation; seagrass; mangrove and saltmarsh; waterbirds; marine invertebrates; fish; and supports threatened species.

The Project is not expected to significantly impact any Components, Processes or Services (CPS) that are considered critical to the ecological character of the Western Port Ramsar site on the basis that none of the LAC which establish quantifiable criteria for potential impacts on CPS have been adversely affected. [**Table 7-12**](#_bookmark33) outlines the critical CPS of Western Port, along with an assessment of the Project against each of these components.

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

**Table 7-12:** Summary of assessment of the Project on Components, Processes or Services (CPS) for the Western Port Ramsar site.

|  |  |  |
| --- | --- | --- |
| **Critical CPS** | **Limit of Acceptable Change (2016**  **revision)** | **Assessment of the Project on Critical CPS** |
| Wetland  bathymetry | No loss of intertidal mudflat area (270 km2) | No change to wetland bathymetry or loss of intertidal mudflat area. The Project would not involve any direct or indirect physical disturbance of intertidal mudflats (see **Chapter 6** *Marine biodiversity*).  CPS would not be impacted, and LAC would not be exceeded. |
| Geomorphology and sedimentation | No LAC set | No change to geomorphology.  Minor change to resuspension of sediments within the area of the existing port due to vessel movements and operations. Additional sediment loads from Pipeline Works in the catchment unlikely to occur due to use of HDD for sensitive stream crossing and sediment control measures where trenching is utilised. CPS would not be impacted. |
| Flora – seagrass | Total seagrass extent will not decline below 5,400 hectares for a period of greater than 10 continuous years. | No loss of seagrass from the Project (see **Chapter 6** *Marine biodiversity*).  CPS would not be impacted, and LAC would not be exceeded. |
| Flora – mangrove and saltmarsh | Total mangrove extent will not decline below 900 hectares.  Total saltmarsh extent will not decline below  850 hectares. | No loss of mangrove or saltmarsh from the Project (see **Chapter 6** Marine biodiversity)  CPS would not be impacted, and LAC would not be exceeded. |
| Fauna -  Waterbirds | Abundance of waterbirds will not decline below the following (calculated as a rolling five-year average of maximum annual count):   1. total waterbirds – 12,000 2. migratory waders – 5,300 3. Australasian waders - 800 4. ducks - 500 5. fishers - 550 6. gulls - 1600 7. large wading birds - 980 8. swans – 1,600   breeding of beach nesting birds annually within the site | The Project would not directly impact on known important habitat areas for waterbirds, particularly primary foraging areas or roosting sites. The Project would not involve any direct physical disturbance of intertidal mudflats and is not expected to indirectly impact on these communities. No impact to waterbird habitat from cold and warm water or chlorine discharge as plumes would not reach waterbird habitat.  No change to the abundance of waterbirds or to the breeding of beach nesting birds is anticipated.  CPS would not be impacted, and LAC would not be exceeded. |
| Fauna - Marine invertebrates | No LAC set | Potential minor impacts to subtidal invertebrate species over 20 hectares within the Port of Hastings area (shipping basin) (see **Chapter 6** *Marine biodiversity*). |
| Fauna –fish | No LAC set | The Project would have negligible impacts on fish populations  in North Arm (see **Chapter 6** *Marine biodiversity*). CPS would not be impacted. |
| Supports threatened species - birds | 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. | Project would not directly impact known important habitat areas for waterbirds, particularly primary foraging areas or roosting sites. The Project would not involve any direct physical disturbance of intertidal mudflats and is not expected to indirectly impact these waterbird species. There would be no impact to waterbird habitat from cold water or chlorine discharge as plumes would not reach waterbird habitat.  No change to Eastern Curlew, Curlew Sandpiper, Fairy Tern, Bar-tailed Godwit, Lesser Sand Plover or Red Knot presence and abundance.  CPS would not be impacted, and LAC would not be exceeded. |
| Supports threatened species - fish | Australian grayling continues to be supported in one or more of the catchments draining into Western Port | No change to the occurrence of Australian grayling populations  in the Western Port catchments.  CPS would not be impacted, and LAC would not be exceeded. |

The Pipeline Works are unlikely to result in an increase or alteration to any of the abovementioned critical CPS as these works would not be undertaken within areas of Western Port. The potential for increased sediment loads entering catchment streams as a result of Pipeline Works in the catchment has been assessed and considered to be low risk due to the use of HDD under sensitive watercourses and adoption of sediment control measures for trenching at disturbed areas during construction. Measures outlining site requirements for contaminants and sediment control would be outlined in the Pipeline Works CEMP so that litter or nutrient rich run-off would not enter Western Port. It is therefore unlikely that sediments or contaminants would enter the Ramsar site and impact mangroves and saltmarsh, seagrasses of intertidal mudflats.

Impacts on water drawdown, flow durations or water levels are unlikely to occur within the Western Port Ramsar site, and any potential impacts from sedimentation or pollution of waterways is unlikely to be of a measurable scale within Western Port. Impacts on the extent of habitat and subsequently waterbird diversity and abundance are therefore unlikely to occur.

As outlined in [**Table 7-12**](#_bookmark33), the Project would not result in the loss of intertidal mudflat areas as no portion of the works or operation are located within the intertidal zone, and would not result in a change to seagrass, mangrove, saltmarsh or wetland bathymetry.

The potential for impacts to both Western Port Ramsar site and waterbirds would primarily be associated with the Crib Point Jetty, where the FSRU would be located, and three locations where the pipeline alignment traverses the Ramsar site via HDD within Warringine Park and Watson Creek. Construction and operation of the Project would unlikely significantly impact waterbirds and other significant migratory bird species as works would not involve the removal of any important foraging or roosting habitat for these species, including mangroves, saltmarsh, seagrass beds of intertidal mudflats.

Existing disturbance levels to migratory species would not substantially increase as a result of the Project, as construction and operation noise levels are not expected to exceed existing noise levels at foraging or roost habitats in proximity to the Crib Point Jetty. In addition, the FSRU would not be adding or removing any nutrients or organic constituents to Western Port and is therefore not expected to alter any food supply for intertidal birds. No change in the abundance of waterbirds is therefore expected to occur as a result of the Project.

An assessment of potential impacts on Australian Grayling from the operation of the FSRU is presented in Section 7 of EES Technical Report A: *Marine biodiversity impact assessment*. The assessment found that Australian Grayling larvae drift downstream and enter Western Port from April to July. The larvae then undergo a period of marine residency for four to five months before returning upstream as young juveniles from September to December. It is not known whether larvae remain in Western Port or are dispersed offshore over the period of marine residency.

The hydrodynamic modelling carried out for the Project (see Section 6 of EES Technical Report A: *Marine biodiversity impact assessment*) found that flushing periods in the Lower North Arm and Western Entrance are short relative to the four to five month larval and juvenile period of Grayling in the marine environment. In addition, the very low number of juveniles in samples from March to September (one, collected in September 2019, see Section 5 of EES Technical Report A: *Marine biodiversity impact assessment*), indicate that it is unlikely that significant proportions of Grayling larvae disperse or remain in Lower North Arm of Western Port. However, the low flushing rates in the north, northeast and Rhyll segments of Western Port suggest that it is possible that larvae and juveniles could spend significant periods there.

The marine investigations carried out for the Project and presented in EES Technical Report A: *Marine biodiversity impact assessment* also identifies that salinity data and physical processes show that freshwater discharges from the northern Western Port streams disperse into the Eastern Arm of Western Port. Eggs are not viable in the marine environment, therefore there is no risk of entrainment of viable eggs being entrained. No early larvae of Australian Grayling were identified in the ichthyoplankton sampling program in Lower North Arm over the thirteen-month period of monthly sampling.

Hydrodynamic modelling carried out as part of the marine investigations also indicates that seawater entering the Confluence Zone from the Western Entrance is deflected towards the eastern side of Lower North Arm (see Section 6 of EES Technical Report A: *Marine biodiversity impact assessment*). Once in Lower North Arm, north going currents are stronger on the eastern side. A late larval Australian Grayling individual was caught during the ichthyoplankton sampling program in Lower North Arm in September when it was likely returning to freshwater habitat in Upper North Arm.

Based on the outcomes of the 13-month sampling program in the North Arm of Western Port and the understanding of Australian Grayling in the Western Port catchment carried out as part of the marine investigations, there is low potential for the Project to impact on the viability of Australian Grayling and very limited potential for any impact to have a detrimental impact on the ecological character of the Western Port Ramsar site.

The risk of the Pipeline Works impacting on the ecological character of Western Port Ramsar site, including waders and waterbirds, is considered to be very low once operational as the pipeline would be underground and the Pakenham Delivery Facility is not located near the Ramsar site.

The operation of the FSRU, specifically the heat- exchange system required for the regasification of liquid natural gas, may result in impacts to marine biota, migratory birds that feed on biota, seagrasses or flora communities that utilise tidal or intertidal habitat, as well as the ecological character of Western Port itself. Processes associated with operation of the FSRU include:

* seawater intake for regasification and other uses

resulting in potential entrainment of marine biota

* cooler water discharge (open loop regasification)
* warm water discharge (closed loop regasification)
* chlorination of seawater for anti-fouling purposes
* contaminants and spills
* physical disturbance
* biological disruption.

For all the above noted processes that present environmental risks, it is determined that impacts would be highly localised to the area immediately adjacent to the FSRU that corresponds with Port of Hastings waters including the previously dredged shipping channel and berth pockets. Potential impacts on adjacent secondary wader and waterbird foraging habitats of Woolleys Beach or nearby seagrass beds and mangroves are not expected to occur. There are no predicted impacts from operation of the FSRU on the food chain such that effects would be felt to any of these nearby sensitive receptors/ habitats.

This means 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 (see **Chapter 6** *Marine biodiversity* for more information).

Further information on potential impacts on critical CPS is provided in EES Attachment I *Matters of National Environmental Significance.*

# **Cumulative impacts**

The broader Western Port Catchment region within which the Project would be located has been subject to significant development and land use changes. Rapid growth and development in the northern parts of the catchment, and steady growth throughout the rest of the catchment, is expected to result in a projected population of 250,000 people by 2041 (sum of municipality projections by *id.population*, 2020). Runoff from the existing urban population and agricultural land has resulted in elevated nutrient concentrations in the north-east section of Western Port. This will likely be exacerbated by the urban development and population growth that is predicted.

It is likely that urbanisation and other activities have impacted on terrestrial and freshwater biodiversity values of the region.

The potential impacts of urbanisation and growing recreational activities on biodiversity values, in particular waterbirds in Western Port, have not been quantified in detail and it is therefore difficult to quantify the potential cumulative impacts with the Project. However, given the scale of forecast regional changes in the catchment and the relatively minor impacts on terrestrial and freshwater biodiversity values from the Project, the Project’s contribution to regional cumulative impacts is expected to be negligible and highly localised to the immediate area around Crib Point. Mitigation measures developed to avoid and minimise impacts and monitor changes would also assist in ensuring the Project’s contribution to cumulative impacts on regional terrestrial and freshwater values would be minimised.

Construction and operation of the Project may coincide with other developments that could result in cumulative impacts on terrestrial and freshwater biodiversity values within the Project Area. Projects with the capacity to contribute to cumulative impacts include:

* high capacity Metro trains (HCMT) depot in Nar Nar Goon
* Healesville-Koo Wee Rup Road upgrade works,

Pakenham South

* Port of Hastings Crib Point Jetty upgrade at Berth 2.

The HCMT Depot runs adjacent with the Project for a number of kilometres at the northern end of the Project Area along the railway corridor, north of Bald Hill Road. Potential impacts of the development on flora and fauna values were assessed and considered to be low or negligible.

Works associated with the Healesville-Koo Wee Rup Road upgrade within the vicinity of the Project Area currently do not have a proposed timeframe. The upgrade works were deemed a controlled action under the EPBC Act in August 2019, due to the potential to impact significant species including Southern Brown Bandicoot and Growling Grass Frog. Impacts to both of these species were assessed as potentially significant in the short to medium term, but not significant in the long term provided appropriate mitigation measures are implemented. Potential impacts on other species as a result of the road upgrade can be avoided with the implementation of mitigation measures.

There is potential for construction of the Project to coincide with other construction works proposed to be undertaken by the Port of Hastings Development Authority (PoHDA) at the Crib Point Jetty. These works would involve the upgrade of existing berth facilities at the Crib Point Jetty. These upgrade works may occur concurrently or sequentially with the Project for a potential period of six months. However, scheduled timing for the Crib Point Jetty upgrade works is yet to be confirmed. An assessment of the jetty upgrade works determined that migratory birds are not expected to be impacted due to the lack suitable habitat within the vicinity of the Crib Point Jetty.

The potential for construction and operation of the Project to contribute to cumulative impacts with other proposed developments, to an extent that is considered significant, is unlikely.

# **Mitigation measures**

The mitigation measures developed for terrestrial and freshwater biodiversity impacts are summarised in [**Table**](#_bookmark35)[**7-13**](#_bookmark35).

Mitigation measures will be applied to the Project as conditions to the relevant approval, including the Pipeline Licence, EPBC Act approval, and the Incorporated Document pursuant to a Planning Scheme Amendment.

**Table 7-13:** Mitigation measures – Terrestrial and freshwater biodiversity

|  |  |  |  |
| --- | --- | --- | --- |
| **Mitigation measure ID** | **Mitigation measure** | **Works area** | **Project phase** |
| MM-FF01 | **Unplanned vegetation loss**  The approved vegetation clearing extent, including retained environmental features within the construction footprint, will be clearly demarcated and identified during the construction stage as follows:   1. Para-webbing, bunting and signage, construction fencing or fauna-specific   temporary fencing in areas of special concern as follows:   * + Merran’s Sun-orchid population   + Southern Brown Bandicoot   + Swamp Skink   + Growling Grass Frog   + Warringine Park   + Any other areas of special concern noted during pre-clearance inspections  1. Bunting in any other areas of native vegetation, as well as habitat features to be retained within the construction footprint 2. Survey pegs in remaining areas of cleared or non-native vegetation. 3. Para-webbing or bunting will not be placed across existing access tracks so that access for landholders is maintained. 4. If clearing of native vegetation outside of the construction impact area is required for pipeline safety or maintenance during the operational phase, the area cleared will be the minimum necessary to complete the work and will be assessed and offset in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017). This requirement will be listed as a commitment in the Pipeline Works OEMP. | Gas Import Jetty Works and Pipeline Works | Construction |
| MM-FF02 | **Aquatic fauna impacts**  Construction works during wet months (e.g. June – September) will require measures to be put in place to ensure that land degradation and surface water management problems can be avoided or appropriate mitigation measures implemented.  Where practicable, all trenched watercourse crossings will be constructed during no or low flow conditions.  Where this is not practical, to further mitigate potential impacts to Australian Grayling and Dwarf Galaxias, work will be undertaken in accordance with the following measures:   1. Flow diversion measures will 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. 2. Where watercourses are trenched, all obstructions to flow will be removed as soon as practicable after the pipe has been laid and backfilled. 3. Watercourses will 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 will be applied to watercourse banks where necessary. 4. The pipeline will be assembled and prepared so that it can be immediately installed once the trenching over the watercourse has been undertaken. | Pipeline  Works | Construction |

Gas Import Jetty and Pipeline Project EES | Volume 2

**7-69**

|  |  |  |  |
| --- | --- | --- | --- |
| **Mitigation measure ID** | **Mitigation measure** | **Works area** | **Project phase** |
| MM-FF03 | **Invasive weeds, pests, pathogens and waste**  The following measures will be implemented to manage biosecurity risks:   1. Consultation with landholders regarding property specific biosecurity management arrangements/plans which are in place and followed by landholders. 2. Undertake a baseline weed survey of the ROW to identify locations of existing   weed infestations.   1. Satisfy Australian Quarantine and Inspection Service (AQIS) regulatory   requirements for any vehicles and equipment sourced from overseas.   1. Inspection and certification of all vehicles and construction machinery upon arrival at site. Vehicles and construction machinery cannot access the ROW until certified as clean. 2. Vehicles and construction machinery will not go outside of the construction footprint or approved roads and tracks unless undertaking survey or property management activities as agreed with the land owner. 3. Operate in accordance with relevant elements of existing property specific   biosecurity plans which landholders operate under.   1. Monitoring of the condition of the ROW and other disturbed areas will 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 self-sustaining, non-pest species, sterile groundcover (on consultation with landholder land use requirements). 2. Waste is to be managed in accordance with MM-C09 (construction waste management) and MM-C10 (operation waste management), which will require provision of lidded refuse containers to prevent fauna access, and their appropriate monitoring and removal. 3. Any topsoil imported for easement maintenance will be of an appropriate quality. 4. Develop a protocol for preventing spread of Cinnamon Fungus *Phytophthora cinnamomi,* including maps identifying any known areas, requirements for managing surface run-off and wash down locations/requirements. | Gas Import Jetty Works and Pipeline Works | Construction and operation |
| MM-FF04 | **Contractor awareness**  All Project personnel will be required to attend an induction that outlines environmental management requirements. This would include information on the biodiversity values of the Project Area specifically areas of threatened flora and fauna habitat. | Gas Import Jetty Works and Pipeline Works | Construction and Operation |

**7-70**

Terrestrial and freshwater biodiversity – Chapter 7

|  |  |  |  |
| --- | --- | --- | --- |
| **Mitigation measure ID** | **Mitigation measure** | **Works area** | **Project phase** |
| MM-FF05 | **Site rehabilitation**  Habitat features removed during construction such as large hollow logs and large rocks will be returned to the ROW as soon as 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 will be made to locate them in suitable nearby sites, such as nearby Council- managed bushland reserves (upon Council approval).  Landholder requirements will be considered prior to returning habitat features to the ROW. Rehabilitation by assisted natural regeneration will be undertaken on the ROW, except within four metres of the pipeline, in the following areas where there is an increased risk of habitat fragmentation:   1. Warringine Park (excluding existing pipeline easements) 2. KP 7.3 to 8.3, excluding existing access roads   3. KP 13.7 to 14.4  4. KP 18.5 to 18.7 (refer to [**Figure 7-6**](#_bookmark11) to [**Figure 7-12**](#_bookmark14) for KP locations).  A site specific Rehabilitation Plan is to be prepared for Warringine Park in  consultation with Mornington Peninsula Shire.  The CEMP (and any relevant Site Rehabilitation Plans) will contain requirements for effective monitoring of the success of assisted natural regeneration and adaptive management responses for additional remediation works, if required. The construction footprint will be reinstated with consideration of the vegetation composition and ground surface adjacent to the area and in consultation with the landholder and in accordance with any agreement made as part of easement negotiations. | Pipeline  Works | Construction |
| MM-FF06 | **Topsoil management**  The following mitigation measures will be implemented to manage topsoil:   1. Vegetation will be cleared prior to stripping of topsoil. 2. Topsoil will be stripped across the construction footprint to maximum depths determined during pre-construction surveys. 3. Topsoil will not be stripped when saturated. 4. Stripped topsoil will be stockpiled separately from woody material and subsoil stockpiles 5. Topsoil stockpile heights will not exceed two metres. 6. Gaps in the linear topsoil stockpiles will be left at appropriate intervals for drainage and for the movement of vehicles and fauna through the site. 7. Topsoil stockpiles, other than linear stockpiles on the ROW, will be clearly   signposted.   1. Topsoil will not be used as a padding material.   i. Stockpiled topsoil will be respread over the construction footprint to a minimum depth of 100mm, or to the depth that topsoil was stripped if this was less than 100mm.  j. Topsoil will not be respread for rehabilitation when saturated. | Gas Import Jetty Works and Pipeline Works | Construction |
| MM-FF07 | **Trench entrapment**  The following mitigation measures will be implemented to manage fauna trench entrapment:   1. Minimising the period of time the trench is open. 2. Providing opportunities for fauna to egress the trench such as ramped trench plugs or other appropriate mechanisms 3. Daily inspections of the open trench, by suitably qualified personnel, to remove   trapped fauna as required.   1. Install fauna shelter devices, such as sawdust filled bags, at intervals of one per 500m along the length of open trench, and every 100m in those areas that will be subject to assisted natural regeneration. | Pipeline  Works | Construction |

Gas Import Jetty and Pipeline Project EES | Volume 2

**7-71**

|  |  |  |  |
| --- | --- | --- | --- |
| **Mitigation measure ID** | **Mitigation measure** | **Works area** | **Project phase** |
| MM-FF08 | **Injury and/or disturbance to fauna**  A suitably qualified wildlife handler will be present for clearing woody vegetation  to:   1. Inspect habitat in advance of clearing. This will include a walk-through/visual inspection of the habitat to be removed immediately prior to clearance to flush out fauna and capture and relocate. 2. Advise on clearing techniques that minimise fauna impact. 3. Keep records of important fauna interactions, listing the species concerned, the nature of the interaction and GPS coordinates.   Fauna management standards will be included in the Gas Import Jetty Works EMP and Pipeline Works CEMP. A specific protocol will be developed for clearing Swamp Skink and Glossy Grass Skink habitat, in consultation with Mornington Peninsula Shire, which will refer to the management activity guidelines developed  by Robertson and Clemann (2015) for Swamp Skink. This protocol will be included as a management standard in the Gas Import Jetty Works EMP and Pipeline Works CEMP.  Noise impacts to fauna will 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. | Gas Import Jetty Works and Pipeline Works | Construction and Operation |
| MM-FF09 | **Southern Brown Bandicoot**  The following measures will be implemented to manage Southern Brown Bandicoot:   1. As soon as practicable following clearing, fencing suitable to exclude the Southern Brown Bandicoot will be installed at the edges of the construction footprint where it is adjacent to any of the 19 locations of Southern Brown Bandicoot habitat areas to reduce the likelihood of animals entering the construction footprint. Monitoring of fencing will be undertaken and repairs completed as required. 2. In the event that Southern Brown Bandicoot are discovered within the construction footprint, all mobile construction equipment in the surrounding area will cease work, excluding use of light vehicles to move staff to and from the area. Mobile construction equipment will not recommence work until a wildlife handler has removed the individual or it has been confirmed that individual has left the workspace. Captured individuals will be removed and relocated to nearest adjacent habitat away from the construction area. 3. If night time activities are required within or adjacent to any of the 19 locations of Southern Brown Bandicoot habitat, a wildlife handler will be available to the construction site. 4. Dense cover of suitable native shrubs, or vegetation of similar structure, will be reinstated in any of the 19 locations of Southern Brown Bandicoot habitat impacted by the construction footprint 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 will be limited to shallow-rooted ground cover species. 5. Easement agreements with landholders will require that this vegetation be reinstated and protected. | Pipeline  Works | Construction |

**7-72**

Terrestrial and freshwater biodiversity – Chapter 7

|  |  |  |  |
| --- | --- | --- | --- |
| **Mitigation measure ID** | **Mitigation measure** | **Works area** | **Project phase** |
| MM-FF10 | **Merran’s Sun-orchid, Pallid Sun-orchid and Gaping Sun-orchid**  The Pipeline Works will avoid threatened orchids and their habitat. A single 650  metre HDD will be used to avoid orchids and habitat between KP 1.13 and KP   * 1. During construction, a return line will need to be placed across orchid habitat to transport drilling mud between the HDD entry and exit points. The following measures will be put in place to protect orchids:      1. Return line to be constructed from high quality HDPE pipe welded together to ensure risk of spill is negligible.      2. Project Ecologist to supervise the placement of the return line, which will be micro-sited to avoid threatened orchids.      3. Return line to be subject to regular visual inspection during drilling.      4. 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.      5. No vehicle access to be permitted in orchid habitat.      6. Project Ecologist to supervise dismantling of return line and complete inspection of habitat following completion of drilling. | Pipeline  Works | Construction |
| MM-FF11 | **Growling Grass Frog**  The following mitigation measures will be implemented to manage impacts to the Growling Grass Frog:   1. Two nocturnal pre-clearance surveys of the construction footprint for the Growling Grass Frog (as per Commonwealth of Australia 2009c) will be undertaken at each of the following locations within four days prior to clear and grade activities commencing, but only if clear and grade activities at these locations are to occur during the breeding season (spring and summer):    * Farm Dam adjacent to KP21.5: KP21.4 to KP21.6 (refer to [**Figure 7-6**](#_bookmark11) to   [**Figure 7-12**](#_bookmark14) for KP locations).   * + 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  1. Any Growling Grass Frog that can be located within the proposed construction footprint during these surveys will be relocated to suitable locations, as determined by the ecologist conducting the survey, within the adjacent waterways. 2. If night time activities are required during the breeding season (spring and summer) within the survey areas described in (a) ), a wildlife handler will be available to the construction site. 3. Hygiene protocols as set out in Murray et al. (2011) will be followed when conducting the surveys described in (a). | Pipeline  Works | Construction |

Gas Import Jetty and Pipeline Project EES | Volume 2

**7-73**

|  |  |  |  |
| --- | --- | --- | --- |
| **Mitigation measure ID** | **Mitigation measure** | **Works area** | **Project phase** |
| MM-FF12 | **Migratory birds**  Project will adhere to the *National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds*. The OEMP will contain a monitoring procedure and an adaptive management response in order to detect, and appropriately respond to, migratory bird strikes with lighting.  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 foraging areas does not impact occupation of a foraging area but may impact on migration routes.  The OEMP will include a monitoring program for waders and waterbirds at Woolleys Beach and Jacks Beach to allow for potential responses to the operation of the FSRU to be detected and, if appropriate, mitigated through an adaptive management response. | Gas Import  Jetty Works | Operation |
| MM-FF13 | **Surface water sedimentation and runoff**  Erosion and sediment controls will follow EPA Victoria publication 480 – *Environmental guidelines for major construction sites* (1996) and be included in the Gas Import Jetty Works EMP and Pipeline Works CEMP. Specific measures that will 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:   1. Water velocity reduction measures and redirection of runoff to stable ground in accordance with MM-SW01 (discharge water). 2. Testing, treatment and management of discharge water to minimise   sedimentation and erosion in accordance with MM-SW01 (discharge water).   1. Implementation of diversion banks and sediment control devices in accordance   with MM-SW01 (discharge water) and MM-SW02 (managing runoff).   1. Regular monitoring of all diversion banks and sediment control devices to ensure these are maintained in good condition throughout the construction phase. | Gas Import Jetty Works and Pipeline Works | Operation |
| MM-FF14 | **Surface water contamination**  Dangerous goods, as defined by the Australian Dangerous Goods Code, and flammable and combustible liquids will 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.   1. Routine visual monitoring and recording of chemicals and fuel storage facilities will be undertaken. 2. Refuelling and maintenance of vehicles and machinery will 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 metres of a watercourse. 3. Spill kits will 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). 4. Waste is to be managed in accordance with MM-C09 (construction waste   management) and MM-C10 (operation waste management). | Gas Import Jetty Works and Pipeline Works | Construction |
| MM-FF15 | **Lighting impacts to fauna**  Light generated during construction will be managed in general accordance with the guidance measures described in the *National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds* | Gas Import Jetty Works and Pipeline Works | Construction |

#### 

|  |  |  |  |
| --- | --- | --- | --- |
| **Mitigation measure ID** | **Mitigation measure** | **Works area** | **Project phase** |
| MM-FF16 | **Dust impacts to flora/fauna**  Management of construction activities will be undertaken in accordance with EPA Victoria publication 480 *Guidelines for major construction sites* (1996) in respect to dust, odour and construction vehicle emissions to minimise amenity impacts during construction.  In accordance with MM-AQ01, dust suppression will 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.  Crushed rock will be placed on unsealed access tracks to suppress dust from vehicle movements, in accordance with MM-AQ03 (crushed rock on access tracks). Vehicle movements will be restricted to within designated access paths, turning circles and the construction footprint, in accordance with MM-AQ02 (restricted vehicle movements).  Monitoring of weather conditions and dust will 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. | Gas Import Jetty Works and Pipeline Works | Construction |

* 1. **Offse****ts**

This section outlines the offsets that are proposed to compensate for Project impacts to vegetation, threatened species habitat and/or threatened species.

**What are offsets?**

**Offsets compensate for biodiversity losses as a result of native vegetation removal. A native vegetation offset consists of a site that protects existing patches of native vegetation, large trees and/or involves planting of new native vegetation. Offset owners secure and manage offset sites to improve native vegetation condition. There are two types of offsets:**

**General offsets: required when the removal of native vegetation does not have a significant impact on habitat for rare or threatened species.**

**Species offsets: required when the removal of native vegetation has a significant impact on habitat for a rare or threatened species. This offset must compensate for the removal of that species’ habitat.**

**The gains that these offsets deliver are measured in habitat units.**

* + 1. **Federal offsets**

It is not considered likely that a significant impact would occur to any MNES. However, in the event the Minister for Planning determines otherwise, federal offsets would be secured to the satisfaction of the Victorian Minister for Planning and/or the Commonwealth Minister for the Environment.

## **State o****ffsets**

State offsets arise through the removal of native vegetation, which corresponds with habitat for threatened flora and fauna under the DELWP advisory lists. They are triggered within the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017) which is an Incorporated Document within the Victoria Planning Provisions under Clause

52.17 (Native Vegetation). It is noted the Pipeline Works are exempt from the application of Planning Scheme requirements through section 85 of the *Pipelines Act 2005* (Vic). The Gas Import Jetty Works (including the FSRU) would be granted approval through the use of a Planning Scheme Amendment and imposition of a 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. The removal of native vegetation would trigger general and species offsets. A total of 16.955 hectares of native vegetation would be removed during construction of the Project.

Gas Import Jetty and Pipeline Project EES | Volume 2

**7-75**

A total of 1.007 general habitat units are required to be offset. These sites are required to be located within the Port Phillip and Westernport Catchment Management Authority area, or Cardinia Shire Council, City of Casey or Mornington Peninsula Shire areas.

The Project has exceeded offset thresholds for six species. Species habitat units for the following DELWP Advisory Listed species are required to be offset:

* 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.

Offsets must also include protection of at least one large tree for every large tree to be removed in either the general, species of combination offsets across all habitat units protected, with a total of 79 large trees required to be offset.

The Project is anticipated to be able to satisfy all offset requirements. An offset strategy is being prepared that would outline how the Project can satisfy its offset requirements. The offset strategy would 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 on 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.

If any further removal of native vegetation is required for pipeline safety or maintenance works during operation, this would also be assessed and offset in accordance with the Guidelines (DELWP 2017).

# **7.13 Conclusion**

The terrestrial and freshwater biodiversity impact assessment has identified the risks and potential impacts associated with construction and operation of the Project on land-based and aquatic (freshwater) flora and fauna values.

The previous and existing land use at Crib Point, and along much of the pipeline alignment, means that many areas have already been disturbed and cleared of native vegetation. There are limited patches of native vegetation and possible habitat for native flora and fauna, particularly around waterways and areas close to the Western Port shoreline, such as Warringine Park.

Specific measures to avoid or minimise impacts include the use of horizontal directional drilling (HDD) in sensitive locations such as dense vegetation and at waterway crossings, and reduction in width of the ROW in multiple locations. The alignment of the pipeline was selected and refined to minimise loss of native vegetation (including but not limited to habitat for threatened and non-threatened flora and fauna) in accordance with relevant legislations and regulations including AS2885.1- 2012 Section 4.2, the APGA Code of Environmental Practice: Onshore Pipelines and the Significant Impact Guidelines 1.1 (EPBC matters) and the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017).

Targeted surveys carried out resulted in further pipeline alignment design revisions to avoid Southern Brown Bandicoot habitat (such as at Cardinia Creek). Design iterations have also resulted in the avoidance of habitat and individual species of Merran’s Sun-orchid, Gaping Sun-orchid and Pallid Sun-orchid. An approximately 650-metre-long HDD section would be used during pipeline construction to avoid any potential impacts to the known population of Merran’s Sun-orchid, as well as known Gaping Sun-orchid and Pallid Sun-orchid individuals.

In some instances, using HDD is not feasible due to other constraints. Open trenching during pipeline construction would occur through areas of suitable habitat for Dwarf Galaxias (Craigs Lane Drain, Tooradin Inlet Drain, Hagelthornes Drain and Western Outfall Drain), which may result in minor short-term impacts to this species. Open trench works would unlikely impact Australian Grayling as no potential habitat was identified in waterways where this construction method would be used. HDD is proposed at waterways where Australian Grayling are assumed likely to be present. Mitigation measures to reduce potential impact on possible habitat for these species have been identified.

Operation of the Project is not considered to have significant impacts on terrestrial flora and fauna values, with all operation risks rated low or very low. Potential impacts identified related to noise, lighting, spills and leaks.

It was determined through the impact assessment that these impacts would be highly localised to the area immediately adjacent to the FSRU. It is not anticipated impacts would occur to the adjacent secondary wader and waterbird foraging habitats of Woolleys Beach, nearby seagrass beds and mangroves or impact the food chain so that effects would be felt to any of the nearby sensitive receptors. Primary foraging and roosting areas for waterbirds are some distance from the FSRU and are not impacted by lighting, noise or temperature variations and residual chlorine concentration associated with the seawater discharge from the FSRU.

There is a negligible 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 FSRU operational processes.

Overall, the potential terrestrial and freshwater biodiversity impacts due to the Project have been assessed in response to the draft evaluation objective in the EES scoping requirements. Potential impacts to terrestrial and freshwater biodiversity would be avoided or minimised with the implementation of the mitigation measures, incorporated as conditions in the relevant statutory approvals and consents.

In response to the biodiversity and water and catchment draft evaluation objectives, impacts of the Project on terrestrial and freshwater biodiversity have been assessed and mitigation measures have been identified to reduce or minimise these impacts.