

# Technical Report B

Supplementary threatened and migratory birds impact assessment



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Viva Energy Gas Terminal Project Supplementary Statement

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Viva Energy Gas Terminal Project

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Viva Energy Gas Terminal Project Supplementary Statement

Client: Viva Energy Gas Australia Pty Ltd

ABN: 645 450 059

Prepared by

**AECOM Australia Pty Ltd**

Wurundjeri and Bunurong Country, Tower 2, Level 10, 727 Collins Street, Melbourne VIC 3008, Australia

T +61 1800 868 654 [www.aecom.com](http://www.aecom.com)

ABN 20 093 846 925

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## Executive summary

This technical report provides a threatened and migratory birds supplementary study in response to Recommendation 9 in Table 1 of the Minister's Directions for the Viva Energy Gas Terminal Project (the Project) Supplementary Statement.

In March 2023, the Victorian Minister for Planning determined that the project EES requires a Supplementary Statement to be prepared by Viva Energy Gas Australia Pty Ltd (Viva Energy), in accordance with sections 5 and 8C(2) of the *Environment Effects Act 1978 (Vic)*. The Supplementary Statement is required to inform decision making and to provide an assessment of the project's environmental effects on the marine environment, noise, air quality and Aboriginal cultural heritage, in accordance with the *Minister's directions for Viva Energy Gas Terminal Project Supplementary Effects Statement (Minister's Directions)* issued on 6 March 2023.

### Overview

Viva Energy is planning to develop a gas terminal using a ship known as a floating storage and regasification unit (FSRU), which would be continuously moored at Refinery Pier in Corio Bay, Geelong. The key objective of the project is to facilitate a secure and flexible supply of gas for the south-east Australian gas market where there is a projected supply shortfall in coming years. This project would support the community's energy needs as the energy market transitions to lower emissions alternatives.

The FSRU would store liquefied natural gas (LNG) received from visiting LNG carriers (that would moor directly adjacent to the FSRU), and regasify the LNG as required to meet industrial, commercial, and residential customer demand. A 7-kilometre gas transmission pipeline would transfer the gas from the FSRU to the Victorian Transmission System (VTS) at Lara.

The gas terminal would be located adjacent to, and on, Viva Energy's Geelong Refinery in a heavily industrialised setting. It would benefit from Viva Energy's experience and capability as an existing Major Hazard Facility (MHF) operator, and potential synergies between the two facilities, such as reuse of the FSRU seawater discharge within the refinery operations.

### Ministers Direction's addressed by this supplementary report

The Minister's Directions require further work which relates to threatened and migratory bird impacts. Recommendation 9 is:

*Undertake further assessment of impacts on threatened and migratory bird species by:*

- a) *Establishing a complete list of threatened and migratory bird species that could potentially be affected by the project (and consider including the black swan).*
- b) *Having the list peer reviewed.*
- c) *Undertaking further analysis of the targeted shorebird surveys, to determine whether the surveyed sites individually or collectively support enough individuals of any particular migratory bird species to be an important site for that species in Australia or the East Asian-Australasian Flyway.*
- d) *Considering the revised marine modelling.*

### Methodology

To address Recommendation 9a of the Minister's Directions, a consolidated list of threatened and migratory bird species has been developed and is provided in Appendix A of this document. The list of threatened and migratory bird species that could occur in the project area, including the black swan, was developed by undertaking the following steps:

- An updated search of the Victorian Biodiversity Atlas (VBA) and/or predicted to occur by the EPBC Act Protected Matters Search Tool (PMST).
- An assessment of the likelihood of threatened and migratory bird species occurring in the project area and offsite environment (Corio Bay, Limeburners Bay and Avalon Beach).

To address Recommendation 9b of the Minister's Directions, the list was peer reviewed by Stantec Australia Pty Ltd (Stantec). Stantec has been engaged as the independent peer reviewer by the Department of Transport and Planning.

To address Recommendation 9c of the Minister's Directions to determine whether the surveyed sites individually or collectively support enough individuals of any particular migratory bird species to be an important site for that species in Australia or the East Asian-Australasian Flyway (EAAF), the findings of the migratory shorebird survey were assessed against:

- the definition of nationally important shorebird habitat in EPBC Act Policy Statement 3.21: Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoEE, 2017).
- the population estimates available for EAAF in Hansen et al. (2016).

To address Recommendation 9c of the Minister's Directions, the conclusions of the revised marine modelling in Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment* were reviewed and compared with the findings of EES Technical Report D: *Terrestrial ecology impact assessment* and EES Technical Report D: *Addendum – Peer Review* (the ecology impact assessment) in relation to the list of threatened and migratory bird species developed to address Ministers Direction 9a and 9b.

### **Outcomes of Supplementary Tasks**

#### *Recommendation 9a and 9b – list of threatened and migratory bird species*

Seventy-three species of threatened and/or migratory birds have potential to occur in association with the Project Area or offsite environment. Those species comprise:

- Five terrestrial (non-aquatic) species which may occur in association with the terrestrial habitats of the Project Area. Two of those may also occur in the offsite environment (Ramsar site).
- One additional terrestrial (non-aquatic) species that may occur in association with the terrestrial habitats of the offsite environment – Orange-bellied Parrot.
- Four raptors (birds of prey) which may hunt over the terrestrial environments of the Project Area and offsite environment (Ramsar site). White-bellied Sea-eagle is also likely to hunt over the marine environment.
- Thirty-two migratory shorebirds most likely to occur in association with the inshore ponds of the former Avalon saltworks (and to a lesser extent Limeburners Lagoon) but some are also likely to forage along the shoreline of Corio Bay within the Ramsar site. Unlikely to occur along the shoreline associated with the Project Area.
- Twelve species of waterbird (including non-threatened Black Swan) which would mostly utilise the inshore ponds and wetlands of the Ramsar site rather than the shoreline or bay. Black Swan may venture into the inshore waters of the marine component of the Project Area. Eastern Great Egret may forage occasionally along the shoreline, along the drain on Cummins Road or around the dam near the tie in point but those areas are marginal habitat of this species.
- Twenty species of seabird which may use the shallow marine waters of Corio Bay for foraging on occasion. Terns are known to regularly occur in the area and may roost on structures.

#### *Recommendation 9c – shorebird survey further analysis*

None of the shorebird survey sites individually or collectively are internationally important for any of the four declared migratory shorebird species recorded during the surveys, as the counts do not reach the 1% threshold. Only one survey site (Site 3T) would be considered important habitat in Australia and/or the EAAF based on data collected during the shorebird survey. Site 3T (Avalon Coastal Park and the former Avalon saltworks) supports enough Sharp-tailed Sandpiper to be an important site for that species in Australia and the EAAF.

Sites in Limeburners Bay, Limeburners Lagoon Flora and Fauna Reserve, Corio Bay opposite Point Aboena, and Avalon Beach (Sites 1, 2, 3P, 4 and 6), despite being within the boundary of the internationally recognised Ramsar site, do not individually or collectively support enough individuals of a

species of migratory shorebird to be an important site in Australia or the EAAF based on the survey data. Site 5 (Corio Bay outfall) is not within the boundary of the Ramsar site and is not important habitat for shorebirds at either an international or national level based on the survey data.

Analysis of the data in relation to whether surveyed sites individually or collectively support enough individuals of a migratory bird species to be an important site for that species does not change the assessment outcomes in Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) and the addendum (AECOM 2022b) in relation to the significance of the study area and surrounds. When assessing project impacts, shorebird habitats at all sites surveyed (except Site 6) were considered as internationally important due to their inclusion in a Ramsar site.

#### *Recommendation 9d – revised marine modelling*

The revised marine modelling in the Technical Report A: *Supplementary marine environment impact assessment* (CEE 2024) results in no significant change to the conclusions in EES Technical Report A: *Marine ecology and water quality impact assessment*. Consequently, the conclusions of Technical Report D: *Terrestrial ecology impact assessment* and the addendum remain unchanged in relation to threatened and/or migratory birds (including marine/shorebirds) and apply to the consolidated list of migratory and/or threatened birds prepared to address Ministers Direction 9a and 9b. Those conclusions are:

- Discharges to the marine environment during operation of the FSRU is unlikely to affect seagrass meadows or food resources for threatened and/or migratory seabirds or shorebirds. Section 6.2 of Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) concluded the following in relation to the two discharge scenarios, based on the findings of Technical Report A: *Supplementary marine environment impact assessment* (CEE 2024):
- Discharge through the existing refinery:
  - The existing chlorine plume from the refinery would remain the same and does not extend to Limeburners Bay or the Ramsar site.
  - Reuse of cooled seawater from the FSRU within the refinery would reduce the existing temperature difference between the current refinery discharge and Corio Bay.
  - A healthy marine ecosystem was found offshore from the refinery discharge of warm water and low levels of chlorine into Corio Bay which has been occurring for over 60 years. Given the historical discharges have not had adverse effects on the marine environment, the project discharge would not have adverse impacts on seagrass or on the food chain (availability of plankton and larvae as food sources) supporting terrestrial shorebirds and other waterbirds in Corio Bay and the Ramsar wetland.
- Direct discharge from FSRU to Corio Bay through diffuser or closed loop operation (an uncommon occurrence during operation):
  - A small cold-water plume in the vicinity of the FSRU due to the high level of mixing achieved via the diffuser. The plume sinks to the seabed in the dredged shipping channel and is remote from both Limeburners Bay and the Ramsar site and is not anticipated to have any adverse impacts on seagrass beds which are not present in the vicinity or on food chain species.
- All seagrass in the Ramsar Zone (zero to 2 m depth) will always receive sufficient light for growth. The extent of suspended sediment covers much the same area as shown in the EES with low concentrations of suspended solids (SS) at the edge of the Ramsar site.
- Potential entrainment of fish larvae and plankton from the Ramsar site and Limeburners Bay is negligible.

The loss of up to 0.5 hectares of seagrass during the installation of the seawater transfer pipe would not affect threatened and migratory bird species or Black Swan.

As such, no residual impacts on the ecological character of the Ramsar site, seagrass or food availability for threatened and/or migratory birds are anticipated as a result of sediment mobilisation during construction or discharge to the marine environment or entrainment during operation of the FSRU.



## Integrated Assessment

As part of the original EES, potential construction and operation impacts of the project to terrestrial ecology, including threatened and migratory birds, was assessed.

This supplementary statement has consolidated a list of threatened and migratory bird species likely to occur in the project area (terrestrial), project area (marine) and the offsite marine environment surrounding the project area. The findings of the consolidated bird list were then integrated with the findings of the original EES in relation to potential direct and indirect impacts the project could have on the species which included removal of habitat, injury to fauna from construction activities, introduction of species and disturbance from noise and lighting. The integrated assessment also considered updates to the marine modelling undertaken in Technical Report A: *Supplementary marine environment impact assessment* (CEE 2024).

Overall, the conclusions of the original EES terrestrial ecology assessment in relation to threatened and/or migratory birds remain unchanged and it was concluded species with potential to occur in the Project Area or offsite environment are unlikely to be significantly impacted by the project.

## Recommended Mitigation Measures

There are no changes to the overall conclusion reached by EES Technical Report D: *Terrestrial ecology impact assessment*, which also apply to the consolidated list of migratory and/or threatened birds combined to address Ministers Direction 9a and 9b. Therefore, no additional mitigation measures have been proposed and the original mitigation measures are considered both appropriate and adequate. All mitigation measures are presented in Chapter 9: Environment Management Framework.

## Abbreviations

Abbreviation	Definition
DTP	Department of Transport and Planning
EES	Environment Effects Statement
FSRU	Floating storage and regasification unit
IAC	Inquiry and Advisory Committee
LNG	Liquefied natural gas
MHF	Major Hazard Facility
ROW	Right of way
SWP	South West Pipeline
VBA	Victorian Biodiversity Atlas
VTS	Victorian Transmission System

## 1.0 Introduction

This technical report provides a threatened and migratory birds supplementary study in response to Recommendation 9 in Table 1 of the Minister's Directions for the Viva Energy Gas Terminal Project (the Project) Supplementary Statement.

Viva Energy Gas Australia Pty Ltd (Viva Energy) is planning to develop a gas terminal using a ship known as a floating storage and regasification unit (FSRU), which would be continuously moored at Refinery Pier in Corio Bay, Geelong. The key objective of the project is to facilitate a secure and flexible supply of gas for the south-east Australian gas market where there is a projected supply shortfall in coming years. This project would support the community's energy needs as the energy market transitions to lower emissions alternatives.

The FSRU would store liquefied natural gas (LNG) received from visiting LNG carriers (that would moor directly adjacent to the FSRU) and would convert LNG back into a gaseous state by heating the LNG using seawater (a process known as regasification) as required to meet industrial, commercial, and residential customer demand. A 7-kilometre gas transmission pipeline would transfer the gas from the FSRU to the Victorian Transmission System (VTS) at Lara.

The project would be situated adjacent to, and on, Viva Energy's Geelong Refinery, within a heavily developed port and industrial area on the western shores of Corio Bay between the Geelong suburbs of Corio and North Shore. Co-locating the project with the existing Geelong Refinery and within the Port of Geelong offers significant opportunity to minimise potential environmental effects and utilise a number of attributes that come with the port and industrial setting.

In March 2023, the Victorian Minister for Planning determined that the project Environment Effects Statement (EES) requires a Supplementary Statement to be prepared by Viva Energy Gas Australia Pty Ltd (Viva Energy), in accordance with sections 5 and 8C(2) of the *Environment Effects Act 1978 (Vic)*. The Supplementary Statement is required to complete the assessment of the project's environmental effects on the marine environment, noise, air quality and Aboriginal cultural heritage in accordance with the Minister's Directions and inform decision making.

### 1.1 Background

An assessment was completed of the potential impacts on threatened and migratory birds from the project as part of the EES (Technical Report D: *Terrestrial ecology impact assessment*). The assessment considered (terrestrial) bird species occurring in proximity to the onshore pipeline, and the offsite environment in relation to shorebirds which use intertidal habitats that are influenced by the marine environment.

Following an independent peer review of the original terrestrial ecology EES study further impact assessment was undertaken which included marine birds. Technical Report D: *Addendum - Peer Review* also considered marine birds (seabirds) that forage in the shallow, marine waters of Corio Bay and therefore are also influenced by impacts on the marine environment. The addendum was submitted to the Inquiry and Advisory Committee (IAC) during the EES panel hearing and not exhibited with the EES. The report was submitted post-exhibition as the peer review and associated updated assessment were completed after exhibition.

The original terrestrial ecology EES study concluded that onshore pipeline construction activities would not result in a significant impact to terrestrial ecological values. Additionally, it was concluded that terrestrial ecological values of the Ramsar site, in particular migratory shorebirds and other waterbirds, would not be directly impacted, as there is no project infrastructure to be located in or near the wetland, nor indirectly impacted. Marine investigations conducted for the EES (Technical Report A: *Marine ecology and water quality impact assessment* (CEE 2022)) indicated that the marine discharge, and entrainment of plankton and larvae in the FSRU water intake, would not adversely impact on species forming part of the food chain for migratory shorebirds and other waterbirds. Turbidity associated with project dredging was found to be localised and would occur for eight-weeks during construction and not impact on the Ramsar site or to elements of the food chain for migratory shorebirds or other waterbirds, for example, seagrass meadows in Corio Bay.

The addendum concluded that the inclusion of seabirds in the impact assessment did not change the outcomes of the original terrestrial ecology EES study.

The IAC concluded that it was not able to determine whether the impacts of the project on aquatic birds, including shorebirds and marine birds, will be acceptable (IAC Report No. 1, section 9.4).

The IAC noted that the coast immediately adjacent to the project does not provide suitable habitat for migratory shorebirds (IAC Report No. 1, section 9.4 (iii)). However, further work was recommended to ensure that potential direct and indirect impacts, including via the marine environment, on all relevant threatened and migratory bird species have been assessed (IAC Report No. 1, section 9.4 (iv)).

## 1.2 Purpose

This supplementary threatened and migratory birds study provides a technical response to Recommendation 9 in Table 1 of the Minister's Directions, integrates the study with key outcomes of the original EES and provides an update to the EES mitigation measures where necessary.

## 1.3 Project area

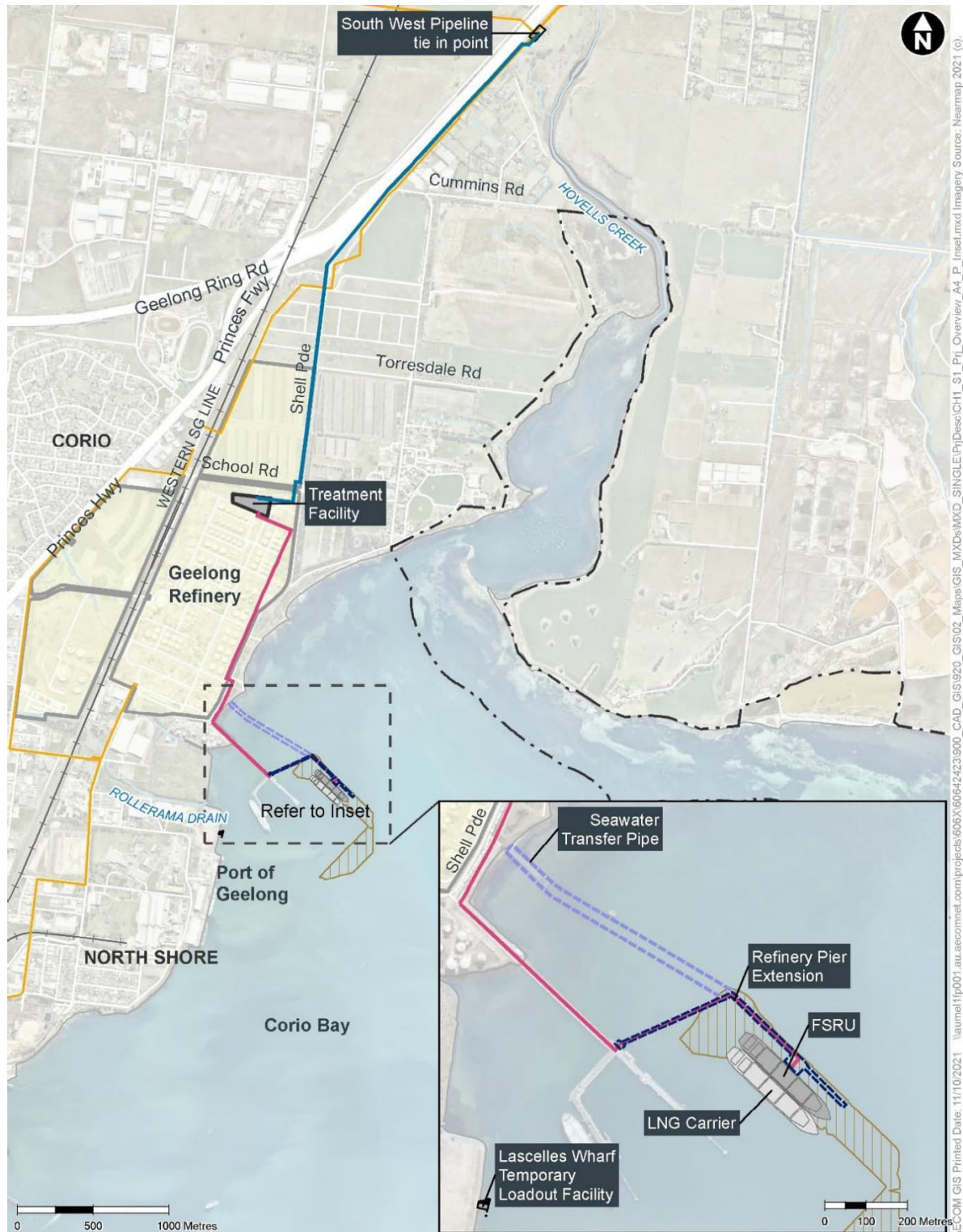
The project would be located adjacent to, and on, the Geelong Refinery and Refinery Pier in the City of Greater Geelong, 75 kilometres (km) south-west of Melbourne. The project area is within a heavily developed port and industrial area on the western shores of Corio Bay between the Geelong suburbs of Corio and North Shore. The Geelong central business district is located approximately 7 km south of the project. The project area is shown in Figure 1-1. Corio Bay is the largest bay in the south-west corner of Port Phillip Bay and is a sheltered, shallow basin at the western end of the Geelong Arm, with an area of 44 square kilometres (km<sup>2</sup>). The Point Wilson/Limeburners Bay section of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site is located along the northern shoreline of Corio Bay, approximately one kilometre to the north-east of the project.

The Port of Geelong has been in operation for over 150 years and is the largest industrial bulk cargo port in Victoria, attracting over 600 ship visits and handling more than 14 million tonnes of product annually. Geelong's shipping channels extend 18 nautical miles through Corio Bay from Point Richards through to Refinery Pier. Ports Victoria manages commercial navigation in the port waters in and around Geelong and is responsible for the safe and efficient movement of shipping, and for maintaining shipping channels and navigation aids. The channels are man-made having been deepened and widened through periodic dredging to support port trade development.

Refinery Pier is the primary location within the Port of Geelong for movement of bulk liquids. Vessels up to 265 metres (m) in length currently utilise the four berths at Refinery Pier which service Viva Energy refinery operations. The majority of ship visits to the port are to Refinery Pier, with Viva Energy accounting for over half of the trade through the Port of Geelong.

The Geelong Refinery has been operating since 1954 with both the refinery and the co-located Lyondell Bassell plant being licensed Major Hazard Facilities (MHFs). A range of industrial activities are situated in the Port environs including wood fibre processing and chemical, fertiliser and cement manufacturing.

To the north of the Geelong Refinery, along the proposed underground pipeline corridor, the area is predominantly rural. There are several other existing Viva Energy-owned underground pipelines running between the refinery and the connection point to the South West Pipeline (SWP) at Lara. The proposed pipeline route follows already disturbed pipeline corridors, where possible, through a mix of land uses.



- Aboveground Pipeline
- Underground Pipeline
- Seawater Transfer Pipe
- Refinery Pier Extension
- Dredged Area
- South West Pipeline
- Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site
- Viva Energy Owned Land
- +— Rail



Figure 1-1 Project overview

## 1.4 Project description

Key components of the project include:

- Extension of the existing Refinery Pier with an approximately 570 m long angled pier arm, new berth and ancillary pier infrastructure including high pressure gas marine loading arms (MLAs) and a transfer line connecting the seawater discharge points on the FSRU to the refinery seawater intake.
- Continuous mooring of an FSRU at the new Refinery Pier berth to store and convert LNG into natural gas. LNG carriers would moor alongside the FSRU and unload the LNG.
- Construction and operation of approximately 3 km of aboveground gas pipeline on the pier and within the refinery site connecting the FSRU to the new treatment facility.
- Construction and operation of a treatment facility on refinery premises including injection of nitrogen and odorant (if required).
- Construction and operation of an underground gas transmission pipeline, approximately 4 km in length, connecting to the SWP at Lara.

The Refinery Pier extension would be located to the north-east of Refinery Pier No. 1. The new pier arm would be positioned to allow for sufficient clearance between an LNG carrier berthed alongside the FSRU and a vessel berthed at the existing Refinery Pier berth No. 1. Dredging of approximately 490,000 cubic metres (m<sup>3</sup>) of seabed sediment would be required to allow for the new berth pocket and swing basin.

The FSRU vessel would be up to 300 m in length and 50 m in breadth, with the capacity to store approximately 170,000 m<sup>3</sup> of LNG. The FSRU would receive LNG from visiting LNG carriers and store it onboard in cryogenic storage tanks at about -160 °C.

The FSRU would receive up to 160 PJ per annum (approximately 45 LNG carriers) depending on demand. The number of LNG carriers would also depend on their storage capacity, which could vary from 140,000 to 170,000 m<sup>3</sup>.

When gas is needed, the FSRU would convert the LNG back into a gaseous state by heating the LNG using seawater (a process known as regasification). The natural gas would then be transferred through the aboveground pipeline from the FSRU to the treatment facility where odorant and nitrogen would be added, where required, to meet Victorian Transmission System (VTS) gas quality specifications. Nitrogen injection would occur when any given gas cargo needs to be adjusted (diluted) to meet local specifications. Odorant (mercaptan) is added as a safety requirement so that the normally odourless gas can be smelt when in use. From the treatment facility, the underground section of the pipeline would transfer the natural gas to the tie-in point to the SWP at Lara.

### 1.4.1 Key construction activities

Construction of the project would occur over a period of up to 18 months. The key construction activities relate to:

- localised dredging of seabed sediments to enable the FSRU and LNG carriers to berth at Refinery Pier and excavation of a shallow trench for the seawater transfer pipe;
- construction of a temporary loadout facility at Lascelles Wharf;
- construction of the new pier arm and berthing infrastructure, and aboveground pipeline along Refinery Pier and through the refinery;
- construction of the treatment facility on a laydown area at the northern boundary of the refinery site;
- construction of the buried pipeline; and
- construction at the tie-in point to the SWP at Lara.

There are no construction activities required for the FSRU component of the project. The vessel would be built, commissioned and all production and safety systems verified prior to being brought to site.

An estimated 490,000 m<sup>3</sup> of dredging would be required, over an area of approximately 12 hectares (ha), adjacent to the existing shipping channel to provide sufficient water depth at the new berth and within the swing basin for visiting LNG carriers to turn. Dredging within the new berth would be undertaken to a depth of 13.1 m and the swing basin would be dredged to a depth of 12.7 m. The dredging footprint is shown in Figure 1-1. It is planned to deposit the dredged material within Ports Victoria's existing dredged material ground (DMG) in Port Phillip Bay to the east of Point Wilson, approximately 26km from Refinery Pier.

The temporary loadout facility at Lascelles Wharf would be the first construction activity to take place in order to facilitate the Refinery Pier extension. This would involve the installation of 10 piles using hydraulic hammers.

Construction of the pier arm would be carried out once dredging was complete, primarily from the water using barge-mounted cranes. Steel piles would be driven into the seabed by cranes mounted on floating barges and pre-cast concrete and pre-fabricated steel components would be transported to site by barge and lifted into position. The installation of pier infrastructure such as the marine loading arms (MLAs), piping from the FSRU to the existing refinery seawater intake (SWI) and aboveground pipeline would also be undertaken from the water using barge-mounted cranes.

Installation of the 3 km above ground pipeline along the pier and through the refinery is anticipated to take 3.5 months to complete. The above ground pipeline would run along the pier to the existing pipe track east of Shell Parade within the pier foreshore compound. It would then pass through a road undercrossing to the existing refinery pipe track. The pipeline would then run north along the existing refinery pipe track to an existing laydown area where the treatment facility would be located.

The treatment facility would be located within an existing laydown area in the refinery site and cover an area of approximately 80 m x 120 m. Construction of the treatment facility would take approximately 6 months and would be undertaken by specialist crews across distinct phases of work. These would include initial earthworks and civil construction, mechanical installation and electrical and instrumentation works.

The 4 km underground pipeline would be installed in stages over an approximate 4-month period within a corridor which has been selected so as to avoid the need for trenchless construction beneath watercourses or other environmental sensitivities. Firstly, a construction right of way (ROW) would be established, clearly identified and fenced off where required. Typically, this would be between 25 and 30 m wide, and minimised where possible to reduce disturbance. Once the construction ROW is established, vegetation would be removed, and a trench excavated to a maximum depth of 2 m and a maximum width of 1 m for the pipeline to be placed. Following the placement of the pipeline, the construction ROW would be rehabilitated to its pre-existing condition as far as practicable for the purposes for which it was used immediately before the construction of that part of the pipeline.

Trenchless construction (including boring or horizontal directional drilling (HDD)) would be used to install the underground pipeline in areas that are not suited to open trenching techniques, such as at intersections with major roads, which would be confirmed during detailed design. Trenchless construction would involve boring or drilling a hole beneath the ground surface at a shallow angle and then pushing or pulling a welded length of pipe through the hole without disturbing the surface. It is anticipated that the maximum depth of the trenchless section would be 25 m.

Construction at the tie-in point to the SWP at Lara would be undertaken by specialist crews across the distinct phases of works, as with the treatment facility.

### 1.4.2 Key operation activities

The project is expected to be in operation for approximately 20 years. Key activities relating to project operation include:

- receipt of up to 45 LNG carriers each year at Refinery Pier – the number and frequency of LNG carriers arriving each year would depend on their storage capacity and gas demand;
- regasification of LNG onboard the FSRU using seawater as a heat source, which would then be reused within the refinery as cooling water;
- injection of nitrogen and odorant into the gas prior to distribution via the VTS; and
- monitoring and maintenance of the pipeline easement.

### 1.4.3 Key decommissioning activities

The FSRU, which continues to be an ocean-going vessel throughout the operation of the project, would leave Corio Bay on completion of the project life to be used elsewhere.

It is anticipated that the Refinery Pier berth and facilities would be retained for other port related uses. The underground pipeline would likely remain in situ subject to landholder agreements and either decommissioned completely or placed into care and maintenance arrangements.

Decommissioning activities may be subject to change, subject to legislative requirements at the time and potential repurposing of the infrastructure at the end of the project.

### 1.4.4 Project activities relevant to the supplementary study

The following project activities are relevant to this threatened and migratory bird supplementary study:

- construction of the pipeline (3 km aboveground and 4 km in a below ground setting)
- construction at the tie-in point to the SWP at Lara
- construction of the seawater transfer pipe
- use of laydown areas along the project corridor during construction
- pier extension and FSRU which have potential to affect marine environments.

## 1.5 Legislation, policy and guidelines

Section 3 of EES Technical Report D: *Terrestrial ecology impact assessment* summarises the key biodiversity legislation and policy that apply to the project in the context of the terrestrial ecology impact assessment, as well as the implications for the project and the required approvals (if any).

Following this supplementary study, there is no change to the key policy requirements.



## 2.0 Minister's Directions

Upon review of the EES, the Inquiry and Advisory Committee (IAC) concluded that:

- *Based on the information before it, the IAC is not able to determine whether the impacts of the Project on aquatic birds, including shorebirds and marine birds, will be acceptable. Further assessment is required. The IAC noted that the coast immediately adjacent to the project does not provide suitable habitat for migratory shorebirds however recommended further work to ensure that potential impacts on all relevant threatened and migratory bird species have been assessed with consideration to the results of the revised marine modelling.*

The Minister's Directions require Viva Energy to prepare a Supplementary Statement to provide an assessment of the environmental effects of the project on the marine environment, noise, air quality and Aboriginal cultural heritage with respect to the consolidated recommendations of the IAC for further work. Table 1 of the Minister's Directions presents the IAC's consolidated recommendations for further work.

One item of further work was identified under Recommendation 9 in Table 1 of the Minister's Directions which relates to threatened and migratory bird impacts. Recommendation 9 is presented in Table 2-1 below.

**Table 2-1 Minister's Directions relevant to this supplementary study**

Recommendation	Description	Section addressed
Recommendation 9	Undertake further assessment of impacts on threatened and migratory bird species by:	Section 4.1
	a. Establishing a complete list of threatened and migratory bird species that could potentially be affected by the project (and consider including the black swan).	
	b. Having the list peer reviewed.	
	c. Undertaking further analysis of the targeted shorebird surveys, to determine whether the surveyed sites individually or collectively support enough individuals of any particular migratory bird species to be an important site for that species in Australia or the East Asian-Australasian Flyway.	Section 4.2
d. Considering the revised marine modelling.	Section 4.3	

## 3.0 Methodology

This section describes how the supplementary threatened and migratory birds study was conducted in order to address the Minister's Directions related to threatened and migratory birds (Recommendation 9). The following sections outline the study methodology.

### 3.1 Proposed tasks to address Minister's Directions

A description of the proposed tasks to address the Minister's Directions related to threatened and migratory birds (Recommendation 9), as well as a summary of the expected outcome of each task is provided in Table 3-1 below. An outline of the approach (method) and results for each task is provided in the respective task sections as indicated in the table below.

**Table 3-1 Threatened and migratory birds methodology**

Task objective	Task description	Outcomes	Relevant section
Develop a consolidated and comprehensive list of threatened and migratory bird species and submit the list for peer review to address Recommendations 9a and b.	<ul style="list-style-type: none"> <li>• Consolidate the information on bird species that could potentially be affected by the project, including the black swan, from EES Technical Report A: <i>Marine ecology and water quality impact assessment</i>, EES Technical Report D: <i>Terrestrial ecology impact assessment</i> and the addendum to Technical Report D. Species to be included in the list will be bird species that are: <ul style="list-style-type: none"> <li>- Listed as threatened under the EPBC Act</li> <li>- Listed as migratory under the EPBC Act</li> <li>- Listed as threatened in Victoria under the FFG Act.</li> <li>- Specifically, suggested in Recommendation 9 in Table 1 of the Minister's Directions i.e., Black Swan <i>Cygnus atratus</i>.</li> </ul> </li> <li>• Update the likelihood of occurrence assessment table for listed species from EES Technical Report D: <i>Terrestrial ecology impact assessment</i>, to include a column for the pipeline study area (as per the addendum to Technical Report D) and another column for marine areas (to include Limeburners Bay, Avalon Beach and Corio Bay) and establish a comprehensive list of species that could be directly or indirectly impacted by the project</li> <li>• Submit list to appointed peer review</li> </ul>	Comprehensive list of threatened and migratory bird species that could potentially be affected by the project (including black swan).	Section 4.1

Task objective	Task description	Outcomes	Relevant section
<p>Establish the extent to which the project would impact important wider habitat for shorebirds to address Recommendation 9c.</p>	<p>Undertake additional analysis of the results of the targeted shorebird surveys with the purpose of determining whether the surveyed sites individually or collectively support enough individuals of any particular migratory bird species to be an important site for that species in Australia or the East Asian-Australasian Flyway.</p> <p>The following data collected from surveys undertaken for the EES will be used:</p> <ul style="list-style-type: none"> <li>• Total observations (total count of all surveys)</li> <li>• Maximum count (highest number during the survey)</li> <li>• Percentage of the East Asian-Australasian Flyway population for both total observations and total maximum counts.</li> </ul> <p>The data will be assessed against:</p> <ul style="list-style-type: none"> <li>• population estimates for the East Asian-Australasian Flyway for the four migratory shorebirds observed (Sharp-tailed Sandpiper, Red-necked Stint, Curlew Sandpiper (also threatened) and Common Sandpiper) in <i>Revision of the East Asian-Australasian Flyway Population Estimates for 37 Listed Migratory Shorebird Species (BirdLife Australia, 2016)</i>, and</li> <li>• the definition of nationally important shorebird habitat in EPBC Act Policy Statement 3.21: <i>Industry guidelines for avoiding, assessing, and mitigating impacts on EPBC Act listed shorebird species (DoEE, 2017)</i>.</li> </ul>	<p>Additional data to be included in the supplementary threatened and migratory bird species impact assessment.</p>	<p>Section 4.2</p>
<p>Revise the threatened and migratory bird species impact assessment based on updated modelling results from the supplementary marine environment study to address Recommendation 9d.</p>	<p>Consider potential direct and indirect impacts from the project on aquatic bird species in light of the results of the further marine modelling work and either update the conclusions reached in the EES if the findings of the modelling change such that potential impacts also change or include a statement that there is no change to the conclusions reached (if appropriate).</p>	<p>Updated conclusions following consideration of results of the further marine modelling work.</p>	<p>Section 4.3</p>

## 3.2 Study area

The study area for this supplementary threatened and migratory bird study is presented in Figure 3-1 and is defined by the:

- Project area for the pipeline and FSRU. The project area has two parts: terrestrial (pipeline) and marine (FSRU). The terrestrial pipeline refers to the above and below ground pipeline connecting the FSRU with the tie in point.
- Offsite environment. While the pipeline component of the project area is restricted to terrestrial environments, the marine component of the project area (the FSRU) is linked via the marine environment to areas of national environmental significance. As such, values within Corio Bay, Limeburner's Bay and wider to Avalon Beach component of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site are also considered within 5 km of the project. As such there is an 'offsite environment' component of the study area. The offsite assessment focused on migratory shorebirds which use intertidal habitats that are influenced by the marine environment.

Specific figures presenting the 5 km database search for the consolidated list of threatened and migratory bird species and the shorebird survey sites are presented in Section 4.0.



Figure 3-1 Study area

### 3.3 Stakeholder and community engagement

In accordance with the Minister's Directions, a Technical Reference Group (TRG) has been convened and is chaired by Department of Transport and Planning, Impact Assessment Unit on behalf of the Minister for Planning. The TRG has provided input to Viva Energy's Study Program required to inform the Supplementary Statement and throughout the Supplementary Statement extended assessment process.

Engagement and consultation to support the assessment of the environmental effects of the project on threatened and migratory birds, with respect to the recommendations in Table 1 of the Minister's Directions, is being undertaken in accordance with Viva Energy's Supplementary Statement Consultation Activities Plan. The approach, as described in the Supplementary Statement Consultation Activities Plan, has been updated taking on board feedback from stakeholders and the IAC. Activities are focused on facilitating meaningful stakeholder involvement in the extended assessment process and providing opportunities for genuine engagement on the further work required by the Minister's Directions. Feedback on the original EES has also been considered in this assessment, as necessary. It should be noted that consultation has been undertaken in accordance with the quarterly Schedule of Activities including contacting a number of bird-specific interest and environment groups. No feedback has been received specific to the supplementary impact assessment. Chapter 02 Stakeholder and Community Engagement of the Supplementary Statement includes details of the engagement activities undertaken and feedback received.

### 3.4 Assumptions and limitations

This supplementary assessment relies on the findings of Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment* in relation to the outcomes of the revised marine modelling when considering implications of the project for threatened and/or migratory birds. The assessment therefore assumes that the findings in Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment* represent the impacts of the project on the marine environment.

Not all locations in the VBA are precise; the actual accuracy of a record can range from +/- 1 m to +/- 500 m. The validity of records accepted by the VBA has not been assessed as part of this report.

### 3.5 Linkages to EES studies and other supplementary studies

This supplementary threatened and migratory birds impact assessment relies on information contained in the following documents:

- EES Technical Report A: *Marine ecology and water quality impact assessment* which characterises and assesses potential impacts to Corio Bay and the Ramsar site from the construction and operation of the project.
- EES Technical Report D: *Terrestrial ecology impact assessment* which characterised and assessed potential impacts on terrestrial ecology values associated with the project including the Port Phillip Bay (Watern Shoreline) and Bellarine Peninsula Ramsar Site and migratory shorebirds.
- EES Technical Report D: *Addendum – Peer Review* which responded to the outcomes of a peer review of EES Technical Report D: *Terrestrial ecology impact assessment* by Nature Advisory.
- Migratory shorebird survey report which formed Appendix D in EES Technical Report D: *Terrestrial ecology impact assessment* and was updated in response to peer review by Nature Advisory and provided as Appendix E in EES Technical D: *Addendum – Peer Review*.
- Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment* which responds to Recommendations 1 to 8 of the Minister's Directions related to project impacts to Corio Bay and the Ramsar site. The supplementary marine environment impact assessment includes a refined regional hydrodynamic model which has been used to re-assess wastewater discharges, the entrainment of plankton and sediment mobilisation during dredging.

- Supplementary Statement Technical Report D: *Supplementary noise impact assessment* which responds to Recommendation 10 of the Minister’s Directions related to the further assessment of project noise impacts.



## 4.0 Results of Supplementary Tasks

### 4.1 List of threatened and migratory bird species

#### 4.1.1 Minister's Direction 9a and 9b

*Recommendation 9: Undertake further assessment of impacts on threatened and migratory bird species by:*

- a) *Establishing a complete list of threatened and migratory bird species that could potentially be affected by the project (and consider including the black swan).*
- b) *Having the list peer reviewed.*

#### 4.1.2 Purpose

The purpose of this assessment is to address Recommendations 9a and 9b of the Minister's Directions by establishing a complete and peer reviewed list of threatened and migratory bird species that could potentially be affected by the project (i.e., establish a list of threatened and migratory bird species that could occur in the project area and undertake a likelihood of occurrence assessment).

In addition, given that the Black Swan *Cygnus atratus* is a component of the Ramsar site, has a close ecological relationship with seagrass and is culturally significant for the Wadawurrung People, it was recommended that the black swan is included in this list.

#### 4.1.3 Background

Appendix A of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) in the project EES contained a likelihood of occurrence table for species listed as threatened and migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act). The likelihood of occurrence assessment considered species occurring in proximity to the onshore pipeline (terrestrial) and the offsite environment in relation to birds which use intertidal habitats that are influenced by the marine environment (shorebirds).

Following an independent assessment by Nature Advisory of the likelihood of occurrence presented in Appendix A of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a), an updated likelihood of occurrence table for species listed as threatened and migratory was produced in Appendix A of Technical Report D: *Addendum - Peer Review* (AECOM 2022b). This updated list additionally considered marine birds (seabirds) that forage in the shallow, marine waters of Corio Bay and may therefore occur adjacent to the onshore pipeline. EES Technical Report D: *Addendum - Peer Review* was submitted to the IAC panel during the hearing and was not exhibited with the EES. The report was submitted post-exhibition as the peer review and associated updates were completed after exhibition.

Upon review of the EES, the Inquiry and Advisory Committee (IAC) determined that a comprehensive assessment of the project's likely impacts on shorebirds and marine birds was difficult. The IAC stated that the 'likelihood of occurrence' assessment for threatened and migratory fauna species was confined to the onshore pipeline study area (50 m either side of the pipeline), instead of the database search radius of 5 km from the proposed pipeline.

The IAC recommended further work to establish a complete list of threatened and migratory bird species that could be impacted by the project. This list should include birds that could be affected through direct and indirect impacts, including via the marine environment, and should include species that use habitats in Corio Bay, Limeburners Bay and Avalon Beach (IAC Report No. 1, section 9.4 (iv)). While not a listed species, the IAC recommended the assessment of the Black Swan because it occurs in very large numbers in Limeburners Bay and has cultural significance for the Wadawurrung People (IAC Report No. 1, section 9.4 (iv)).

#### 4.1.4 Method

To address Recommendation 9a of the Minister's Directions, a consolidated list of threatened and migratory bird species has been developed and is provided in Appendix A of this document. A summary of the methodology to develop this list is provided below.



The list of threatened and migratory bird species that could occur in the project area, including the black swan, was developed by undertaking the following steps:

- An updated search of the Victorian Biodiversity Atlas (VBA) and/or predicted to occur by the EPBC Act Protected Matters Search Tool (PMST).
- An assessment of the likelihood of threatened and migratory bird species occurring in the project area and offsite environment (Corio Bay, Limeburners Bay and Avalon Beach).

An online search of the BirdLife Australia database in March 2024 with the same 5 km search radius did not add any threatened or migratory bird species to the list presented in Appendix A.

To address Recommendation 9b of the Minister's Directions, this list will be peer reviewed by Stantec Australia Pty Ltd (Stantec). Stantec has been engaged as the independent peer reviewer by the Department of Transport and Planning (DTP).

#### 4.1.4.1 Database searches

Revised searches of the VBA and PMST were undertaken on 8 September 2023. The revised database searches were based on a 5 km buffer including terrestrial and marine components of the project, and the surrounding offsite environment (Corio Bay, Limeburners Bay and Avalon Beach). The database search area is presented in Figure 4-1.

The terrestrial component of the project includes the:

- southwest pipeline tie in point;
- underground pipeline alignment;
- treatment facility; and
- aboveground pipeline alignment to the Corio Bay shoreline.

The marine component of the project includes the:

- aboveground pipeline alignment from the Corio Bay shoreline;
- refinery pier extension; and
- the FSRU.

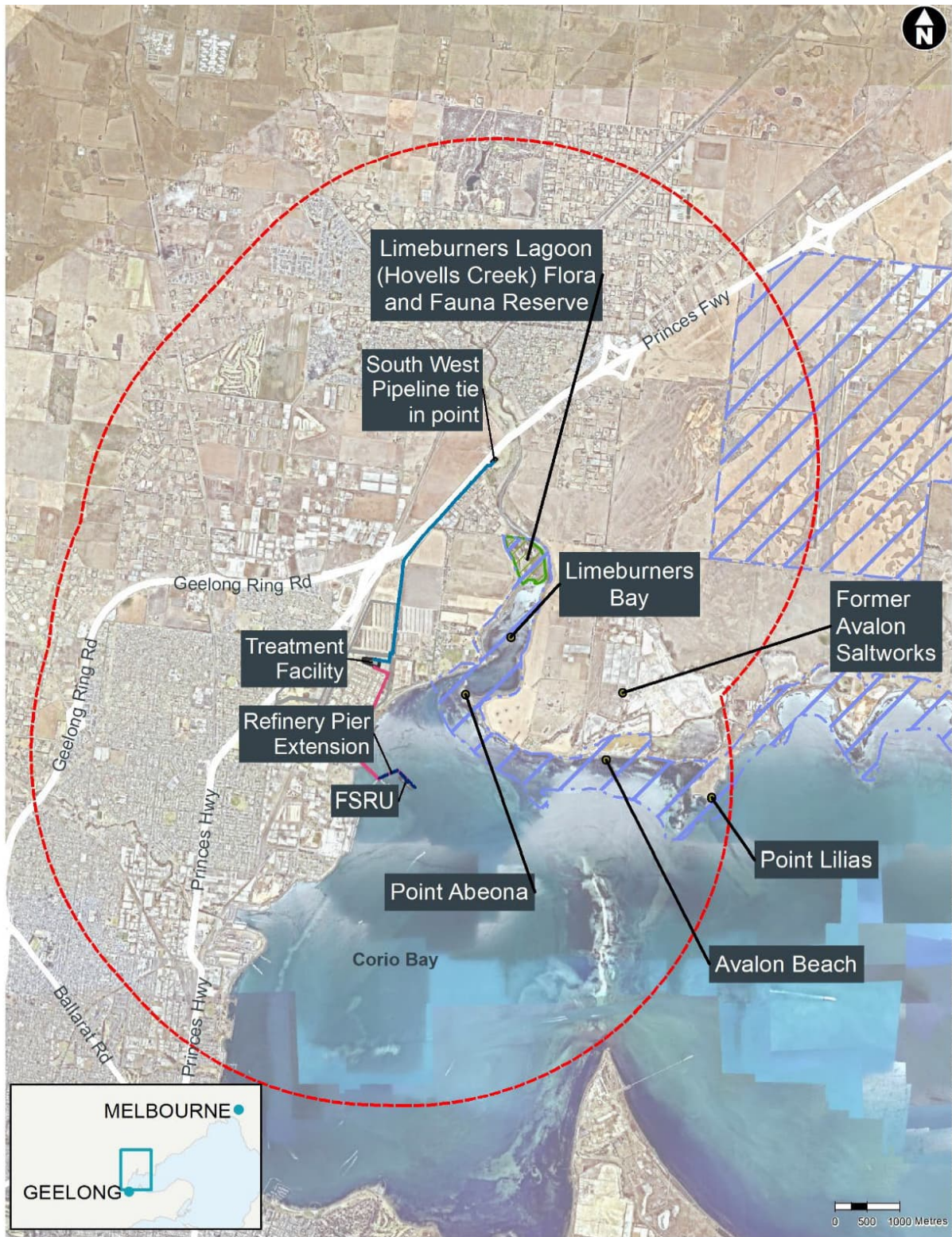
#### 4.1.4.2 Likelihood of occurrence assessment

The threatened and migratory bird species included in the likelihood of occurrence table includes species that are:

- Listed as threatened under the EPBC Act
- Listed as migratory under the EPBC Act
- Listed as threatened in Victoria under the FFG Act.
- Black Swan, as requested by Recommendation 9a of the Minister's Directions.

The likelihood of occurrence assessment was completed for species recorded on the VBA and/or predicted to occur by the PMST, within 5 km of the Project Area (refer to Figure 4-1). The likelihood of occurrence assessment was based on the number of VBA records, year of most recent VBA record, species ecology and the habitat values observed during the field assessment. Species observations in the *Migratory shorebird survey* report were also considered.

Species with VBA records older than 30 years (recent records) were excluded unless also identified via the PMST search. As the likelihood of occurrence assessments undertaken for EES Technical Report D: *Terrestrial ecology impact assessment* were based on records older than 30 years, being those pre-1990, that same timeframe was applied to the revised database search. Consequently, all species previously identified in Appendix A of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) and EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b) were retained in the list.



- - - 5 km database search buffer
- Offsite Coastal Locations
- Aboveground Pipeline
- Underground Pipeline
- - - Refinery Pier Extension
- ▨ Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site
- ▭ Viva Energy owned land
- ▨ Parks and reserves

Figure 4-1 Database search area

Likelihood of occurrence categories and definitions are outlined in Table 4-1.

**Table 4-1 Likelihood of occurrence categories and definitions**

Likelihood	Description
Unlikely	No preferred habitat in the study area. No recent records of the species within 5 km of the study area. Species unlikely to be present on the site at any time or during any season.
Possible	Habitat is available in the study area which partially meets the requirements of the species. Recent record/s of the species within 5 km of the study area. In the case of fauna, the species may infrequently visit for foraging but would not reside, roost or otherwise depend on habitats in the study area for their survival. Migratory and aerial foraging birds may overfly the site.
Likely	Species has historically been recorded in the study area (or within very close proximity). The study area contains habitat that meets their habitat requirements and is likely to support a population of the species.
Present	Species confirmed to be present within the study area.

When assessing species likelihood, each species was appraised for its likelihood to occur in the terrestrial and marine environs. It is noted that some species are solely reliant on either terrestrial or marine environments, while others can occur across both habitats. Bird classification has, at least in part, been informed by the species classification as detailed in *Migratory shorebird survey: Corio Bay, Limeburners Bay and Avalon Beach* (AECOM, 2022c) (Table 4-2).

**Table 4-2 Bird Groupings and Descriptions**

Aquatic Bird Group	Description
Terrestrial (non-aquatic)	Birds that are solely reliant and associated with terrestrial environs for foraging and breeding activities. Examples include woodland and grassland bird species.
Raptors (birds of prey)	Such as eagles, kestrels, kites and falcons due to their potential to interact with aquatic food chains. Although White-bellied Sea-eagle <i>Haliaeetus leucogaster</i> is classified as a seabird and declared marine species under the EPBC Act (DoEE, 2019) it is included in the raptor category for this assessment.
Shorebirds (waders)	Shorebirds (also known as waders) are so named as they commonly feed by wading in shallow water along the shoreline of lakes, rivers and the sea (Geering, 2006). Species include plovers, lapwings, stone-curlews, sandpipers, 'shanks', tattlers, curlews, godwits, snipes, pranticole, oystercatchers, stilts, avocets and jacana (Geering, 2006; BirdLife Australia n.d.). Shorebirds use intertidal areas (between high and low waterline) to forage and supratidal areas (above high waterline) to roost. Shorebirds predominantly feed on insects, aquatic invertebrates and small fish.
Waterbirds	Waterbirds are species that primarily inhabit freshwater environments although some can also be found in intertidal, coastal areas. Waterbirds include ducks, swans, ibises, herons, egrets, spoonbills, darters, waterhens, crakes, rails and grebes (Menkhorst et al. 2017; DoEE, 2019). Waterbirds predominantly feed on fish, frogs and aquatic invertebrates.
Seabirds (marine birds)	Seabirds are birds that spend most of their time on, over or near the marine environment. Seabird species include gulls, gannets, terns, albatrosses, petrels, jaegers, petrels, cormorants, penguins, pelicans and shearwaters (Menkhorst et al. 2017; DoEE, 2019). Seabirds forage at sea by surface feeding, diving and scavenging. They feed predominantly on fish, but other food sources include marine invertebrates.



The likelihood of occurrence ratings assigned to species for this supplementary study consolidates the previous likelihood of occurrence ratings for threatened and migratory bird species as presented in:

- Appendix A of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) for the pipeline study area.
- Appendix A of EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b) for the pipeline study area.
- Appendix 4 of *Viva Energy Gas Terminal Project Peer review of terrestrial ecological impact assessment* (Nature Advisory 2022) for the project area (terrestrial and marine). The habitat requirements for species provided in Nature Advisory (2022) have been adopted where available.
- *Migratory shorebird survey: Corio Bay, Limeburners Bay and Avalon Beach. Project Vega Gas Import Facility* (AECOM 2022c) for the offsite environment.

Species identified in the revised VBA search conducted for this supplementary study that were not identified in the search outputs in EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) and EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b) were assigned a rating consistent with the approach taken at that time and as outlined above. An indication of the species identified in the supplementary VBA search and not in the EES is provided in Appendix A (refer to key to Table 8-1).

Species conservation status at the time of the revised VBA search included updates to the FFG Act (September 2022 list) and EPBC Act (March 2023). However, Section 158A(4) of the EPBC Act requires the decision maker to disregard listing events (except delistings or downlistings) that have occurred after the controlled action decision. This means that species listed under the EPBC Act after a referral decision has been made are not required to be assessed as a Matter of National Environmental Significance (MNES). The decision for the project (referral EPBC 2020/8838) was made on 21 January 2021 which means any species listed under the EPBC Act after that date is not considered as a MNES under the EPBC Act. The list of threatened and migratory bird species in Appendix A acknowledges updates in listing status under the EPBC Act, but impacts on the species are assessed based on the species' status at the time of the referral decision for EPBC 2020/8838 (21 January 2021).

#### 4.1.4.3 Peer review

Recommendation 9b of the Minister's Directions requires that the list of threatened and migratory bird species be peer reviewed. Stantec Australia Pty Ltd (Stantec) was engaged by the Department of Transport and Planning (DTP) to undertake an independent peer review of the list of threatened and/or migratory bird species. The list of species was provided to Stantec on 28 February 2024 and draft peer review comments were received on 26 March 2024. The findings of the peer review were considered and adopted as relevant in the list of threatened and/or migratory species in Appendix A.

A copy of the peer review report is presented in Attachment I of the supplementary statement. The peer reviewer concluded that the list of threatened and migratory species presented in Appendix A is sound.

#### 4.1.5 Results

The complete list of threatened and migratory bird species within 5 km of the project area, and their likelihood of occurrence, is provided in Appendix A. The location of records of these species is shown in Figure 4-2. Species that have been added to the consolidated list that were not initially considered in the original EES are highlighted in Appendix A.

Species are considered to potentially occur in the project area (terrestrial or marine) and surrounding offsite environment (Corio Bay, Limeburners Bay and Avalon Beach) if they received a likelihood rating of possible, likely or present (refer Table 4-1 in Section 4.1.4.2 for definitions) and are discussed in this section. Species that are unlikely to occur are not discussed below.

The existing conditions for project area (terrestrial or marine) and surrounding offsite environment are presented in EES Technical Report A: *Marine ecology and water quality impact assessment* and EES Technical Report D: *Terrestrial ecology impact assessment*.

Species with potential to occur are those that have potential to be affected by the project. An assessment of potential impacts on these threatened and/or migratory birds is provided in the integrated assessment in Section 5.0.

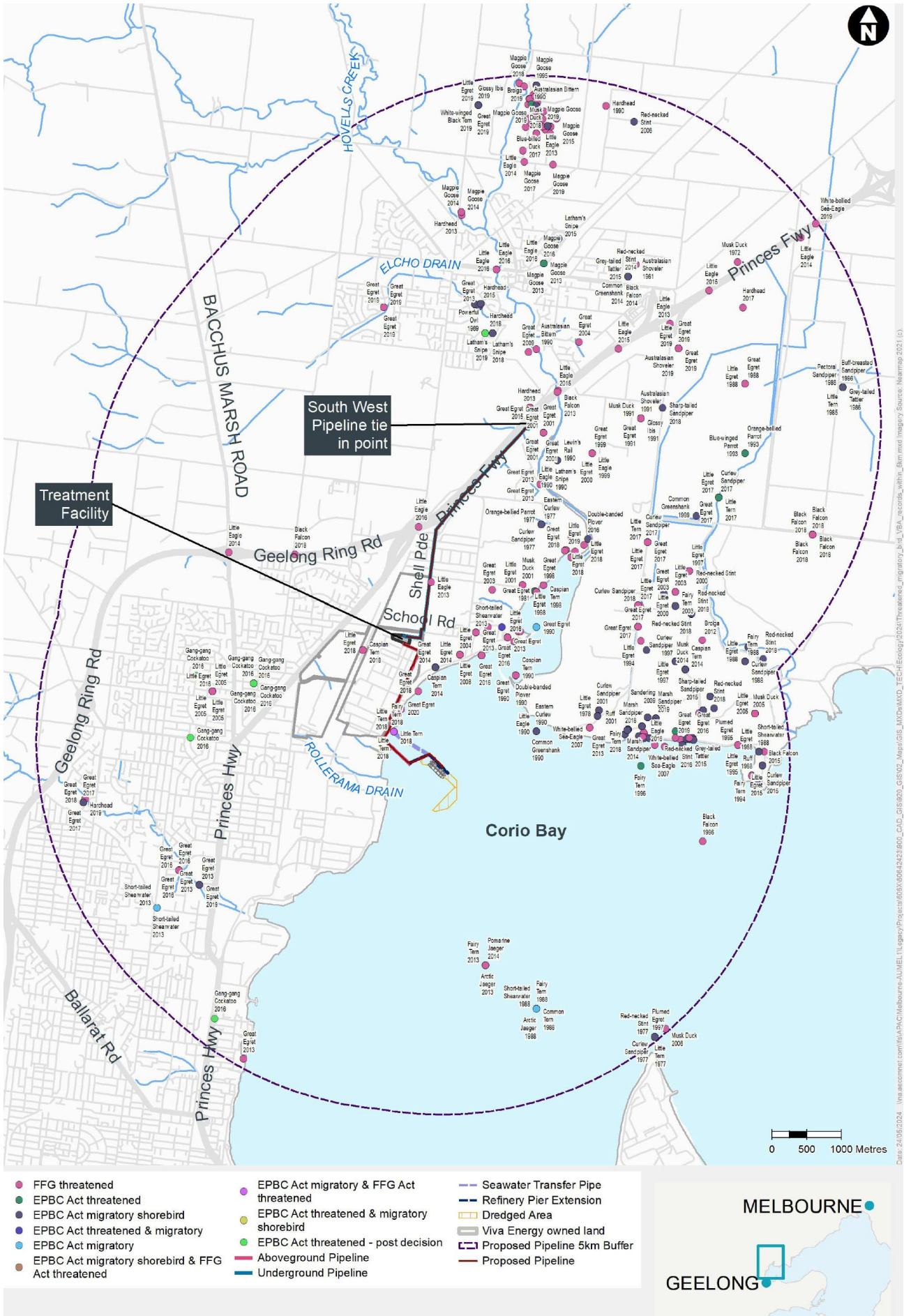


Figure 4-2 VBA records of threatened and/or migratory birds within 5km of the project area

#### 4.1.5.1 Project Area (terrestrial)

Threatened and migratory bird species with the potential to occur within the terrestrial, pipeline component of the project area are:

- Fork-tailed Swift *Apus pacificus* – migratory under the EPBC Act
- Eastern Great Egret *Ardea alba modesta* – vulnerable under the FFG Act
- Gang-gang Cockatoo *Callocephalon fimbriatum* – endangered under the FFG Act (also endangered under the EPBC Act but listing occurred after the referral decision for the project therefore not a MNES)
- Black Falcon *Falco subniger* – critically endangered under the FFG Act
- White-bellied Sea-Eagle *Haliaeetus leucogaster* – endangered under the FFG Act
- Little Eagle *Hieraaetus morphnoides* – vulnerable under the FFG Act
- White-throated Needletail *Hirundapus caudacutus* – vulnerable and migratory under the EPBC Act
- Rufous Fantail *Rhipidura rufifrons* – migratory under the EPBC Act
- Swift Parrot *Lathamus discolor* – critically endangered under the EPBC Act and FFG Act.

#### 4.1.5.2 Project Area (marine)

The marine component of the project area is modified by the existing refinery pier and associated anthropogenic industrial activity. As such, the habitat is unlikely to support many threatened and migratory bird species. Species that may occur in this area are likely to only do so on occasion as part of wider activity in the surrounding marine environment.

Threatened and/migratory birds with some potential to occur in or immediately adjacent to the marine component of the project area are:

- White-bellied Sea-eagle (endangered under the FFG Act) may hunt over the area on occasion but the Project Area is marginal habitat for this species. White-bellied Sea-eagle are sensitive to human habitation (O'Donnell and Debus 2012) and may therefore prefer areas away from the existing refinery and pier.
- Three species of terns that may occasionally forage over the marine waters of the Project Area and may rest on anthropogenic structures:
  - Gull-billed Tern *Gelochelidon nilotica macrotarsa* (migratory under the EPBC Act and endangered under the FFG Act)
  - Caspian Tern *Hydroprogne caspia* (migratory under the EPBC Act and vulnerable under the FFG Act).
  - Common Tern *Sterna hirundo* (migratory under the EPBC Act).
- Little Tern *Sternula albifrons* (migratory under the EPBC Act) and Fairy Terns *Sternula nereis* (vulnerable under the EPBC Act) that have been recorded roosting on the seawater intake that extends approximately 100 m from the shore immediately adjacent to the existing pier (VBA). This structure will not be impacted by project works. These two tern species may forage along the shoreline and over the marine waters of the Project Area and may roost on anthropogenic structures.
- Crested Tern *Thalasseus bergii* (migratory under the EPBC Act) that regularly forage over shallow marine waters of Corio Bay and were observed during shorebird surveys at the former Avalon saltworks, W5 outfall in proximity to the Project Area and Point Aboena (AECOM 2022c). Crested Terns may forage along the shoreline and over the marine waters of the Project Area and may roost on anthropogenic structures.

Black Swan has been identified as a species of interest for the project given that it has a close ecological relationship with seagrass and is culturally significant for the Wadawurrung People. The species is not listed as threatened or migratory under the EPBC Act or FFG Act. Black Swans were

observed in small numbers at W5 outfall during shorebird surveys (AECOM 2022c) and may occasionally venture into the shallower waters of the marine component of the project area.

#### 4.1.5.3 Offsite environment

Threatened and migratory bird species with potential to occur in the offsite environment (Limeburners Bay, Avalon Beach and Corio Bay) comprise:

- Thirty-two species of migratory shorebirds. Six of those species are also listed as threatened under both the EPBC Act and FFG Act, 12 species are listed as threatened under the FFG Act only, 12 species are not listed as threatened and one species (Latham's Snipe) was not considered as a threatened species because its threatened status under the EPBC Act occurred after the referral decision for the project. These species are more likely to occur in association with the inshore ponds of the former Avalon saltworks (and to a lesser extent Limeburners Lagoon) but some are also likely to forage along the shoreline of Corio Bay within the Ramsar site.
- Twenty species of seabirds comprising of three species of shearwater, seven species of tern, two species of giant petrel, one storm petrel, one prion, three species of jaeger, and three species of albatross. Most of those species are pelagic, which means they occupy open oceans in preference to embayments. Pelagic species are unlikely to occupy Port Phillip Bay (and therefore Corio Bay) for most of their lifespan. The species may use the shallow marine waters of Corio Bay for foraging on occasion but are more likely to use the bay opportunistically during rough weather (AECOM 2022b). Terns are known to regularly occur in the area and are the seabirds most likely to hunt in the waters of Corio Bay in the offsite environment. Terns may also roost on structures (see Section 4.1.5.2).
- Twelve species of waterbird including Black Swan (not threatened but species of note), five species of duck, three species of egret, Glossy Ibis, Brolga and Lewin's Rail. Most of these species would utilise the inshore ponds and wetlands of the Ramsar site rather than the shoreline or bay. Black Swans are known to congregate in large numbers in Limeburners Bay.
- Four species of raptor (birds of prey) that are likely to hunt over the terrestrial and inland aquatic environments of the Ramsar site. White-bellied Sea-eagle is also likely to hunt over the marine environment.
- Three terrestrial (non-aquatic) species that may occur in the terrestrial environments of the Ramsar site on occasion: Rufous Fantail, White-throated Needle-tail and Orange-bellied Parrot may be occasional visitors to Limeburners Bay and former Avalon Saltworks.

#### 4.1.6 Conclusion

Seventy-three species of threatened and/or migratory birds have potential to occur in association with the Project Area or offsite environment. Those species comprise:

- Five terrestrial (non-aquatic) species that may occur in association with the terrestrial habitats of the Project Area (pipeline). Two of those may also occur in the terrestrial environment of the offsite environment (Ramsar site) – Rufous Fantail and White-throated Needle-tail.
- One additional terrestrial (non-aquatic) species that may occur in association with the terrestrial habitats of the offsite environment – Orange-bellied Parrot.
- Four raptors (birds of prey) that may hunt over the terrestrial environments of the Project Area and offsite environment (Ramsar site). White-bellied Sea-eagle is also likely to hunt over the marine environment.
- Thirty-two migratory shorebirds most likely to occur in association with the inshore ponds of the former Avalon saltworks (and to a lesser extent Limeburners Lagoon) but some are also likely to forage along the shoreline of Corio Bay within the Ramsar site. Unlikely to occur along the shoreline associated with the Project Area.
- Twelve species of waterbird (including non-threatened Black Swan) that would mostly utilise the inshore ponds and wetlands of the Ramsar site rather than the shoreline or bay. Small numbers of Black Swan may venture into the inshore waters of the marine component of the Project Area. Eastern Great Egret may occasionally forage along the shoreline, along the drain on Cummins Road or around the dam near the tie in point but those areas are marginal habitat of this species.

- Twenty species of seabird that may occasionally use the shallow marine waters of Corio Bay for foraging. Most of the species are pelagic (they occupy open oceans in preference to bays) and may forage in Corio Bay, on occasion, particularly during periods of rough weather. Terns are known to regularly occur in the area and may roost on structures.

## 4.2 Shorebird survey further analysis

### 4.2.1 Minister's Direction 9c

*Recommendation 9: Undertake further assessment of impacts on threatened and migratory bird species by:*

- c) *Undertaking further analysis of the targeted shorebird surveys, to determine whether the surveyed sites individually or collectively support enough individuals of any particular migratory bird species to be an important site for that species in Australia or the East Asian-Australasian Flyway.*

### 4.2.2 Purpose

The purpose of this assessment is to address Recommendation 9c of the Minister's Directions, to determine whether targeted shorebird survey sites individually or collectively support enough individuals of any particular migratory bird species to be an important site for that species in Australia or the East Asian-Australasian Flyway (EAAF) based on the data collected during targeted shorebird surveys undertaken for the EES.

### 4.2.3 Background

As detailed in Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) a baseline assessment of migratory shorebirds within, and adjacent to, the project was undertaken in 2021. Six shorebird survey sites were established that comprised four major and two minor sites (see Figure 4-3). Major sites were selected based on their size and the high value of the habitat they contained. Minor sites contained less expansive habitat but were selected due to their proximity to the area of potential impact. The six shorebird survey sites included:

- Site 1 – Limeburners Bay (also known as Limeburners Lagoon)
- Site 2 – Limeburners Lagoon (Hovells Creek) Flora and Fauna Reserve (also referred to as Limeburners Reserve)
- Site 3P – Avalon Beach (east) – point
- Site 3T – Avalon Beach (east) – transect with shoreline and inland former Avalon saltworks
- Site 4 – Avalon Beach (west) – saltpans near the boat ramp carpark
- Site 5 – Corio Bay outfall
- Site 6 – Point Aboena, Corio Bay.

Four surveys were undertaken in summer (February and March 2021) at a time when migratory shorebirds are in Australia (southern hemisphere non-breeding season). One survey was conducted in winter (July 2021) to capture data on birds that remain in Australia during the breeding season as well as Double-banded Plover *Charadrius bicinctus* that migrate from New Zealand to Australia over autumn and winter (March to August). The shorebird survey was therefore conducted in accordance with the guidelines for migratory shorebirds within the EPBC Act Policy Statement 3.21 *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (DAWE 2017).

Survey focused on waders (Charadriiformes), including migratory shorebirds. Other species included in the count data were waterbirds (e.g., waterfowl, herons, egrets and grebes), seabirds (e.g. gulls, cormorants and terns) and raptors (e.g. eagles, kestrels, kites and falcons) due to their potential to interact with aquatic food chains. The migratory shorebird survey was presented in a standalone report (AECOM 2022c) appended to Technical Report D: *Terrestrial ecology impact assessment*.

The migratory shorebird survey report (AECOM, 2022c) was updated in response to a peer review of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) completed by Nature



Advisory and appended to EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b) as Appendix E. AECOM agreed that the recommendations from the peer review would add value to the analysis of shorebird data. Updates were made to the shorebird report (AECOM 2022c) to provide data related to mean and max high and low tide counts per site for each migratory shorebird species (Curlew Sandpiper, Sharp-tailed Sandpiper, Red-necked Stint and Common Sandpiper). The analysis completed as part of EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b) identified areas of greatest use to be Limeburners Bay and Avalon Beach (former Avalon saltworks). EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) already concluded that these habitats are beyond the reach of modelled marine impacts from the offshore component of the project and are well beyond the pipeline construction footprint.

Analysis in relation to whether each site would meet the threshold for being an important site in the context of Australia or the East Asian-Australasian Flyway (EAAF) (percentage of the national and EAAF estimated populations) was recommended by the peer review, however the recommendation was not adopted in EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b) for several reasons:

- The objective of the survey was to examine sites in proximity to the project and whether any shorebirds would be impacted by the project.
- The project will not impact on any of the sites where shorebirds were recorded.
- Most of the sites are within the Ramsar site and are therefore already considered ‘significant’, regardless of an assessment according to the EAAF.

Upon review of the EES, the IAC determined that further analysis of the shorebird observations should be undertaken to determine whether any of the surveyed areas support a sufficient number of individuals of any particular migratory bird species to be an important site for that species in Australia or the EAAF.

#### 4.2.4 Method

To address Recommendation 9c of the Minister’s Directions to determine whether the sites surveyed in 2021 individually or collectively support enough individuals of any particular migratory bird species to be an important site for that species in Australia or the EAAF, the findings of the migratory bird survey presented as Appendix E in EES Technical Report D: *Addendum Report – Peer Review* were assessed against:

- the definition of nationally important shorebird habitat in EPBC Act Policy Statement 3.21: Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoEE, 2017).
- the population estimates available for EAAF in Hansen et al. (2016).

The process for identifying important habitat for migratory shorebirds under the EPBC Act is presented in Figure 2 in DoEE (2017). An extract of the figure is provided below (refer to Figure 4-4) and includes the definitions for ‘area’ and ‘support’ that apply to all migratory shorebirds excluding Latham’s Snipe.

The process for identifying important habitat for migratory shorebirds under the EPBC Act (refer to Figure 4-4) consists of two steps. Step one considers whether the shorebird area is already identified as internationally important, and step two considers whether the shorebird habitat supports:

- per cent of the flyway population of a single species of migratory shorebird OR
- 2000 migratory shorebirds OR
- 15 migratory shorebird species (DoEE 2017).

Internationally important habitat for shorebirds is considered habitat that regularly supports 1% of the flyway population of a single species of migratory shorebird (DoEE 2017). The definition of internationally important habitat also includes all waterbirds, but that is not relevant for the purpose of this assessment.

Four migratory shorebird species were identified during the surveys undertaken as part of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a). Those four species were

Sharp-tailed Sandpiper *Calidris acuminata*, Red-necked Stint *Calidris ruficollis*, Curlew Sandpiper *Calidris ferruginea* and Common Sandpiper *Actitis hypoleucos*. EAAF population estimates from Hansen et al. (2016) for the four migratory shorebird species observed during the shorebird surveys are provided in Table 4-3.

**Table 4-3 EAAF population estimates for the four migratory shorebird species recorded during shorebird surveys (Hansen et al. 2016)**

Species	EAAF population estimate	1% flyway population	0.1% of flyway population
Sharp-tailed Sandpiper	85,000	850	85
Red-necked Stint	475,000	4,750	475
Curlew Sandpiper	90,000	900	90
Common Sandpiper	190,000	1,900	190

#### 4.2.5 Results

Table 4-4 below presents a comparison of shorebird survey data against the EAAF population estimate for the four migratory shorebirds recorded during the project survey. The table encompasses total number of observations (total count), maximum single count per survey site, and the percentage of the EAAF population each site supports for both the total mean and total maximum counts. Migratory shorebirds were recorded at four of the survey sites – Site 2, Site 3P, Site 3T and Site 4. As such, Site 1, Site 5 and Site 6 are not included in Table 4-4.

Table 4-5 provides a summary of the survey sites and whether they meet step one or step two of the process for identifying important habitat for migratory shorebirds under the EPBC Act (Figure 4-4). Site 1, Site 5 and Site 6 are included in Table 4-5.

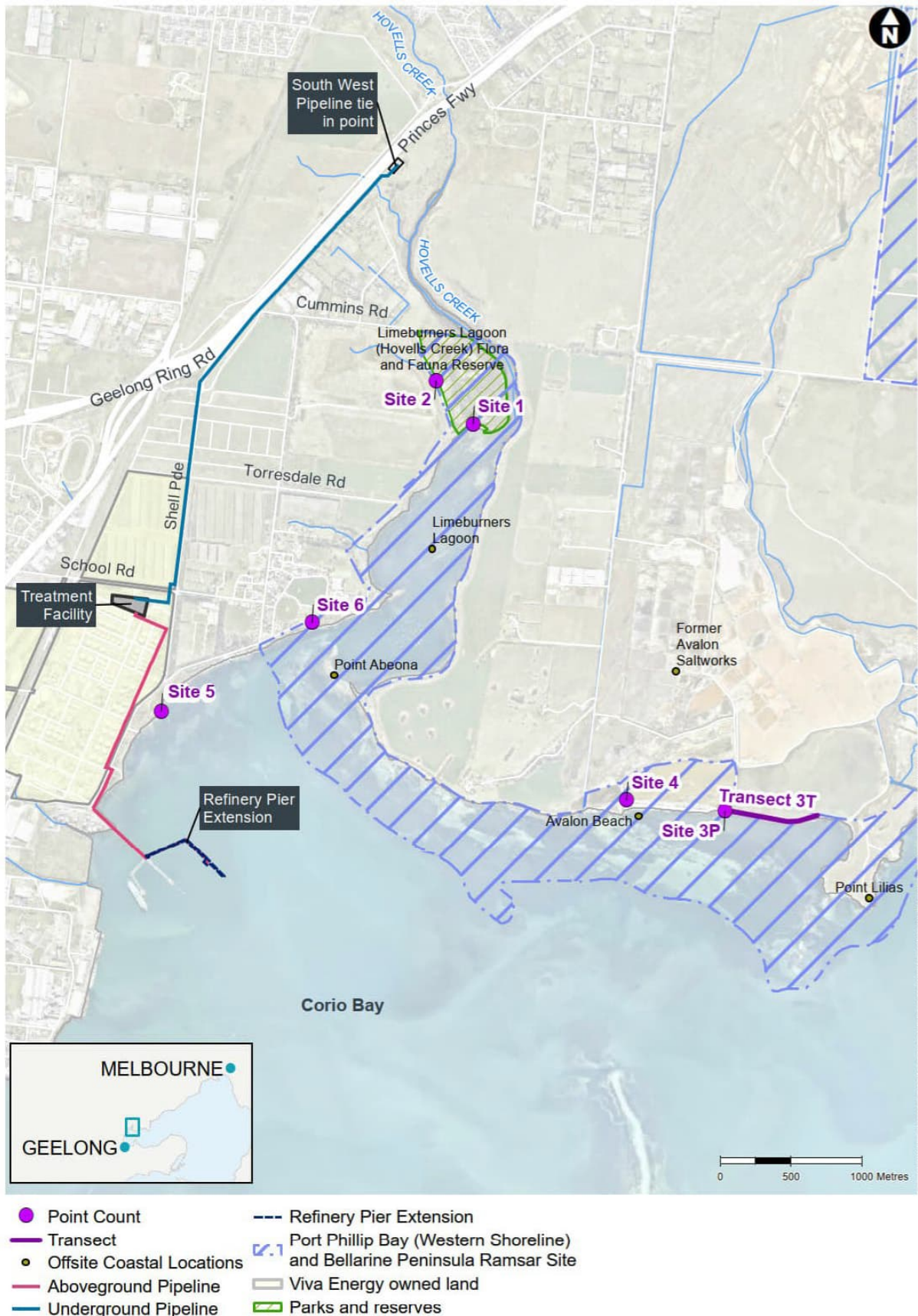
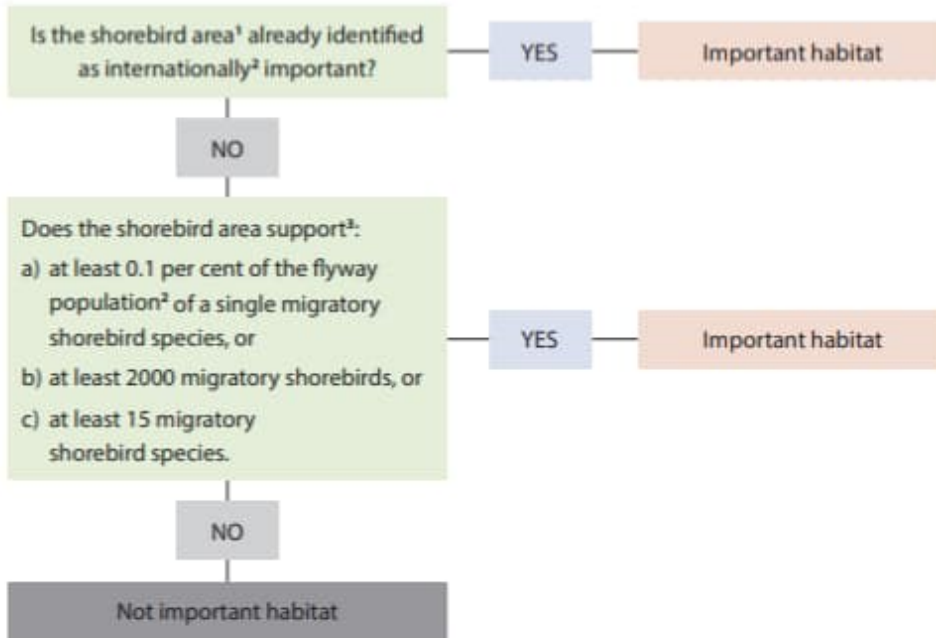


Figure 4-3 Shorebird survey locations.

**Figure 2. Process for identifying important habitat for migratory shorebirds (excluding Latham’s snipe)**



1. Following Clemens et al. (2010) a shorebird area is defined as: the geographic area that had been used by the same group of shorebirds over the main non-breeding period. This is effectively the home range of the local population when present. Shorebird areas may include multiple roosting and feeding habitats. While most migratory shorebird areas will represent contiguous habitat, non-contiguous habitats may be included as part of the same area where there is evidence of regular bird movement between them. Migratory shorebird areas may therefore extend beyond the boundaries of a property or project area, and may also extend beyond Ramsar boundaries for internationally important areas. Existing information and/or appropriate surveys can determine the extent of a migratory shorebird area.
2. Population estimates for 37 migratory shorebirds in the East Asian–Australasian Flyway are available at [www.environment.gov.au/biodiversity/migratory-species/migratory-birds](http://www.environment.gov.au/biodiversity/migratory-species/migratory-birds). Shorebird population estimates, may, from time-to-time be updated as new information is made available. Further information can be found on the Department’s website.
3. ‘Support’ is defined differently depending on whether the habitat is considered permanent or ephemeral.
  - For permanent wetlands, ‘support’ is defined as: *migratory shorebirds are recorded during surveys and/or known to have occurred within the area during the previous five years.*
  - For ephemeral wetlands, ‘support’ is defined as: *habitat that migratory shorebirds have ever been recorded in, and where that habitat has not been lost permanently due to previous actions.*

**Figure 4-4 Process for identifying important habitat for migratory shorebirds (excluding Latham’s Snipe). Extract from DoEE (2017).**

Table 4-4 Comparison of shorebird survey data (total observations and total max. count) against EAAF population estimate for the four migratory shorebirds recorded

Species	Population estimate EAAF (Hansen et al. 2016)	All sites (combined)				Site 2				Site 3P				Site 3T				Site 4			
		Total Obs	% of pop	Total Max count	% of pop	Total Obs	% of pop	Max count	% of pop	Total Obs	% of pop	Max count	% of pop	Total Obs	% of pop	Max count	% of pop	Total Obs	% of pop	Max count	% of pop
Common Sandpiper	190,000	1	0.001	1	0.001	0	0.000	0	0.000	0	0.000	0	0.000	1	0.001	1	0.001	0	0.000	0	0.000
Curlew Sandpiper	90,000	1	0.001	1	0.001	0	0.000	0	0.000	0	0.000	0	0.000	1	0.001	1	0.001	0	0.000	0	0.000
Red-necked Stint	475,000	81	0.017	55	0.012	0	0.000	0	0.000	2	0.000	1	0.000	28	0.006	18	0.004	51	0.011	51	0.011
Sharp-tailed Sandpiper	85,000	498	<b>0.586</b>	131	<b>0.154</b>	52	0.061	31	0.036	71	0.084	24	0.028	375	<b>0.441</b>	126	<b>0.148</b>	0	0.000	0	0.000

Note: **Bold and red** indicates meets the 0.1% flyway population threshold.

Table 4-5 Summary of survey sites and whether they individually or collectively meet the definition of important habitat for migratory shorebirds

Site	Internationally important?		Nationally important?				Important habitat for migratory shorebirds?
	1% flyway population	Ramsar site?	0.1% flyway population of single species	2000 migratory shorebirds	15 migratory shorebird species	Nationally important criteria met?	
Site 1 – Limeburners Bay#	No	<b>Yes</b>	No	No	No	No	<b>Yes</b>
Site 2 – Limeburners Lagoon#	No	<b>Yes</b>	No	No	No	No	<b>Yes</b>
Site 3P – Avalon Coastal Reserve (shoreline and Avalon saltworks)#	No	<b>Yes</b>	No	No	No	No	<b>Yes</b>
Site 3T – Avalon Coastal Reserve (shoreline# and Avalon saltworks)	No	<b>Yes</b> (shoreline side only)	<b>Yes</b>	No	No	<b>Yes</b>	<b>Yes</b>
Site 4 – Avalon Beach lagoon#	No	<b>Yes</b>	No	No	No	No	<b>Yes</b>
Site 5 – Corio Bay outfall	No	No	No	No	No	No	No
Site 6 –Point Aboena, Corio Bay#	No	<b>Yes</b>	No	No	No	No	<b>Yes</b>
All sites (combined)	No	n/a	<b>Yes</b>	No	No	<b>Yes</b>	<b>Yes</b>

Note: #Within the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site boundary



**4.2.6 Discussion**

In accordance with DoEE (2017) (refer to Figure 4-4), the process of identifying important habitat for migratory shorebirds relates first and foremost to whether a shorebird area is already identified as internationally important. As summarised in Table 4-5, all sites located within the Ramsar site (i.e. all except Site 6) are recognised as an internationally important area and are therefore automatically important habitat for migratory shorebirds. None of the sites individually or collectively are internationally important for any of the four declared migratory species recorded during the surveys as the counts do not reach the 1% threshold (Table 4-4).

Only one of the survey sites would be considered important habitat for migratory shorebirds in Australia and/or the EAAF based on data collected during the survey. Site 3T (Avalon Coastal Reserve) supports enough Sharp-tailed Sandpiper to be an important site for that species in Australia and the EAAF. The site supports 1% of the EAAF population of Sharp-tailed Sandpiper based on both maximum single count and total observations over the survey. Site 3T is only partially within the boundary of the Ramsar site (Figure 4-3) with the inland side of the site (i.e. the former Avalon saltworks) not currently part of the Ramsar site.

The former Avalon saltworks (aka Avalon Coastal Reserve or Avalon Coastal Park) adjacent to the Point Wilson/Limeburners Bay section of the Ramsar site (and therefore Site 3T) is one of three areas near Geelong (and 11 wetland areas in total; Figure 4-6) that are being considered for inclusion in the Ramsar site (DEECA 2023). It is noted, however, that the review of wetland areas for inclusion in the Ramsar site is ongoing.

Avalon Coastal Reserve (former Avalon saltworks) inland of Site 3T is recognised as an important shorebird site with average summer counts since 2001 of 3200 shorebirds and peak counts of over 6800 shorebirds (Rogers et al. 2010). The inland habitats are important high tide roosts (Rogers et al. 2010; DEECA n.d) and foraging areas for shorebirds and seabirds with 18 species of shorebirds recorded. The area supports significant numbers of Red-necked Stint, Curlew Sandpiper and Sharp-tailed Sandpiper (Engage Victoria n.d). While the outcome of the review of the Ramsar site boundary is unknown at this stage, the proposal of the former Avalon saltworks in the Ramsar site is indicative of its value and ability to meet the definition of an internationally significant area for shorebirds.

Figure 9. The Werribee-Avalon Shorebird Area, showing the three properties that comprise the complex: Avalon Salt Works, Pt Wilson and the Western Treatment Plant. Major sites (used by > 1000 migratory shorebirds on a regular basis are highlighted in red (roosts) and yellow (feeding areas)).



**Figure 4-5 Werribee-Avalon shorebird area showing major roost and feeding sites (from Rogers et al. 2010)**

Despite being within the boundary of the internationally recognised Ramsar site, Sites 1, 2, 3P, 4 and 6 (in Limeburners Lagoon Flora and Fauna Reserve, Limeburners Bay, Corio Bay opposite Point Aboena and Avalon Beach) do not support enough individuals of a species of migratory shorebird, based on the survey data alone, to be an important site in Australia or the EAAF.

Site 5 is the only site that is not important habitat for shorebirds at either an international or national level. This conclusion aligns with the findings of Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a).

Collectively, the sites would be considered important habitat in Australia and the EAAF based on the data collected during the shorebird survey for the project, but that is solely due to Sharp-tailed Sandpiper counts at Site 3T (Avalon Coastal Park).



Figure 4-6 Map of potential Ramsar site additions (Source: DELWP 2023)

#### 4.2.7 Conclusion

Based on the data from the migratory shorebird survey undertaken in 2021 for the EES, none of the shorebird survey sites individually or collectively are internationally important for any of the four declared migratory species recorded during the surveys, as the counts do not reach the 1% threshold.

Only one survey site would be considered important habitat in Australia and/or the EAAF ( $\geq 0.1\%$  population threshold) based on data collected during the shorebird survey. Avalon Coastal Park (Site 3T) supports enough Sharp-tailed Sandpiper to be an important site for that species in Australia and the EAAF.

Sites 1, 2, 3P, 3T and 6 (Limeburners Lagoon, Corio Bay opposite Point Aboena and Avalon Beach), despite being within the boundary of the internationally recognised Ramsar site, do not support enough individuals of a species of migratory shorebird to be an important site in Australia or the EAAF based on the survey data alone.

Site 5 is the only site that is not important habitat for shorebirds at either an international or national level.

Analysis of the data in relation to whether surveyed sites individually or collectively support enough individuals of a migratory bird species to be an important site for that species does not change the assessment outcomes in EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) and Appendix A of EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b): in relation to the significance of the study area and surrounds.

Avalon Beach (former Avalon Saltworks) supported all four of the observed migratory shorebird species and Sharp-tailed Sandpiper was recorded in Limeburners Reserve. Both Avalon Beach and Limeburners Bay support a high abundance and diversity of waterbirds and seabirds including species listed as threatened under the FFG Act and as migratory or marine under the EPBC Act.

When assessing project impacts, shorebird habitats at all sites surveyed (except Site 6) were considered as internationally important due to their inclusion in a Ramsar site. The project was not considered to be likely to have a significant impact on migratory shorebirds.

### 4.3 Revised marine modelling

#### 4.3.1 Minister's Direction 9d

*Recommendation 9: Undertake further assessment of impacts on threatened and migratory bird species by:*

*d) Considering revised marine modelling.*

#### 4.3.2 Purpose

The purpose of this assessment is to address Recommendation 9d of the Minister's Directions. This considers the potential direct and indirect impacts from the project on threatened and/or migratory aquatic bird species in light of the results of the further marine modelling work undertaken in supplementary statement Technical Report A: *Supplementary marine environment impact assessment*. The conclusions reached in EES Technical Report D: *Terrestrial ecology impact assessment* are to be updated, as required, with consideration to the findings of the revised marine modelling.

#### 4.3.3 Background

Revised marine modelling relates to the Minister's Directions addressed by the supplementary marine environment study (Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment*). Most of the recommendations relate to additional investigations and modelling to be undertaken. The marine recommendations of relevance to the discussion of ecological impacts are listed in Table 4-6 below.

**Table 4-6 Minister's Directions for the supplementary marine study relevant to ecology**

Recommendation	Description	Relevance to ecology	Relevant Section
Recommendation 3	<p><i>Re-run the wastewater discharge modelling with revised inputs based on the refined hydrodynamic model.</i></p> <p><i>Consider:</i></p> <p>a. <i>Revising the nearfield modelling of discharges from the diffuser to address the matters raised by Dr McCowan in his written evidence (D75)</i></p> <p>b. <i>The IAC's recommended default guideline values (DGV) for chlorine discharges (7.2 µg/L in Corio Bay generally, including the Project area; 2.2 µg/L at the Ramsar site).</i></p>	Discharge to the marine environment	Section 5 of Technical Report A: <i>Supplementary marine environment impact assessment</i>



Recommendation	Description	Relevance to ecology	Relevant Section
Recommendation 5	<i>Recommendation 5 of the Minister's Directions was to re-run the entrainment modelling with revised inputs based on the refined hydrodynamic model.</i>	Entrainment as that may affect food supply for threatened and/or migratory birds	Section 7 of Technical Report A: <i>Supplementary marine environment impact assessment</i>
Recommendation 7	<i>Undertake further assessment of dredging impacts on seagrass based on:</i> <ul style="list-style-type: none"> <li>a. <i>The revised sediment transport modelling</i></li> <li>b. <i>Revised light thresholds of 10 percent to 20 percent surface irradiance (20 percent surface irradiance should be applied to any sediment plumes that extend to the Port Phillip Bay (western shoreline) and Bellarine Peninsular Ramsar Site)</i></li> <li>c. <i>The updated seagrass mapping (Rec. 1b).</i></li> </ul>	Sediment mobilisation as it relates to seagrass as a food source and key part of the food web.	Section 8 and Section 9 of Technical Report A: <i>Supplementary marine environment impact assessment</i>
Recommendation 8	<i>Confirm the EES conclusion that dredging will not impact the Ramsar site after considering:</i> <ul style="list-style-type: none"> <li>a. <i>The revised marine modelling</i></li> <li>b. <i>The revised assessment of impacts on seagrass</i></li> </ul>	Conclusion in relation to Ramsar site after considering revised marine modelling and revised assessment of impacts on seagrass	Section 10 of Technical Report A: <i>Supplementary marine environment impact assessment</i>

#### 4.3.4 Method

To address Recommendation 9c of the Minister's Directions, the conclusions of the revised marine modelling were reviewed and compared with the findings of the ecology impact assessment in relation to the list of threatened and migratory bird species developed to address Ministers Direction 9a and 9b. As such this is an integrated assessment of impacts based on revised marine modelling and the list of threatened and migratory bird species defined in Section 4.1.

#### 4.3.5 Results

The revised marine modelling presented in Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment* (CEE, 2024) concluded that the additional information obtained in the supplementary marine studies confirms the conclusions in EES Technical Report A: *Marine ecology and water quality impact assessment*.

A summary of the findings from the original EES Technical Report A: *Supplementary marine environment impact assessment* and from supplementary statement Technical Report A: *Supplementary marine environment impact assessment* is presented in Table 4-7 below. These outcomes relate to Recommendation 3, 5, 7 and 8.

**Table 4-7 Summary of original EES and supplementary statement findings related to the marine environment**

Original marine EES study (CEE 2022)	Supplementary statement marine study (CEE 2024)
<b>Recommendation 3</b>	
<p><b>Method</b></p> <ul style="list-style-type: none"> <li>• In the original EES, the near-field model, together with the regional hydrodynamic model, was used to predict the path, initial dilution and extent of the discharge plumes close to the point of the existing refinery discharges.</li> <li>• Modelling was used to simulate existing and future discharges</li> <li>• A Computational Fluid Dynamics (CFD) field model was used to model temperature and chlorine discharge plumes close to the four existing refinery discharge outlets.</li> <li>• The CEE INITDIL near-field model was used to simulate the cold water discharge plume within 50 metres of the proposed diffuser on Refinery Pier.</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>• With the project in operation and the FSRU discharging cooled water into the refinery prior to discharge through the existing refinery outlets, the area of the modelling showed that the temperature plume along the shoreline would be smaller, and most of the plume would only be 1 to 2°C above ambient seawater temperature, as a result of the cooled water input from the FSRU.</li> <li>• The temperature plume would return to ambient temperature well before the Ramsar site.</li> <li>• Future chlorine discharges would be the same as existing discharges as the same volume and same concentration of residual chlorine would be discharged with the project in operation.</li> <li>• The diffuser would achieve a 20:1 dilution and to ensure that the discharge had a temperature change of less than 0.4°C from ambient to minimise the impact of the plume.</li> <li>• The diluted plume is slightly more dense than ambient seawater and would form a plume approximately 1 m thick on the seabed in the dredged shipping channel.</li> </ul>	<p><b>Method</b></p> <ul style="list-style-type: none"> <li>• As part of the supplementary statement, the near-field model was re-run using the refined regional hydrodynamic model.</li> <li>• An independent analysis of the near-field modelling was undertaken by Prof Lee, Director of the Croucher Laboratory of Environmental Hydraulics at the University of Hong Kong (an independent specialist modeller) using Visjet, a different near-field model.</li> <li>• The assertions made during the hearing on superelevation and other matters were assessed.</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>• The independent specialist modeller predicted the same dilution of 20:1 from the diffuser, matching the dilution predictions in the original EES and confirming the original findings.</li> <li>• Consistent with the original EES modelled findings, the temperature and chlorine levels in the plume from the diffuser would meet the DGV with a large factor of safety.</li> <li>• The predicted chlorine dilution of 20:1 would reduce the expected chlorine discharge concentrations from 50 µg/L to 2.5 µg/L, which is well below the guideline value of 10 µg/L. It is noted that in the original EES, a conservative chlorine concentration of 100 µg/L was assumed to discharge from the FSRU. This has been revised to 50 µg/L in the supplementary statement, as the refinery does not exceed chlorine discharges of 50 µg/L.</li> </ul>

Original marine EES study (CEE 2022)	Supplementary statement marine study (CEE 2024)
<ul style="list-style-type: none"> <li>The predicted chlorine concentration with the diffuser would be 5.4 µg/L, which is well below the (then) 7.2 µg/L guideline value for chlorine in marine waters.</li> </ul>	
<b>Recommendation 5</b>	
<p><b>Method</b></p> <ul style="list-style-type: none"> <li>The original EES assessed the potential for entrainment of plankton and fish larvae into the intake of the FSRU.</li> <li>A detailed survey of plankton (phytoplankton, zooplankton and ichthyoplankton (fish eggs and fish larvae)) in Corio Bay was conducted from November 2020 to November 2021. The survey assessed the type and spatial distribution of plankton and larvae in Corio Bay.</li> <li>The sampling included collection and identification of phytoplankton, zooplankton and ichthyoplankton at ten sites in Corio Bay, including the existing refinery seawater inlet, other sites around Corio Bay and the Geelong Arm of Port Phillip Bay.</li> <li>An analysis of the results showed that the plankton have similar composition and abundance throughout the Bay with no significant difference detected between plankton in North Corio, South Corio and the Geelong Arm.</li> <li>Entrainment modelling was undertaken to simulate the potential transport and dispersion of plankton and larvae from different regions of the Bay.</li> <li>Particles that entered the intake zone were counted and assumed to be entrained. The counts were made for 7-, 14- and 28-day periods after release and repeated for release at high tide and low tide.</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>The original EES concluded that the majority of fish larvae originating from the Ramsar site are dispersed into Port Phillip Bay as a result of currents and other physical processes.</li> <li>The proportion of plankton and larvae originating from the Ramsar site that would be entrained in the existing refinery seawater intake and the proposed FSRU intake would be no more than 0.13% and 0.27% respectively.</li> </ul>	<p><b>Method</b></p> <ul style="list-style-type: none"> <li>During the supplementary statement, an eDNA survey was undertaken to expand the list of fish species in Corio Bay, particularly smaller species.</li> <li>The IAC determined that re-running the plankton and larvae modelling using the refined hydrodynamic model would be prudent to assess whether the refined model resulted in any material impacts to entrainment of plankton and larvae.</li> <li>Additional information on fish species in Corio Bay was obtained from Professor Jenkins (Professorial Fellow in Fish Ecology at Melbourne University).</li> <li>The entrainment modelling from the original EES was re-run using the refined regional hydrodynamic model and further understanding of fish species present in Corio Bay.</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>The results from running the refined hydrodynamic model indicated that for the proportion of plankton and larvae originating from the Ramsar site, approximately the same percentage (0.12%) of particles (used as a proxy for plankton and larvae in the model) would be entrained in the existing refinery inlet and at a future FSRU intake. This correlates closely with the 0.13% entrainment predicted for the refinery intake in the original EES modelling and is slightly lower than the 0.27% predicted for the FSRU intake in the original modelling.</li> <li>Overall, it is concluded that there would not be a significant change in the proportion of fish eggs entrained with the FSRU in operation compared to the current entrainment in the existing refinery intake and that the proportion of fish eggs entrained is very small in relation to the natural processes of starvation and predation.</li> </ul>

Original marine EES study (CEE 2022)	Supplementary statement marine study (CEE 2024)
<ul style="list-style-type: none"> <li>This was considered inconsequential when compared with natural attrition rates and the EES concluded that operation of the FSRU would have negligible impact on plankton and larvae populations.</li> </ul>	<ul style="list-style-type: none"> <li>The supplementary modelling concluded that the project would have negligible impact on plankton and larvae populations and productivity, the food chain and in turn the ecological character of the Ramsar site and food availability for migratory shorebirds.</li> </ul>
Recommendation 6	
<p><b>Method</b></p> <ul style="list-style-type: none"> <li>The original EES marine studies modelled the likely movement and settlement of sediments released during the proposed 8-week dredging in and around Refinery Pier.</li> <li>The regional hydrodynamic model was used to simulate the dispersion and settling of fine sediments released by the project dredging and from disposal of dredge spoil from a barge at the dredged material ground in Port Phillip Bay.</li> <li>The model was configured to simulate four different sediment sizes including:                     <ul style="list-style-type: none"> <li>Clay with a particle size of 2 micron which makes up 46% of the dredged material.</li> <li>Silt with a particle size of 30 micron which makes up 17% of the dredged material.</li> <li>Fine sand with a particle size of 125 micron which makes up 12% of the dredged material.</li> <li>Sand with a diameter of 250 microns for the remaining 25% of the dredged material.</li> </ul> </li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>Suspended solids modelling predicted that there would be a small 7 ha patch of 5 mg/L suspended solids above ambient and a large 210 ha patch of 2 mg/L suspended solids above ambient at the surface during dredging.</li> <li>There would be larger patches and higher concentrations on the seabed.</li> </ul>	<p><b>Method</b></p> <ul style="list-style-type: none"> <li>The IAC recommended that the modelling of sediment transport and settlement associated with the proposed project dredging be rerun with the refined hydrodynamic model and adopting a ‘worst case’ scenario which assumed fine and very fine sediments with the slowest settlement times.</li> <li>The spill rates and settling velocity were refined using additional borehole data collected after the EES.</li> <li>The sediment transport model was updated to include:                     <ul style="list-style-type: none"> <li>Organic fines, with a settling velocity of 0.01 mm/s, making up 2% of the dredged material.</li> <li>Clay, with a settling velocity of 0.063 mm/s, making up 44% of the dredged material.</li> <li>Fine silt, with a settling velocity of 0.26 mm/s, making up 11% of the dredged material.</li> <li>Medium silt, with a settling velocity of 0.8 mm/s, making up 11% of the dredged material.</li> <li>Sand, with a settling velocity of 1 mm/s, making up 32% of the dredged material.</li> </ul> </li> <li>To verify the model, parameters from an independent sediment transport model completed following the Corio Bay Channel Improvement Program were used as a comparison.</li> </ul>

Original marine EES study (CEE 2022)	Supplementary statement marine study (CEE 2024)
<ul style="list-style-type: none"> <li>Modelling indicated the highest sediment accretion of 20 mm occurs on the seabed in the area to be dredged and deepened. Lower accretion rates of 2 to 10 mm would occur over a larger area surrounding the dredging zone.</li> <li>The rate of accretion (0.04 mm/day to 0.2 mm/day) would have negligible impact on the muddy seabed and the infauna or mobile marine communities.</li> <li>The implications of these sedimentation results from the modelling on marina biota is discussed under Recommendation 7.</li> </ul>	<p><b>Results</b></p> <ul style="list-style-type: none"> <li>The refined modelling indicates that there is a small area of 5 ha adjacent to the dredging area where the suspended solids concentration would be 5 mg/L above ambient and a large area of approximately 200 ha where the suspended solids concentration would be 2 mg/L above ambient.</li> <li>The comparison of the project model with an independent model previously used for modelling dredging in Corio Bay showed little difference between the predicted average concentrations.</li> <li>The rate of accretion results were much the same as in the EES.</li> <li>Both modelling programs predicted similar results.</li> <li>The predicted suspended solids levels are expected to cause minimal impacts.</li> </ul>
<b>Recommendation 7</b>	
<p><b>Method</b></p> <ul style="list-style-type: none"> <li>The method for predicting the increase in suspended solids in the original EES is described in more detail in Recommendation 6 in this report (and summarised above). The method involved using the original hydrodynamic model to predict the transport and settlement of sediments based on the various sediment particle sizes adopted.</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>The results of the modelling for the original EES indicated that suspended solids and turbidity would be limited to the proposed dredging area and immediate surrounds with the Ramsar site and central Corio Bay experiencing only a minor increase in turbidity.</li> <li>The area of predicted 5 mg/L suspended solids modelled in the original EES does not extend over any seagrass.</li> <li>The increase in turbidity and light attenuation could result in a temporary loss in productivity of a small area of deeper seagrass around the area to be dredged but within the tolerance range of seagrass as outlined in the Victorian Dredging Guidelines.</li> </ul>	<p><b>Method</b></p> <ul style="list-style-type: none"> <li>The IAC recommended that a minimum surface irradiance light threshold was applied to seagrass in the Ramsar site (20%) and Corio Bay (10%) to assess potential impacts of reduced light during dredging.</li> <li>The predicted suspended solids concentrations from Recommendation 6 were converted to a reduction in light using the equations listed in Appendix 5 of the Victorian Dredging Guidelines (EPA, 2001).</li> <li>WAMSI Dredging Science Node suggest an appropriate time scale for detecting impacts on seagrass is 2 weeks.</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>The highest average 14-day suspended solids concentration in the Ramsar site was 5.9 mg/L, including background.</li> <li>This corresponds to 22% light availability for seagrass in the Ramsar site meaning that all seagrass in the Ramsar site would receive more than the specified minimum 20% of available light during the dredging program and meets the IAC recommended threshold.</li> </ul>

Original marine EES study (CEE 2022)	Supplementary statement marine study (CEE 2024)
<ul style="list-style-type: none"> <li>The increase in turbidity and light attenuation could result in a minor loss in productivity of seagrass in deeper waters.</li> <li>The original EES concluded that while there could be minor losses of seagrass productivity over the 8 week dredging period, the levels of light attenuation and settlement of sediments predicted are well within the ranges experienced by seagrass and impacts would be minimal.</li> </ul>	<ul style="list-style-type: none"> <li>In summary, all seagrass in the Ramsar site (zero to 2 m depth) will always receive sufficient light for growth during the proposed dredging program.</li> <li>The highest average 14-day suspended solids concentration in Corio Bay seagrass at 4 m depth is 6.7mg/L.</li> <li>This corresponds to 14% light availability for seagrass in Corio Bay meaning that seagrass in Corio Bay would receive more than the specified minimum 10% of available light during the dredging program as recommended by the IAC.</li> <li>Deep sparse seagrass near the dredging area may experience a minor setback in growth rates during the 8-week period of dredging.</li> <li>Any seagrass growth slowed by turbidity would recover soon after completion of the dredging program.</li> <li>The modelling for a ‘worst case’ sediment scenario indicated that there would be no unacceptable impacts on seagrass from light attenuation both in the Ramsar site and Corio Bay and supports the original EES findings.</li> </ul>
<b>Recommendation 8</b>	
<p><b>Method</b></p> <ul style="list-style-type: none"> <li>The original EES determined that the pathways for an impact of dredging on the Ramsar site would be direct removal of seagrass, impacts associated with temperature and chlorine discharges for the project or an increase in turbidity and light attenuation over the seagrass beds within the Ramsar site boundary.</li> <li>The methods used to assess seagrass impacts in the Ramsar site in the original EES are described below and involved an assessment of temperature and chlorine plumes from discharges, sediment transport and accretion and light attenuation associated with dredging.</li> <li>The proposed dredging at refinery pier would not involve any removal of seagrass.</li> </ul>	<p><b>Method</b></p> <ul style="list-style-type: none"> <li>The methods used to conduct the additional assessments in the supplementary statement involve use of a refined hydrodynamic model and conservative parameters for sediment sizing and light attenuation thresholds.</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>The area predicted to have 5 mg/L median suspended solids is approximately 5 ha.</li> <li>The 5 mg/L suspended solids contour would not extend into the Ramsar site and would not have any impact on seagrass in the site.</li> </ul>

Original marine EES study (CEE 2022)	Supplementary statement marine study (CEE 2024)
<ul style="list-style-type: none"> <li>• The assessment of whether temperature and chlorine impact would potentially impact on seagrass in the Ramsar site is described in the response to Recommendation 1 in this supplementary report and summarised in this table above.</li> <li>• The assessment of whether sedimentation from dredging would impact the Ramsar site is described as part of Recommendation 1 (seagrass surveys and mapping), Recommendation 6 (Sediment transport modelling) and Recommendation 7 (Further assessment of dredging on seagrass).</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>• The original EES modelling indicated that the median 5 mg/L suspended solids contour would not extend into the Ramsar site.</li> <li>• The original EES findings showed that the level of sedimentation expected in the Ramsar site are well within the tolerance ranges of by seagrass and there would be no material impacts on the Ramsar seagrass beds or to the Ramsar values.</li> <li>• There would be no reduction in the area of seagrass or seagrass health in the Ramsar site. The predicted increases in turbidity would occur within the limited 8-week dredging period and impacts would recover quickly post dredging.</li> </ul>	<ul style="list-style-type: none"> <li>• The highest average suspended solids concentration predicted at the outer edge of the Ramsar site is approximately 3 mg/L which is well within the tolerance ranges experienced by seagrass and there would be no material impacts on the Ramsar seagrass beds or to the Ramsar values.</li> <li>• There would be no reduction in the area of seagrass or seagrass health in the Ramsar site.</li> <li>• The predicted increases in turbidity would occur within the limited 8-week dredging period.</li> <li>• This could have a minor effect in slowing the growth of seagrass in deeper waters near the dredging but the impact would be too small to be measured and of no ecological consequence.</li> <li>• There is no change to the conclusion in the original EES that dredging would not impact the Ramsar site.</li> </ul>



#### 4.3.5.1 Discharge to the marine environment

Risk identified in EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) was:

*Regasification of LNG (conversion back to a gaseous state) onboard the FSRU using seawater as a heat source requires the discharge of cooled seawater which contains chlorine.*

*Cooled seawater from the FSRU regasification process would then be piped to the existing refinery seawater intake for reuse within the refinery as cooling water. The seawater would be discharged back to Corio Bay via the four existing discharge points known as W1, W3, W4 and W5.*

*Occasionally if [parts of] the refinery [are shutdown] for maintenance [significant shutdowns occur every second year for two to three months, however cooling water is still required for the operational part of the refinery and the diffuser may not be required] or another reason, the seawater from the FSRU would be directly discharged to Corio Bay through a diffuser installed under the new pier. It is not anticipated that discharge through the diffuser would be a common [regular] occurrence.*

*Closed loop mode of operation is not anticipated to be a common occurrence [only in the very unlikely event that the FSRU was unable to discharge water through the seawater transfer pipe to the refinery] but would involve less water being discharged to Corio Bay as water is recycled within the vessel. However, the closed loop would require excess heat to be discharged as a warm water plume and additional air emissions as LNG would be used to fuel the boilers.*

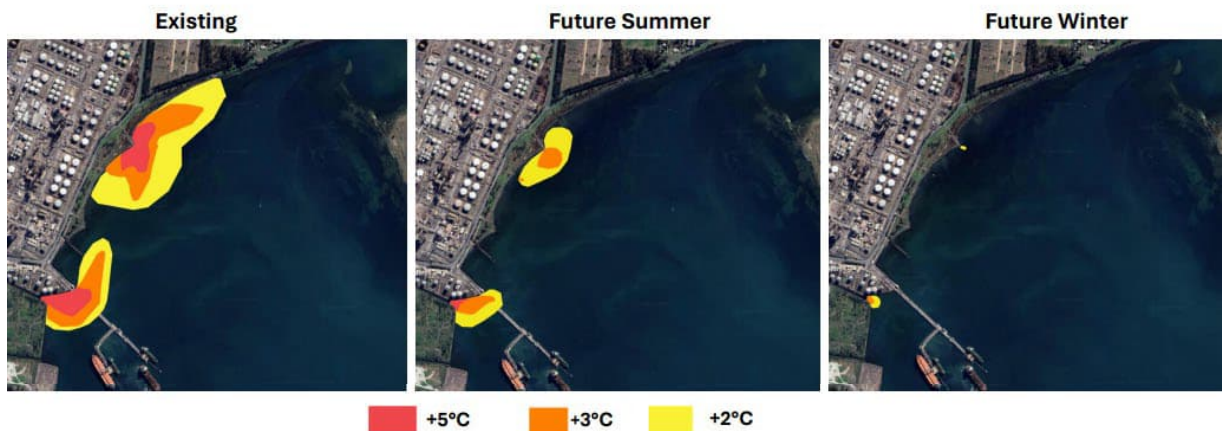
*Potential impacts associated with discharge of water used for regasification of the LNG from the FSRU would relate to changes in temperature and chlorine levels in the waters of Corio Bay. Changes in temperature and chlorine levels could affect seagrass extent and food sources for migratory shorebirds and other waterbirds.*

Recommendation 3 of the Minister's Directions required the supplementary marine study to re-run the diffuser modelling after consideration of the matters raised by Dr McCowan and with the refined hydrodynamic model as well as re-run the wastewater discharge modelling with the revised regional hydrodynamic model. This has been completed and is presented in Section 5 of Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment*. The report concludes:

*The near-field modelling was repeated by an independent specialist modeller in Hong Kong using a different model from the three models used previously. The dilution predicted by the independent near-field model is essentially the same initial dilution of 20:1 as predicted in the modelling conducted for the original EES and provides an additional level of assurance. At this point, four different near-field jet models have been used and all give the same results.*

*The regional plume modelling was repeated for the discharges from the diffuser using the refined hydrodynamic model with the FSRU included in the model grid. The repeated modelling predicted the same results as in the EES. The assertions made in written evidence D75 are not supported by the results. The predicted temperature contour of 0.5°C is well below the DGV of 2°C for temperature variations in Corio Bay. The predicted chlorine contour of 3 µg/L is well below the DGV of 10 µg/L for chlorine in Corio Bay.*

*The regional plume modelling was repeated for the existing discharges from the refinery wastewater discharge points and the future discharges from the refinery wastewater discharge points with the refinery and FSRU in operation using the refined hydrodynamic model. It was determined that the future plumes would be smaller than the existing plumes as per the figure below.*



**Figure 4-7 Existing and future modelled refinery discharges**

As the repeated regional plume modelling predicted the same (or reduced impact) results as presented in EES Technical Report A: *Marine*, the conclusions reached in EES Technical Report D: *Terrestrial ecology impact assessment* in relation to ecology remain the same. Those conclusions were that no residual impacts on the Ramsar site are anticipated as a result of discharges to the marine environment as the discharges are remote from both Limeburners Bay and the Ramsar site. Discharge to the marine environment during operation of the FSRU is unlikely to affect seagrass meadows or food resources for threatened and/or migratory seabirds or shorebirds.

An extract from Section 6.2.1 of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) is provided below:

*Discharge through the refinery*

*The project involves recycling of water used in the regasification of LNG in the FSRU through the refinery as cooling water resulting in a discharge which is very similar to that discharged from the refinery for more than 60 years (CEE, 2021). The project discharge through the refinery will have the same low levels of residual chlorine as the current refinery discharge and a water temperature closer to ambient in Corio Bay than the current discharge. The marine investigations showed that the existing refinery chlorine concentrations along the shoreline adjacent to the four current discharge points would not be altered by the discharge of recycled FSRU regasification water via the refinery as the chlorine dosing for the refinery would remain the same (CEE, 2021). The existing plume does not extend to Limeburners Bay or the Ramsar site and would not do so once the project was operational. For further detail, refer to Technical Report A: Marine ecology and water quality impact assessment (CEE, 2021).*

*Reuse of cooled seawater from the FSRU within the refinery would reduce the existing temperature difference between the current refinery discharge and Corio Bay (CEE, 2021). Currently, water is discharged to Corio Bay approximately 8 to 10°C above ambient seawater temperature. Cooled seawater to be discharged from the FSRU into the refinery would be approximately 1 to 3°C above ambient seawater temperature once it is discharged to Corio Bay, improving the temperature difference by approximately 7°C. For further detail refer to Technical Report A: Marine ecology and water quality impact assessment (CEE, 2021).*

*The existing Geelong Refinery has been discharging warm water and low levels of chlorine into Corio Bay for over 60 years providing an ideal opportunity for the EES technical studies to assess the impacts of this discharge as a baseline for assessing potential project impacts. The studies found a healthy marine ecosystem offshore from the refinery discharge indicating that historical discharges have not have adverse effects on the marine environment (CEE, 2021). On this basis, there is strong empirical evidence (current healthy marine ecosystem) to suggest that the project discharge would not have adverse impacts on seagrass or on the food chain supporting terrestrial shorebirds and other waterbirds in Corio Bay and the Ramsar wetland. The FSRU water intake was found to have little to no impact on the availability of plankton and larvae as food sources*

*within Corio Bay and at the Ramsar site. (Refer to Technical Report A: Marine ecology and water quality impact assessment).*

#### *Discharge through diffuser or closed loop operation*

*As outlined in the project description of this EES, there may be times when the cooled water discharge from the FSRU needs to be discharged directly into Corio Bay. This could occur when the refinery is partially shut down for maintenance or if the refinery was decommissioned at some point in the future. During operational life of the refinery, direct discharges to the Bay would be an uncommon occurrence. Direct discharges of the cooled water from the FSRU would be via a long diffuser located on the Refinery Pier extension. The EES studies included modelling of this discharge which results in a small cold water plume in the vicinity of the FSRU due to the high level of mixing achieved via the diffuser. The plume sinks to the seabed in the dredged shipping channel and is remote from both Limeburners Bay and the Ramsar site and is not anticipated to have any adverse impacts on seagrass beds which are not present in the vicinity or on food chain species (Refer to Technical Report A: Marine ecology and water quality impact assessment).*

#### **4.3.5.2 Sediment mobilisation**

Risk identified in EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) was:

*Sediment mobilisation through dredging leads to increased turbidity of the water column (referred to as suspended solids) and release of nutrients and contaminants and sedimentation as suspended solids settle on the seabed.*

*Suspended solids can influence the distribution of seagrass through increased light attenuation (reduced light transmission) of the water column and smothering as the sediment settles on the seabed.*

*A reduction in density or extent of seagrass could have implications for the food web for migratory shorebirds.*

Recommendation 6 of the Minister's Direction required the supplementary marine study to re-run the sediment transport modelling with revised inputs using the refined hydrodynamic model.

Minister's Direction Recommendation 7 was to undertake further assessment of dredging impacts on seagrass based on the revised sediment transport modelling (to address Recommendation 6), revised light thresholds of 10% to 20% surface irradiance (20% surface irradiance should be applied to any sediment plumes that extend to the Port Phillip Bay (western shoreline) and Bellarine Peninsular Ramsar Site) and updated seagrass mapping completed for Recommendation 1b.

#### **Updated sediment modelling**

The sediment transport modelling was completed using the updated regional hydrodynamic model, including the updated wind file. Section 8.4 and Section 10.3.2 in Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment* conclude that the updated sediment modelling shows only minor changes from the results reported in the EES. The extent of suspended sediment covers much the same area as shown in the EES with low concentrations of suspended solids (SS) at the edge of the Ramsar site (CEE 2024).

Figure 4-8 shows the predicted increase in median suspended solids concentration in the surface layer (surface to 2 m depth) due to dredging over 8 weeks from the refined hydrodynamic model and the seagrass distribution zones. There is a small area of 5 ha adjacent to the dredging area where the suspended solids concentration would be 5 mg/L above ambient and a large area of approximately 200 ha where the suspended solids concentration would be 2 mg/L above ambient. The average concentrations in this layer are represented by the concentrations at 1 m depth (CEE 2024). The area of elevated SS in the surface waters is well away from the seagrass as shown in Figure 4-8. The proposed dredging at refinery pier would not remove any seagrass beds. There would be limited seagrass removal during the trenching of the seawater transfer pipe (refer to Section 5.1.3). This predicted increase in median suspended solids concentration at the surface is slightly less than what was predicted in the original EES, which modelled a small 7 ha patch of 5 mg/L suspended solids above ambient and a large 210 ha patch of 2 mg/L suspended solids above ambient at the surface during dredging.

Figure 4-9 shows the predicted SS concentration at the seabed. The orange indicates the area predicted to be affected by 20 mg/L median suspended solids (15 ha) and the pink indicates 5 mg/l median suspended solids (40 ha). There would be higher SS concentrations at the seabed, as expected, because the sediment is settling out of the water column to the seabed. The 5 mg/L SS covers a seabed area of 40 ha, predominantly in the port zone and offshore from the seagrass meadows, and the 2 mg/L SS covers a seabed area of 265 ha.

The accretion of sediment on seagrass beds in the Ramsar site is from zero to 2 mm which is expected to have negligible to very minor impact as seagrass naturally traps and accumulates sediment.



Figure 4-8 Suspended solids plume (at the surface) and seagrass beds



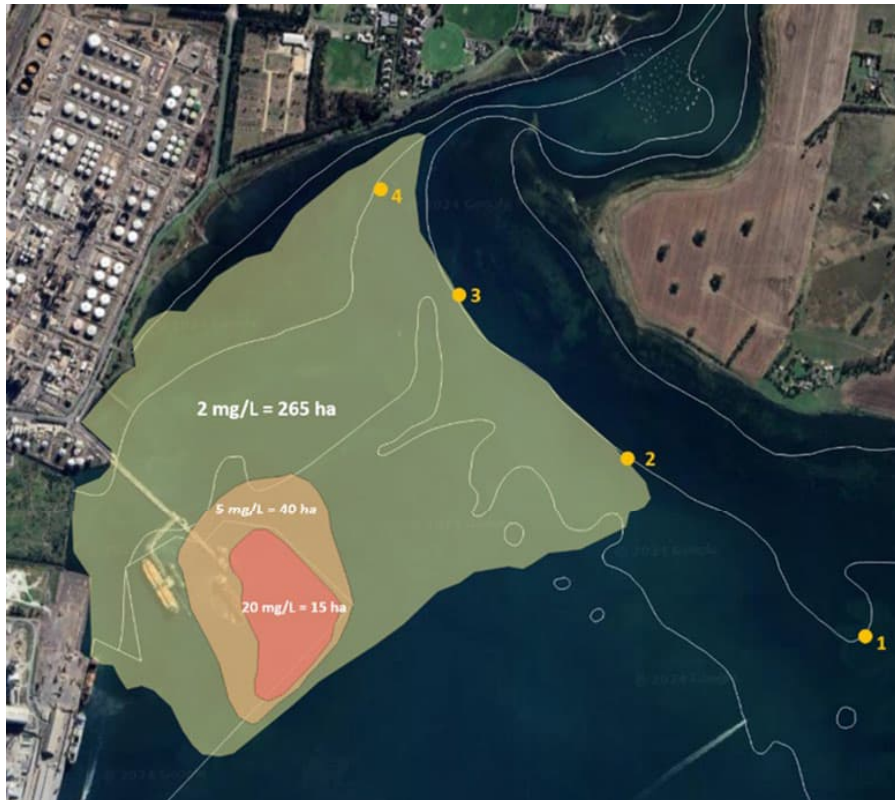


Figure 4-9 Median SS Concentration at the Seabed (Extract of Figure 4-13 from CEE 2024)

### Potential impacts on seagrass

The IAC recommended that the seagrass in the Ramsar site receive a minimum of 20% surface irradiance and 10% surface irradiance for the rest of Corio Bay.

Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment* CEE (2024) concluded the following in relation to the assessment of light levels for seagrass (taken from Section 9.4 and Section 10.3.2):

- The dredging is not expected to have any impact on intertidal seagrass, as that seagrass is exposed to high light intensity every low tide (during daylight hours).
- All seagrass in the Ramsar site will receive more than 20% of available light during the dredging program. Peak 14-day average SS concentrations of 5.9 mg/L corresponds to 22% of available light, exceeding the 20% minimum set by the IAC. The 14-day average SS concentration was set based on McMahon et al. (2017) and Chartrand et al. (2012) cited as suggesting an appropriate time scale for monitoring and detecting impacts on seagrass is 2 weeks.
- Seagrass at a site outside the Ramsar site and closer to the dredging will receive at least 14% of available light which is more light than the limit of 10% of surface irradiance suggested by the IAC.
- Microphytobenthos (MPB) are small algae that grow on the seabed and can grow at depths where there is only 4% of surface light and are unlikely to be affected by the minor increase in turbidity in the Ramsar site.
- Deep sparse seagrass near the dredging site may experience a setback in growth rates during the dredging period. Experiments at Western Australian Marine Science Institution (WAMSI) on *Halophila ovalis* led to recommended light thresholds of 2.3  $\mu\text{mol}/\text{m}^2\cdot\text{d}$  over 9 weeks and only 0.9  $\mu\text{mol}/\text{m}^2\cdot\text{d}$  over 3 weeks. These thresholds suggest no effect of *Halophila* in an 8-week dredging program with intermittent turbidity peaks.



- All seagrass will recover rapidly to normal growth after completion of the 8-week dredging program. Recovery of seagrass following periods of reduced light, due to dredging or floods, is well established. Where the rhizomes are not damaged, recovery occurs rapidly – in less than 2 months (Vanderklift, 2017).

Overall, the predictions show that little suspended solids or turbidity will enter Limeburners Bay and there would be no significant impact to seagrass. As such, it can be concluded that dredging will not affect Critical Processes and Services of the Ramsar site.

Conclusions reached in EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) and EES Technical Report D: Addendum – Peer Review (AECOM 2022b) therefore remain unchanged that dredging activity is unlikely to affect the Ramsar site, seagrass meadows or threatened and/or migratory seabird or shorebird food resources.

#### 4.3.5.3 Entrainment

Risk identified in EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a):

*Entrainment is the unwanted passage of fish through a water intake. Entrainment of fish larvae or plankton that may spawn in the Ramsar site including Limeburners Bay may affect the food web and in turn the ecological character of the Ramsar site and food availability for migratory shorebirds.*

CEE (2024) presents the re-run of the entrainment modelling with revised inputs based on the refined hydrodynamic model. The report concludes the following:

*The refinery seawater intake has been capturing a very small proportion of ichthyoplankton in Corio Bay for the last 60 years. Transfer of the seawater intake to the FSRU is predicted to not change the proportion of fish eggs that are entrained. The very small number of ichthyoplankton captured has negligible effect on plankton and fish populations in Corio Bay, or on the availability of ichthyoplankton as food in the Ramsar Zone.*

*The results are very similar to the previous entrainment predictions presented in the EES.*

This means the conclusions reached in EES Technical Report D: *Terrestrial ecology impact assessment* and EES Technical Report D: Addendum remain unchanged that the potential entrainment of fish larvae and plankton from the Ramsar site and Limeburners Bay is negligible (CEE, 2021). The previous entrainment predictions summarised in Technical Report D were that the estimated amount of plankton entrained by the FSRU compared to all plankton in Corio Bay was less than 0.1% of the total. This <0.1% is negligible as this is quite small in relation to natural mortality rates that are around 99%. The potential entrainment of fish larvae after 28 days is less than 0.5%, which is small in comparison to natural predation and mortality rates.

As such no residual impacts on the ecological character of the Ramsar site or food availability for threatened and/or migratory seabirds or shorebirds are anticipated as a result of entrainment during operation of the FSRU.

#### 4.3.6 Conclusion

Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment* conclude that the revised marine modelling shows no change to the EES conclusions in EES Technical Report A: *Marine ecology and water quality impact assessment*. Consequently, the conclusions of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) and EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b) remain unchanged and apply to the consolidated list of migratory and/or threatened birds prepared to address Ministers Direction 9a and 9b. Those conclusions are:

- Discharges to the marine environment during operation of the FSRU is unlikely to affect seagrass meadows or food resources for threatened and/or migratory seabirds or shorebirds. The EES concluded the following in relation to the two discharge scenarios.
- Discharge through the existing refinery.
- The existing chlorine plume from the refinery would remain the same and does not extend to Limeburners Bay or the Ramsar site.

- Reuse of cooled seawater from the FSRU within the refinery would reduce the existing temperature difference between the current refinery discharge and Corio Bay.
- A healthy marine ecosystem was found offshore from the refinery discharge of warm water and low levels of chlorine into Corio Bay which has been occurring for over 60 years. Given the historical discharges have not had adverse effects on the marine environment, the project discharge would not have adverse impacts on seagrass or on the food chain (availability of plankton and larvae as food sources) supporting terrestrial shorebirds and other waterbirds in Corio Bay and the Ramsar wetland.
- Direct discharge from FSRU to Corio Bay through diffuser or closed loop operation (an uncommon occurrence during operation).
- A small cold water plume in the vicinity of the FSRU due to the high level of mixing achieved via the diffuser. The plume sinks to the seabed in the dredged shipping channel and is remote from both Limeburners Bay and the Ramsar site and is not anticipated to have any adverse impacts on seagrass beds, which are not present in the vicinity, or on food chain species.
- All seagrass in the Ramsar Zone (zero to 2 m depth) will always receive sufficient light for growth. The extent of suspended sediment covers much the same area as shown in the EES with low concentrations of suspended solids (SS) at the edge of the Ramsar site.
- Potential entrainment of fish larvae and plankton from the Ramsar site and Limeburners Bay is negligible.

As such no residual impacts on seagrass or food availability for threatened and/or migratory birds or the Ramsar site are anticipated as a result of sediment mobilisation during construction or discharge to the marine environment or entrainment during operation of the FSRU.

## 5.0 Integrated Assessment

An integrated assessment of potential impacts on threatened and/or migratory birds are described below for the project area (terrestrial), project area (marine) and offsite environment.

Revised marine modelling has not increased potential impacts on the marine environment and therefore the Ramsar site, migratory or marine birds from those presented in the EES Technical Report D: *Terrestrial ecology impact assessment* and Technical Report D: *Addendum – Peer Review* report. Analysis of the shorebird data has not changed the status of the Ramsar site as a nationally and internationally significant wetland (see Section 4.2).

Establishing a peer reviewed list of threatened and/or migratory birds that may occur (Section 4.1) does not affect these conclusions.

### 5.1 Potential impacts on threatened and/or migratory birds

Section 6 of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) described the potential impacts on ecological values onsite (associated with the pipeline) and offsite (associated with Corio Bay/ Ramsar site).

The assessment considered the following impact pathways for terrestrial ecology impacts associated with the pipeline alignment:

- Ecological impact (flora and fauna) from pipeline within construction footprint.
- Ecological impact (flora and fauna) from pipeline encroaching on native grassland reserve.
- Injury to sensitive and native fauna from construction activities.
- Night lighting disturbing native fauna.
- Introduction/spread of weeds & disease during construction (biosecurity) from movement of vehicles.
- Operational activities (including noise and lighting) impact on non-marine fauna.

Potential impacts associated with the FSRU and potential changes to the marine environment that may affect intertidal areas and the ecological character of the Ramsar site considered in EES Technical Report D: *Terrestrial ecology impact assessment* included:

- Plumes of turbid water generated during dredging impacting on environmentally sensitive areas within Corio Bay.
- Noise associated with construction (dredging and pile installation) and operation.
- Changes to water quality (chlorine) and temperature (water discharge).
- Light disrupting movement of birds.
- Additional shipping movements and associated risk of fuel and chemical spills and marine pest introductions.

#### 5.1.1 Project area (terrestrial)

A small extent of marginal habitat occurs along the foreshore, the swale drain on Macgregor Court and around the dam near Lara City Gate for FFG Act listed Great Egret. These habitats are avoided by the construction footprint and, as such, Eastern Great Egret is unlikely to be affected by the project.

Raptors (Black Falcon, White-bellied Sea-eagle, Little Eagle) may hunt over the Project Area. Little Eagle may nest in the area (Nature Advisory, 2022) although there are very few, if any, large trees within 200m of the pipeline. Construction of the pipeline is unlikely to affect raptors as the species are highly mobile and hunt over large areas.

Fork-tailed Swift and White-throated Needle-tail may forage over the Project Area or may on rare occasions loaf or roost in trees. The construction footprint avoids most planted trees but will remove a maximum of 0.354 ha of planted overstorey trees. Foraging and loafing resources are available

elsewhere in the landscape and these species are highly mobile. As such, they are unlikely to be affected by the project.

Swift Parrot and Gang-gang Cockatoo are highly mobile species that may use planted native trees for winter foraging on an occasional and opportunistic basis. Narrow strips of mixed native, non-indigenous trees occur along the pipeline alignment between School Road and Torresdale Road (Figure 3-1 in Section 3.2) as described in Section 5.1.2.3 of EES Technical Report A: *Terrestrial ecology impact assessment*. The construction footprint avoids most planted trees and planted trees extend beyond the construction footprint for the project. Gang-gang Cockatoo and Swift Parrot are unlikely to be significantly impacted by the loss of a maximum of 0.354 ha of planted overstorey trees as foraging resources are available elsewhere in the landscape.

Rufous Fantail may occur on occasion when on passage from south-eastern Australia to spend winter in northern Australia. Foraging and loafing resources are available elsewhere in the landscape and the species is highly mobile. As such, it is unlikely to be affected by the project.

### 5.1.2 Project area (marine)

Threatened and/or migratory terns and the White-bellied Sea-eagle may forage along the shoreline and over the marine waters of the Project Area on occasion as part of wider activity in the surrounding (offsite) marine environment. However, human activity associated with the existing refinery and pier is likely to discourage regular occurrence of these species.

As such, construction and operation of the project is unlikely to significantly affect these species.

### 5.1.3 Offsite environment

#### Potential impact on migratory shorebirds and seabirds

Offshore construction activities of most relevance to potential impacts on migratory shorebirds and seabirds are dredging and construction of the new pier arm and berthing infrastructure once dredging is complete. The potential for impact relates to sediment mobilisation during dredging that may affect seagrass meadows and the food web for marine and intertidal birds and noise and lighting which may cause disturbance to the surrounding marine environment.

Potential impacts associated with operation of the FSRU relate primarily to discharge of seawater to the marine environment and operation noise and lighting, but also entrainment and increased shipping movements.

The revised marine modelling undertaken by the supplementary marine study considered sediment mobilisation during construction or discharge to the marine environment or entrainment during operation of the FSRU. The revised marine modelling showed no change to the EES conclusions as outlined in Section 4.3.

Potential impacts on threatened and/or migratory birds (shorebirds and seabirds) are summarised below integrating the findings of this supplementary report with the impact assessment for the offsite environment provided in EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a) and EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b). As noise, light and additional shipping movements are not discussed elsewhere in this report, some additional detail has been provided from Technical Report D: *Terrestrial ecology impact assessment* for context.

#### *Sediment mobilisation*

Dredging activity is unlikely to affect seagrass meadows or food resources (see Section 4.3.5.2). As such, dredging is unlikely to change the ecological character of the Ramsar site or affect the availability of food for migratory shorebirds, seabirds or other waterbirds.

#### *Discharge to the marine environment*

Discharge to the marine environment from the FSRU during operation is unlikely to affect seagrass or the availability of plankton or larvae as food sources within Corio Bay and at the Ramsar site (see Section 4.3.5.1). This is because:

- Discharge through the existing refinery would not change the existing chlorine plume from the refinery that does not currently extend to Limeburners Bay or the Ramsar site. Reuse of cooled seawater from the FSRU within the refinery would reduce the existing temperature difference

between the current refinery discharge and Corio Bay and the historical (and therefore) project discharge, which has not had adverse effects on the marine ecosystem. Therefore, this would not have adverse impacts on seagrass or the availability of food for threatened and/or migratory shorebirds and other waterbirds in Corio Bay and the Ramsar wetland.

- The absence of detectable concentrations of chlorine by-products in both wild and translocated mussels suggest that there is no evidence that there is a significant risk to fish, bird, or other biota from the existing chlorine discharges from the refinery to Corio Bay (refer to Section 6.5 of Technical Report A: *Supplementary marine environment impact assessment*).
- Direct discharge from FSRU to Corio Bay (which would be an uncommon occurrence during operation) would result in a small cold water plume that sinks to the seabed in the dredged shipping channel remote from both Limeburners Bay and the Ramsar site and seagrass beds.

#### *Entrainment*

Potential entrainment of fish larvae and plankton from the Ramsar site and Limeburners Bay is negligible (see Section 4.3.5.3). No impacts on the ecological character of the Ramsar site or food availability for migratory shorebirds are therefore anticipated as a result of operation of the FSRU.

#### *Seagrass removal*

Seagrass mapping undertaken in supplementary statement Technical Report A: *Supplementary marine environment impact assessment* identified the potential removal/disturbance of approximately 0.5 ha of seagrass as a result of excavation of a shallow trench for installation of the seawater transfer pipe (Figure 5-1).

Approximately 0.3 ha of seagrass would be directly removed and a further 0.2 ha would be smothered as the excavated sediment is placed on the seabed adjacent to the trench. Only seagrass within the subtidal area at 2 m depth will be affected. Mapping indicates that the seagrass which would be potentially disturbed/removed would primarily be a mixture of *Halophila australis* (Halophila) and *Heterozostera nigricaulis* (*H. nigricaulis*). *H. nigricaulis* is listed as endangered under the FFG Act. The seagrass surveys undertaken Technical Report A: *Supplementary marine environment impact assessment* show very little *H. nigricaulis* around the mouth of the intake with a small area with moderate to dense cover further offshore along the alignment.

Loss of seagrass to install the seawater transfer pipe is unlikely to affect threatened and/or migratory shorebirds or seabirds, or Black Swan. This is because the area of impact is localised and small in extent (0.5 ha), the seagrass to be removed is at 2 m depth in the subtidal and not intertidal zone (and therefore not accessible) and the loss would be temporary. Seagrasses would regrow from rhizomes and plants adjacent to the cleared strip and it is anticipated that at three years after pipe installation, seagrass cover would be the same as elsewhere in Corio Bay.

Overall, the localised and temporary loss of a small area of seagrass is unlikely to affect the food web to the extent that migratory shorebirds, seabirds or Black Swan would be impacted.

Secondary approval requirements for the removal of seagrass are discussed in Technical Report A: *Supplementary marine environment impact assessment*.



Figure 5-1 Seawater transfer pipe location in relation to seagrass distribution in Corio Bay (2023 – 2024)



## Noise

Noise during construction of the pier extension and infrastructure and operation of the FSRU is unlikely to affect the foraging behaviour of migratory shorebirds or seabirds as maximum predicted noise levels are modelled to be within the range of existing ambient noise levels experienced on the foreshore near Geelong Grammar School and in the Avalon area (and therefore the Ramsar site).

Noise modelling was undertaken during the EES for construction of the refinery pier extension and operation of the FSRU and was presented in EES Technical Report I: *Noise and vibration impact assessment*. Modelled scenarios for operation of the FSRU were updated in Appendix D of Supplementary Statement Technical Report D: *Supplementary noise impact assessment* to better reflect proposed operations and noise reduction obtained through design optimisation. The modelling still considered 'worst case' noise propagating weather conditions and the FSRU closed loop operating scenario included in the original EES noise modelling.

Noise modelling presented here is therefore based on EES Technical Report I: *Noise and vibration impact assessment* for construction of the refinery pier extension and infrastructure and Supplementary Statement Technical Report D: *Supplementary noise impact assessment* for operation. The noise modelling concludes the following:

- Construction: The maximum predicted construction noise level is associated with piling and would be 49 dB at Geelong Grammar School and 46 dB in the Avalon area. Maximum predicted noise level during dredging works is 45 dB(A) at Geelong Grammar School and 43 dB(A) in the Avalon area.
- Operation: The predicted operational noise levels at Geelong Grammar School are 39 to 43 dB(A) and Avalon foreshore are 36 to 40 dB(A).

Existing noise levels on the foreshore near Geelong Grammar School range between 57 and 46 dB(A) across day, evening and nighttime periods based on the findings in Section 4.1 of Supplementary Statement Technical Report D: *Supplementary noise impact assessment*. In the Avalon foreshore area the existing ambient noise levels range between 46 and 45 dB(A).

Construction noise levels would therefore be within the range of existing ambient noise levels on the foreshore near Geelong Grammar School and in the Avalon area. Although the level at Avalon would be at the higher end of existing ambient noise levels, piling would not be undertaken at night when ambient noise levels are quietest. Construction noise will also be temporary.

Operational noise levels would be lower than ambient noise levels currently experienced on the foreshore near Geelong Grammar School and in the Avalon area. The source of noise during operation would be regular (which means wildlife are more likely to habituate) and >1.4 km away from Limeburners Bay and >3 km from the former Avalon Saltworks.

Construction and operation would therefore be unlikely to alter noise levels in the Ramsar site above those currently being experienced. The predicted noise levels during both construction and operation are also considerably lower than the >60 dB(A) levels at which responses have been detected in birds in the examples provided in Section 6.1.2.2 of EES Technical Report D: *Terrestrial ecology impact assessment* provided here for ease of reference:

*In Australia there is little data on the effects of noise on fauna. Weston et al., (1995) conducted a study on the effects of aircraft noise on birds at Avalon, Victoria and found that the likelihood of a response resulting in birds taking flight increased when the noise levels from fixed-wing aircraft or helicopters exceeded 80dB(A). In addition, some birds exhibited a response at noise levels down to 60 dB(A) (Weston et. al., 1995). No significant effect of jet overflights at levels of 55-110 dB(A) were reported on wading birds (Black et al. 1984). Crested terns in Australia showed escape behaviours following exposure to pre-recorded aircraft noise at levels of 85 dB(A) (Brown, 1990).*

Construction of the pier extension and infrastructure and operation of the FSRU were therefore unlikely to affect the ecological character of the Ramsar site or the foraging behaviour of migratory shorebirds.

Noise from construction and operation of the FSRU is also unlikely to significantly affect seabirds in Corio Bay. Seabirds identified in EES Technical Report D: *Addendum – Peer Review* and in the updated list in Section 4.1.5 and Appendix A of this report are unlikely to be reliant on Corio Bay as their sole foraging resource. Most of the seabird species primarily inhabit the open oceans rather than bays

and are therefore more likely to be occasional visitors to Corio Bay. Those species tend to breed in colonies on offshore islands therefore their occurrence in the marine environment associated with the project is limited to occasional foraging, which therefore reduces their potential to be impacted. Terns occur more regularly in Corio Bay and may also occur in the project area (marine) and are therefore the species with the most potential to be affected by noise.

Extensive foraging areas exist through Corio Bay and Port Phillip Bay beyond nearby sensitive receptors and seabirds are highly mobile and can therefore move away from the area if necessary. Terns currently roost on the seawater intake structure next to the existing pier and are already exposed to human activity. Consequently, terns are possibly habituated to that source of disturbance.

### Light

Light associated with construction and operation of the project in the existing modified environment is unlikely to significantly affect migratory shorebirds or seabirds. Lighting requirements for safety and security during construction will be localised, temporary and in the context of an environment already subject to artificial lighting. Lighting associated with operation would be contained to the vicinity of the pier and FSRU and LNG carriers as shown in Figure 5-2 which was presented as Figure 9 in EES Technical Report D: *Addendum – Peer Review* (AECOM 2022b) extracted from EES Technical Report J: *Landscape and visual impact assessment*. The most prominent lighting would be on the LNG carrier associated with the bridge and this lighting faces downwards onto the foredeck. With bows facing south-east, this more prominent lighting would not be directly noticeable from Foreshore Road (Geelong Grammar School) or the Ramsar site.

As light spill will be localised (Figure 5-2) and in an environment already subject to artificial lighting, seabirds, migratory shorebird habitat and ecological character of the Ramsar site are unlikely to be affected by light during construction and operation.

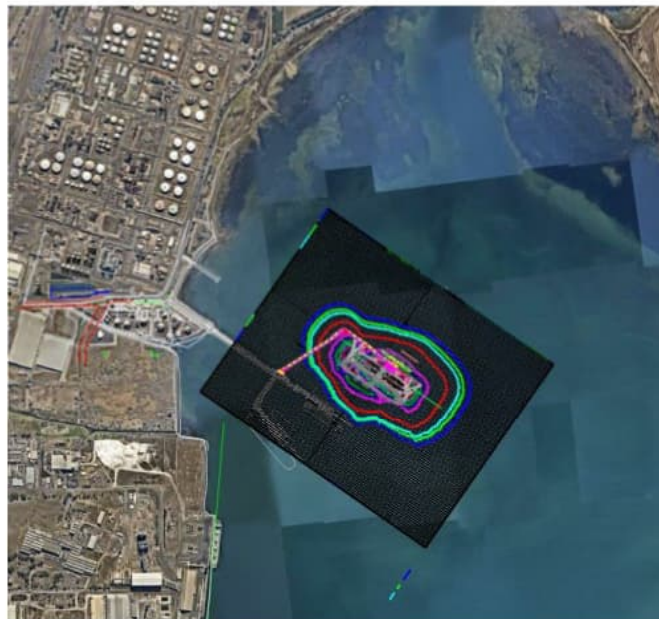


Figure 5-2 Light modelling for FSRU and LNG carrier concurrently berth at new pier extension

### Additional shipping movements

Technical Report D: *Terrestrial ecology impact assessment* concluded that additional shipping movements are not anticipated to affect the ecological character of the Ramsar site or food availability as risk of fuel and chemical spills from the FSRU or LNG carriers is low and risk of introduction of pest species attached to the hull or in the ballast of the LNG carriers is no greater than for other international vessels that enter Port Phillip Bay.

Technical Report D: *Addendum – Peer Review* concluded that seabirds may temporarily suspend foraging while LNG carriers pass, although normal behaviour is likely to resume within the same day

(Agness et al. 2008). In the context of existing ship movements into and out of the Port of Geelong, the addition of up to 45 additional ships per year (5% increase) would lead to a marginal increase in the likelihood of foraging being disrupted.

### **Potential impact on waterbirds**

Most of the waterbird species are more likely to occur in the inshore ponds and wetlands of the Ramsar site than the shoreline or marine environment of Corio Bay. Those areas are unlikely to be affected by noise, light or discharge to the marine environment associated with the project.

Eastern Great Egret is likely to forage along the shoreline of Corio Bay and Limeburners Bay. Large numbers of Black Swans occur in Limeburners Bay and may use the bay for roosting as well as foraging.

The project is unlikely to affect Eastern Great Egret or Black Swans in Limeburners Bay or along the shoreline for the same reasons that the project is unlikely to affect migratory shorebirds, seabirds, or other waterbirds. Those reasons are:

- Discharge to the marine environment from the FSRU or burial of the pipeline is unlikely to affect seagrass or the food web.
- Dredging activity is unlikely to affect seagrass meadows or the food web.
- Seagrass to be lost is too deep for foraging birds, including Black Swans.
- Noise from construction and operation of the FSRU is unlikely to affect the ecological character of the Ramsar site or the foraging behaviour as levels during dredging and piling are not modelled to exceed those currently experienced in the environments of the Ramsar site.
- Light associated with construction and operation of the project in the existing modified environment is unlikely to affect waterbirds. Light spill will be localised therefore habitat is unlikely to be affected by light during construction or operation.
- The implementation of ongoing design refinements which seek to ensure operational optimisation e.g. removal of the air compressor and transformer from the noise model which are no longer required in the design (Refer to Annexure 1 contained within Appendix C of Technical Report D Supplementary Noise Impact Assessment).

### **Potential impacts on raptors**

Unlikely to be impacted as not reliant on marine habitats and the Ramsar site is unlikely to be affected for the reasons outlined above.

### **Potential impacts on terrestrial (non-aquatic) species**

Unlikely to be impacted as not reliant on marine habitats and the Ramsar site is unlikely to be affected for the reasons outlined above.

## **5.2 Threatened and/or migratory birds with potential to be affected by the project**

Potential impacts have been assessed against threatened and/or migratory bird species with the potential to occur within 5 km of the project. These species are unlikely to be significantly impacted by the project because:

- Terrestrial birds, including raptors, are highly mobile and are able to move away from the construction area. Most habitat would be avoided by the construction footprint of the pipeline. Areas of planted native trees that aren't avoided are considered small in extent and foraging, loafing and resting habitats are available beyond the construction footprint. Terrestrial habitats of the offsite environment are unlikely to be impacted by construction or operation of the FSRU.

- Migratory shorebirds, seabirds and waterbirds (including Black Swan) that utilise habitats of the Ramsar site are unlikely to experience a reduction in food availability or disturbance from noise or light because:
  - Dredging activity during construction and discharge to the marine environment from the FSRU during operation area unlikely to affect seagrass or the food web.
  - Entrainment of fish larvae and plankton from the Ramsar site and Limeburners Bay is negligible therefore food availability is not anticipated to be affected by operation of the FSRU.
  - Noise levels during dredging and piling are not modelled to exceed those currently experienced in the environments of the Ramsar site.
  - Light associated with construction and operation of the project will be localised and in an existing modified environment.
- Seabirds and waterbirds that may utilise the marine environment of the Project Area and surrounds (Corio Bay) are unlikely to experience a significant reduction in availability of foraging habitat or food resources because:
  - Seabirds are unlikely to be reliant on Corio Bay as their sole foraging resource. Most of the seabird species primarily inhabit the open oceans rather than bays and are therefore more likely to be occasional visitors to Corio Bay. Those that occur more regularly are highly mobile and able to access foraging resources elsewhere in the bay.
  - Risk of fuel and chemical spills from the FSRU or LNG carriers is low.
  - While seabirds may temporarily suspend foraging while LNG carriers pass, normal behaviour is likely to resume within the same day and the number of additional ships represents a marginal 5% increase in the number of movements into and out of the port.
  - Human activity associated with the existing refinery and pier is likely to discourage regular occurrence of these species and they may therefore prefer areas in the offsite environment away from the existing refinery and pier.
- Terns and waterbirds that may forage along the shoreline of Corio Bay (Eastern Great Egret, Black Swan, White-bellied Sea-eagle) are highly mobile and utilise a wide range of habitats and, as such, can seek alternative resources. The habitat is currently exposed to human activity associated with the existing refinery and pier.

## 6.0 Mitigation Measures

There are no changes to the overall conclusion of the original terrestrial ecology EES study. This supplementary assessment has considered a consolidated list of threatened and migratory bird species that could potentially be affected by the project, including marine species not previously assessed, as well as the revised modelling undertaken in the supplementary marine assessment.

As the threatened and migratory bird species with potential to occur in the project area or offsite environment are unlikely to be significantly impacted by the project, the mitigation measures specified in the original terrestrial ecology EES study (EES Technical Report D: *Terrestrial ecology impact assessment*), as well as EES Technical Report A: *Marine ecology and water quality impact assessment* (CEE, 2021) are considered appropriate to avoid or minimise impacts to terrestrial ecology and threatened and migratory bird species.

The original mitigation measures recommended to avoid, minimise, and mitigate potential adverse effects on terrestrial ecology, including threatened and migratory bird species, are listed in Section 7 of the EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a).

Mitigation measures identified in EES Technical Report A: *Marine ecology and water quality impact assessment* (CEE, 2021) to reduce impacts in the marine environment are drawn on as relevant in Section 6 of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a). These measures are presented in Section 14 of EES Technical Report A: *Marine ecology and water quality impact assessment* (CEE, 2021) and have not changed following the revised marine modelling in Supplementary Statement Technical Report A: *Supplementary marine environment impact assessment* (CEE 2024).

As specified in Section 7 of EES Technical Report D: *Terrestrial ecology impact assessment* (AECOM 2022a), EES Technical Report A: *Marine ecology and water quality impact assessment* (CEE, 2021) makes recommendations around mitigations for the dredging works which include timing the dredging to avoid spring (the active growth season of seagrass) and installation of silt curtains to reduce the spread of suspended solids. EES Technical Report D: *Terrestrial ecology impact assessment* suggested another factor to consider in timing of the dredging and piling works is to avoid spring to late summer when migratory shorebird numbers are at their peak, if practicable.

No additional management and mitigation measures are recommended as construction and operation of the FSRU is unlikely to affect the ecological character of the Ramsar site. Impacts on seagrass and seaweeds will be localised and would occur for eight-weeks duration during construction and therefore unlikely to affect the availability of food for threatened and migratory bird species.

Therefore, no additional mitigation measures have been proposed following the supplementary studies and the original mitigation measures are considered both appropriate and adequate in relation to threatened and migratory birds. All mitigation measures, including those adopted following recommendations in the IAC report, are presented in Chapter 9: *Environment Management Framework*.

## 7.0 Conclusion

A complete list of threatened and migratory bird species (including Black Swan) with potential to occur in the project area (terrestrial or marine) and surrounding offsite environment (Corio Bay, Limeburners Bay and Avalon Beach) was generated in response to Minister's Direction 9a. The updated list consolidated the groups of species considered in EES Technical Report D: *Terrestrial ecology impact assessment* (terrestrial birds and shorebirds) and EES Technical Report D: *Addendum – Peer Review* (seabirds) to adequately identify all of the aquatic bird species of conservation significance that could potentially be impacted by the project. The list was generated through a new search of the same databases used to generate the original lists for the EES for consistency and was peer reviewed in accordance with Minister's Direction 9c. Seventy-three species of threatened and/or migratory birds were identified with potential to occur in association with the Project Area or offsite environment and therefore potential to be affected by the project.

Potential impacts on threatened and/or migratory birds associated with construction of the pipeline (terrestrial environment) and construction and operation of the FSRU (marine environment) considered in EES Technical Report D: *Terrestrial ecology impact assessment* were then integrated into an assessment based on the consolidated list of threatened and/or migratory birds (Minister's Direction 9a and 9b) and revised marine modelling (Minister's Direction 9d).

Revised marine modelling completed in Supplementary Statement Technical Report A: *Supplementary marine impact assessment* has not predicted any increase in potential impacts on the marine environment. This means that there is no predicted increase in impacts on threatened and/or migratory birds (including marine/shorebirds) or the Ramsar site presented in the EES Technical Report D: *Terrestrial ecology impact assessment* and Technical Report D: *Addendum – Peer review* and consequently, the consolidated list of migratory and/or threatened birds prepared to address Minister's Direction 9a and 9b.

Integration of the EES assessment findings with the revised marine modelling and consolidated list of threatened and/or migratory birds concludes there are no changes to the overall findings of the impact assessment. Threatened and/or migratory birds with potential to occur in the Project Area or offsite environment are unlikely to be significantly impacted by the project because:

- Terrestrial birds including raptors are highly mobile and able to move away from the construction area, most habitat is avoided by the construction footprint of the pipeline, areas of planted native trees that are not avoided is small in extent and foraging, loafing and resting habitats are available beyond the construction footprint. Terrestrial habitats of the offsite environment are unlikely to be impacted by construction or operation of the FSRU.
- Migratory shorebirds, seabirds and waterbirds (including Black Swan) that utilise habitats of the Ramsar site are unlikely to experience a reduction in food availability or disturbance from noise or light because:
  - Dredging activity during construction and discharge to the marine environment from the FSRU during operation area unlikely to affect seagrass or the food web.
  - Entrainment of fish larvae and plankton from the Ramsar site and Limeburners Bay is negligible, therefore food availability is not anticipated to be affected by operation of the FSRU.
  - Noise levels during dredging and piling are not modelled to exceed those currently experienced in the environments of the Ramsar site.
  - Light associated with construction and operation of the project will be localised and in an existing modified environment.
- Seabirds and waterbirds that may utilise the marine environment of the Project Area and surrounds (Corio Bay) are unlikely to experience a significant reduction in availability of foraging habitat or food resources because:
  - Seabirds are unlikely to be reliant on Corio Bay as their sole foraging resource. Most of the seabird species primarily inhabit the open oceans rather than bays and are therefore more



likely to be occasional visitors to Corio Bay. Those that occur more regularly are highly mobile and able to access foraging resources elsewhere in the bay.

- Risk of fuel and chemical spills from the FSRU or LNG carriers is low.
- While seabirds may temporarily suspend foraging while LNG carriers pass, normal behaviour is likely to resume within the same day and the number of additional ships represents a marginal 5% increase in the number of movements into and out of the port.
- Human activity associated with the existing refinery and pier is likely to discourage regular occurrence of these species and they may therefore prefer areas in the offsite environment away from the existing refinery and pier.
- Terns and waterbirds that may forage along the shoreline of Corio Bay (Eastern Great Egret, Black Swan, White-bellied Sea-eagle) are highly mobile and utilise a wide range of habitats and, as such, can seek alternative resources. The habitat is currently exposed to human activity associated with the existing refinery and pier.

Analysis of the shorebird survey data in response to Minister's Direction 9c found that none of the shorebird survey sites individually or collectively are internationally important for any of the four declared migratory shorebird species recorded during the surveys. Only one survey site would be considered important habitat in Australia and/or the EAAF based on data collected during the shorebird survey. That site - Avalon Coastal Park (former Avalon Saltworks) - supports enough Sharp-tailed Sandpiper to be an important site for that species in Australia and the EAAF. Sites at Limeburners Lagoon, Corio Bay opposite Point Aboena and Avalon Beach, despite being within the boundary of the internationally recognised Ramsar site, do not support enough individuals of a species of migratory shorebird to be an important site in Australia or the EAAF based on the survey data.

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# Appendix A

Likelihood of occurrence  
- threatened birds

## Appendix A Likelihood of occurrence - threatened birds

### Key to table

<b>EPBC Act</b>		<b>FFG Act</b>	
CR	Critically Endangered	cr	Critically Endangered
EN	Endangered	en	Endangered
VU	Vulnerable	vu	Vulnerable
#	Listed under the EPBC Act after referral decision (21 January 2021)		
Mi	Migratory species listed under bilateral migratory bird agreements: JAMBA, CAMBA, ROKAMA, Bonn Convention		
Ma	Marine species declared under s248 of the EPBC Act which are relevant to actions by Commonwealth agencies and actions on, or impacting on, Commonwealth areas only. The Commonwealth area includes marine areas beyond state and territory waters (from three nautical miles or 5.5 km from the shore) and extend to the outer boundary of Australia's exclusive economic zone (200 nautical miles or approximately 370 km) from the shore (Samuel, 2020).		
<b>Source</b>			
VBA	Victorian Biodiversity Atlas data cut October 2021; # - number of records since 1991 (<30 years old)		
PMST	EPBC Act Protected Matters Search Tool		
#	Species listed as threatened under the EPBC Act after the referral decision was made therefore not require to be assessed as a MNES in accordance with Section 158A(4) of the EPBC Act		
*	Species not in the likelihood of occurrence list in EES Technical Report D. <i>Terrestrial ecology impact assessment</i>		
**	Species not in the likelihood of occurrence list in EES Technical Report D or Peer Review (Nature Advisory 2022)		
Grey cells	Species with potential to occur – rating of possible, likely or present		

Table 8-1 Likelihood of occurrence – threatened birds with VBA recent (<30 years old) records within 5 km of the Project Area

Common Name	Scientific Name	Status		Source			Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
<b>Terrestrial (non-aquatic)</b>												
Regent Honeyeater	<i>Anthochaera phrygia</i>	CR	cr	Known	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits dry box-ironbark eucalypt forests near rivers and creeks on inland slopes of the Great Dividing Range. Can also occur in small remnant patches or in mature trees in farmland or partly cleared agricultural land (Higgins et al. 2001).</i> Nomadic species which mostly inhabits box-ironbark woodland and dry sclerophyll forest on the inland slopes of Great Dividing Range (DoE 2015; 2016). Also inhabits riparian vegetation and lowland coastal forest (DoE 2016). Core breeding area in Victoria is centred around Chiltern and other breeding areas are in the Lurg-Benalla district (DoE 2016).	Unlikely	Unlikely	Unlikely	No suitable habitat in or adjacent to the Project Area.	Unlikely
Southern Whiteface**	<i>Aphelocephala leucopsis</i>	VU#	-	Known	-	-	Southern Whitefaces occupy a range of open woodland shrublands with an understorey of shrubs and/or grasses. The species forages almost exclusively on the ground in small groups of 2-8 individuals, although the birds may congregate in larger flocks (of as many as 70) during the non-breeding season. Breeding occurs from July to October in nests constructed in a hollow or crevice, occasionally in small shrubs. Southern Whitefaces are mostly sedentary, but records suggest the individuals may move into wetter areas during drought (DCCEEW 2023).	n/a	n/a	n/a	Southern Whiteface was listed as vulnerable under the EPBC Act on 31 March 2023 after the referral decision for the Gas Terminal Project and is therefore not considered a MNES in this instance. As the species is not listed as threatened under the FFG Act it is not a threatened species that must be considered for this report.	Unlikely



Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Fork-tailed Swift*	<i>Apus pacificus</i>	Mi, Ma	-	Likely	2015	6	Nature Advisory (2022) describes the habitat requirements as: <i>The species can occur in wet sclerophyll forest but mainly prefers open forest or plains. It is almost exclusively aerial and feeds up to hundreds of metres above the ground, but can feed among open forest canopy. The species breeds internationally and seldom roosts in trees (Higgins 1999).</i>	Possible	Unlikely	Unlikely	Almost exclusively aerial species. May forage over the pipeline component of the Project Area or occasionally loaf in trees.	Unlikely
Gang-gang Cockatoo**	<i>Callocephalon fimbriatum</i>	EN#	en	Know	2016	24	Gang-gang Cockatoos primarily occur in temperate eucalypt forests and woodlands (Menkhorst et al. 2017). Gang-gang Cockatoos are altitudinal migrants moving from montane breeding habitat in the summer months to lowland areas in winter (DAWE 2022). Old growth forest and woodland assemblages are preferred for nesting, loafing, and roosting (DAWE 2022). During the summer months, Gang-gang Cockatoos primarily occupy mature, eucalypt-dominated wet sclerophyll forests with dense understoreys (DAWE 2022). During the winter months, Gang-gang Cockatoos migrate from montane forests to inhabit more open forest and woodland assemblages at lower, drier elevations where they are often seen in urban areas (DAWE 2022).	Likely	Unlikely	Unlikely	Gang-gang Cockatoo was not listed under the EPBC Act or FFG Act at the time of the EES. The species was listed as vulnerable under the EPBC Act on 2 March 2022 after the referral decision for the Gas Terminal Project and is therefore not considered a MNES in this instance. Gang-gang Cockatoo was listed as endangered under the FFG Act in the June 2023 list but the status was not updated in the VBA at the time of the search. Gang-gang Cockatoo may opportunistically feed in trees and large shrubs (both planted and native vegetation) within the Project Area terrestrial component, particularly during the non-breeding winter months, when they rely more heavily on drier forests and woodlands at lower altitudes (DAWE 2022).	Unlikely
Brown Treecreeper (south-eastern)*	<i>Climacteris picumnus victoriae</i>	VU#	-	May	1969	1	Brown Treecreeper (south-eastern) is one of three subspecies of Brown Treecreeper. The south-eastern subspecies occurs in dry open eucalypts and woodlands of south-eastern Australia from the coast to the inland slopes of the Great Dividing Range with their range extending from the Grampians in Victoria to the Bunya Mountains in Queensland. Brown Treecreepers forage for invertebrates on the ground and in mature live and dead trees and are also known to feed on nectar, sap, and lizards (DCCEEV, 2023b).	Unlikely	Unlikely	Unlikely	Brown Treecreeper was listed as vulnerable under the EPBC Act on 31 March 2023 after the referral decision for the Gas Terminal Project and is therefore not considered a MNES in this instance. As the species is not listed as threatened under the FFG Act it is not a threatened species that must be considered for this report.	Unlikely
Painted Honeyeater	<i>Grantiella picta</i>	VU	vu	Likely	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits box-ironbark forests and woodlands and mainly feeds on the fruits of mistletoe. Strongly associated with mistletoe around the margins of open forests and woodlands. Can also be found in farmland containing remnant treed vegetation. Occurs at few localities. Uncommon breeding migrant from further north, arriving in October and leaving in February (Higgins et al. 2001; Tzaros 2005).</i>	Unlikely	Unlikely	Unlikely	No suitable habitat within or adjacent to Project Area.	Unlikely

Common Name	Scientific Name	Status		Source			Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
White-throated Needletail	<i>Hirundapus caudacutus</i>	VU, Mi, Ma	vu	Known	1981	9	White-throated Needletail is an aerial insectivore which breeds in the northern hemisphere and migrates to the southern hemisphere to spend their non-breeding season in eastern and south-eastern Australia during the Australian spring to early-autumn. Nature Advisory (2022) describes the habitat requirements as: <i>Aerial, over all habitats, but probably more over wooded areas, including open forest and rainforest. Often over heathland and less often above treeless areas such as grassland and swamps or farmland (Higgins 1999).</i>  Although they are mostly aerial and occur more often over wooded areas, White-throated Needle-tail roost in trees in amongst dense foliage of the canopy or in hollows (TSSC 2019). White-throated Needle-tails can form large flocks and feed on flying insects from heights of less than 1 m up to more than 1 kilometre (TSSC, 2019).	Possible	Unlikely	Possible	Suitable habitat occurs in the Project Area.  White-throated Needle-tail may feed in the airspace over the pipeline component of the Project Area when in south-eastern Australia during the Australian spring to early-autumn (TSSC 2019). May roost in trees on occasion.  May feed in the airspace over the terrestrial areas of offsite environment (Ramsar site).	Unlikely
Swift Parrot	<i>Lathamus discolor</i>	CR, Ma	cr	Known	2019	11	Nature Advisory (2022) describes the habitat requirements as: <i>Prefers a select range of eucalypts in Victoria, including Yellow Gum, Grey Box, White Box, Red Ironbark and Yellow Box, as well as River Red-gum when this species supports abundant 'lerp' (Saunders &amp; Tzaros 2011). The species is also known to forage within planted stands of Spotted Gum and Sugar Gum (Nature Advisory; unpublished data). Breeds in Tasmania and migrates to the mainland of Australia for the autumn, winter and early spring months. It lives mostly north of the Great Dividing Range, passing through two areas of Victoria on migration: the Port Phillip district and Gippsland (Emison et al. 1987; Higgins 1999; Kennedy &amp; Tzaros 2005). Though it is also not uncommonly sighted in urban areas (Nature Advisory; unpublished data). Occurrence of this species on the mainland can substantially change from year to year depending on food availability, giving potential for this species to occur almost anywhere throughout its range (Emison et al. 1987).</i>	Possible	Unlikely	Unlikely	Marginal foraging habitat in the form of planted trees which occur in and immediately adjacent to the pipeline component of the Project Area. Habitat limited in extent and maturity.  Highly mobile species which may use habitat on an occasional and opportunist basis.  VBA record from Geelong Grammar in 1998. Most records on the VBA within 5 km of the Project Area are from between Lara and Little River (the You Yangs or Serendip Sanctuary) and Newtown, Geelong. One record from 1998	Unlikely

Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Major Mitchell's Cockatoo*	<i>Lophochroa leadbeateri</i>	EN#	cr	-	1961	1	Nature Advisory (2022) describes the habitat requirements as: <i>Dry woodlands, particularly mallee (Higgins 1999).</i>	Unlikely	Unlikely	Unlikely	Rare, vagrant species in Port Phillip Bay. Nature Advisory (2022) VBA search area detected last record in 2005. Major Mitchell's Cockatoo was listed as endangered under the EPBC Act on 31 March 2023 after the referral decision for the Gas Terminal Project and is therefore not considered a MNES in this instance. The species is listed as threatened under the FFG Act it is therefore considered as a Victorian threatened species for this report. Subspecies <i>Lophochroa leadbeateri leadbeateri</i> Major Mitchell's Cockatoo (eastern) is listed as threatened under the EPBC Act. Nominat species <i>Lophochroa leadbeateri</i> is listed as threatened under the FFG Act. For this assessment <i>Lophochroa leadbeateri</i> records on the VBA area considered to represent the EPBC Act listed subspecies.	Unlikely
Hooded Robin (south-eastern)	<i>Melanodryas cucullata cucullata</i>	EN#	vu	Known	2016	1	Nature Advisory (2022) describes the habitat requirements as: <i>Occur mostly in open Grey Box, White Box, Yellow Box, Yellow Gum and Ironbark woodlands with pockets of saplings or taller shrubs, an open shrubby understorey, sparse grasses and patches of bare ground and leaf-litter, with scattered fallen timber. The population has declined throughout range, especially since the early 1980s. This species typically occurs north of the great divide in shrubland or woodland dominated by acacias (Higgins &amp; Peter 2002; Tzaros 2005).</i>	Unlikely	Unlikely	Unlikely	No habitat on or adjacent to the Project Area. Hooded Robin was listed as endangered under the EPBC Act on 31 March 2023 after the referral decision for the Gas Terminal Project and is therefore not considered a MNES in this instance. The species is listed as threatened under the FFG Act it is therefore considered as a Victorian threatened species for this report. Subspecies <i>Melanodryas cucullata cucullata</i> is listed as threatened under the EPBC Act. Nominat species <i>Melanodryas cucullata</i> is listed as threatened under the FFG Act. For this assessment <i>Melanodryas cucullata</i> records on the VBA area considered to represent the EPBC Act listed subspecies.	Unlikely
Black-faced Monarch*	<i>Monarcha melanopsis</i>	Mi, Ma	-	-	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Rainforests, eucalypt woodlands, coastal scrub and damp gullies (Higgins et al. 2006)</i>	Unlikely	Unlikely	Unlikely	No habitat on or adjacent to the Project Area or in the offsite environment. Species not identified in the PMST or VBA search in September 2023. Nature Advisory (2022) search identified as species with potential to occur in the PMST search therefore kept in list.	Unlikely
Yellow Wagtail	<i>Motacilla flava</i>	Mi, Ma	-	Likely	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Regular non-breeding visitor in northern Australia mainly spring-summer, vagrant to the south. Occupies a wide range of habitats, usually open areas with low vegetation such as crop, grassland and even parkland. Often recorded near water (Higgins, Peter &amp; Cowling 1999)</i>	Unlikely	Unlikely	Unlikely	Rare, vagrant species in Port Phillip Bay. No VBA records within 5 km of Project Area.	Unlikely

Common Name	Scientific Name	Status		Source			Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	Mi, Ma	-	Known	2016	8	Nature Advisory (2022) describes the habitat requirements as: <i>Mostly found in eucalypt forest, particularly tall wet forests and woodland within gullies (Higgins et al. 2006). Also inhabits eucalypt woodland comprising an open understorey and a grassy ground layer (Higgins et al. 2006). Generally absent from rainforest (Higgins et al. 2006).</i>	Unlikely	Unlikely	Unlikely	No habitat on or adjacent to the Project Area.	Unlikely
Orange-bellied Parrot	<i>Neophema chrysogaster</i>	CR, Ma	cr	Known	1993	4	Nature Advisory (2022) describes the habitat requirements as: <i>The Orange-bellied Parrot is endemic to south-eastern Australia. Its current non-breeding mainland distribution is from the mouth of the Murray River in South Australia, along the coast, to the east of Jack Smith Lake in South Gippsland, Victoria, covering approximately 1000 km of coastline. The most used sites in Victoria are around Port Phillip Bay and Bellarine Peninsula. In South Australia, Carpenter Rocks is the main site. During winter on the mainland, found mostly within 3 km of the coast. In Victoria, they mostly occur in sheltered coastal habitats, such as bays, lagoons and estuaries, or, rarely, saltworks. They are also found in low samphire heathland dominated by Beaded Glasswort <i>Sarcocornia quinqueflora</i>, Sea Heath <i>Frankenia pauciflora</i> or Sea-bite <i>Suaeda australis</i>, and in taller shrubland dominated by Shrubby Glasswort <i>Sclerostegia arbuscula</i>. They are sometimes found in low samphire dominated by Grey Glasswort <i>Halosarcia halocnemoides</i> or in <i>Chenopodium</i> herbfields. Breeds at Meialeuca in Tasmania during spring/summer months (DAWE 2020).</i> In Victoria, 70% of the population has historically been distributed between three main sites – Swan Bay (including Swan Island), Lake Connewarre and the Western Treatment Plant in Werribee which encompasses Point Wilson and the Murtcain Wildlife Area (BirdLife Australia 2020).	Unlikely	Unlikely	Possible	. A Small area of coastal saltmarsh (0.015 ha) occurs within 50 m of the terrestrial pipeline project near existing water intake structure although this area may be planted. The coastal saltmarsh is beyond the project area and will be avoided by the project. Species may occur in the offsite environment in association with Coastal Saltmarsh at Limeburner's Lagoon or former Avalon Saltworks on occasion as there are previous VBA records from those areas: <ul style="list-style-type: none"> <li>One record of Orange-bellied Parrot from Avalon Saltworks north of Dandos Road (inland adjacent to Avalon airport) from 1993.</li> <li>One record from 1986 from Limeburners Bay.</li> </ul> However, the stronghold for the species when on mainland Victoria is centred around the Western Treatment Plant/Point Wilson/Murtcain Wildlife Area more than 10 km to the west, Swan Bay/Swan Island approximately 30 km to the south-east and Lake Connewarre approximately 15 km south of the Project Area.	Unlikely
Blue-winged Parrot*	<i>Neophema chrysostoma</i>	VU, Ma	-	Known	2016	28	Inhabit a range of habitats from coast, sub-coastal and inland areas to semi-arid zones where they tend to favour grasslands and grassy woodlands. Often found near wetlands near the coast in semiarid zones and can also be seen in altered environments such as airfields, golf courses and paddocks (DCCEEW 2023c). Blue-winged Parrots breed in hollows in eucalypt forests and woodlands on mainland Australia along the southern Victorian coast, far south-east South Australia and part of Tasmania (DCCEEW 2023c). In Victoria, the species is known to breed mainly in heathy forests and woodlands (DCCEEW 2023c).	n/a	n/a	n/a	Blue-winged Parrot was listed as vulnerable under the EPBC Act on 31 March 2023 after the referral decision for the Gas Terminal Project and is therefore not considered a MNES in this instance. The species is not listed as threatened under the FFG Act therefore it is not considered as a threatened species for this report.	Unlikely

Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Elegant Parrot*	<i>Neophema elegans</i>	-	vu	-	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Occupy open habitats, both coastal and inland: grassland, mallee shrublands; dry open woodlands, and acacia scrubs. In Vic. Scattered records in west (Higgins 1999).</i>	Unlikely	Unlikely	Unlikely	VBA records from You Yangs and the Western Treatment Plant. Nature Advisory (2022) VBA search area detected last record in 1993. Habitat in and immediately adjacent to the Project Area is not suitable. Some potential to occur in the offsite environment in association with the inland habitats of the Ramsar site.	Unlikely
Barking Owl*	<i>Ninox connivens</i>	-	cr	-	1969	1	Nature Advisory (2022) describes the habitat requirements as: <i>Eucalyptus dominated forests and woodlands, commonly near water-bodies, such as streams and rivers, and requires hollow trees for nesting and trees with dense foliage for roosting (Higgins 1999).</i>	Unlikely	Unlikely	Unlikely	Rare, vagrant species in Port Phillip Bay. Nature Advisory (2022) VBA search area detected last record in 2006.	Unlikely
Plains-wanderer	<i>Pedionomus torquatus</i>	CR	cr	Likely	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>This species is highly sensitive to changes in grassland cover and density. Typically inhabits treeless native grasslands with sparse cover, with a preference for grasslands composed of wallaby grass and spear grass (Marchant &amp; Higgins 1993). Habitat becomes unsuitable when grassland becomes dense (CA 2016). Evidence suggests it avoids areas of tree cover, with no records of the species within 300m of trees (&gt;10 m high) in their strongholds in New South Wales or Victoria (CA 2016).</i>	Unlikely	Unlikely	Unlikely	No suitable habitat within or adjacent to the Project Area. Rare, vagrant species in Port Phillip Bay / Greater Geelong / Melbourne area. No VBA records within 5 km of the Project Area.	Unlikely
Speckled Warbler	<i>Pyrrholaemus sagittatus</i>	-	en	-	2018	1	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits dry eucalypt forests and woodlands, especially those with box-ironbark eucalypt associations. It is also found in River Red Gum woodlands. The species is uncommon; populations have declined since the 1980s (Higgins &amp; Peter 2002; Tzaros 2005).</i>	Unlikely	Unlikely	Unlikely	No suitable habitat in or adjacent to the Project Area.	Unlikely
Rufous Fantail	<i>Rhipidura rufifrons</i>	Mi, Ma	-	Known	2016	10	Nature Advisory (2022) describes the habitat requirements as: <i>In east and south-east Australia, mainly inhabits tall wet sclerophyll forests, often in gullies. When on passage in warmer months, they are sometimes recorded in drier sclerophyll forests and woodlands, as well as parks and gardens (Higgins et al. 2006). Virtually absent from south-eastern Australia during winter (Higgins et al. 2006).</i>	Possible	Unlikely	Possible	VBA records from 2014 in the surrounds of Geelong Grammar School and at Serendip Sanctuary, Lara in 2016. Historic records in the Avalon area in the 1970s and 1980s. Potential to occur on passage through the Corio /Avalon area in areas of grassland and planted vegetation in the Project Area and terrestrial areas of the offsite environment.	Unlikely

Common Name	Scientific Name	Status		Source			Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Diamond Firetail*	<i>Stagonopleura guttata</i>	VU#	vu	Known	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Commonly found in box-ironbark forests and woodlands and also occurs along watercourses and in farmland areas. Widespread but scattered. Forages on a wide range of seeds, which in some cases a large portion can be derived from weed species (Read 1994). Populations had declined in Victoria since the 1950s (Emison et al. 1987; Tzaros 2005).</i>	Unlikely	Unlikely	Unlikely	No habitat in or adjacent to the Project Area. Diamond Firetail was listed as vulnerable under the EPBC Act on 31 March 2023 after the referral decision for the Gas Terminal Project and is therefore not considered a MNES in this instance. The species is listed as threatened under the FFG Act therefore it is not considered as a Victorian threatened species for this report.	Unlikely
Masked Owl*	<i>Tyto novaehollandiae</i>	-	cr	-	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Open woodlands and forests that provide dense and tall tree cover, and adjoining open habitats such as cleared farmlands. In Victoria, most widespread in E. Gippsland (Higgins 1999).</i>	Unlikely	Unlikely	Unlikely	Rare, vagrant species in Port Phillip Bay. Nature Advisory (2022) VBA search area detected last record in 2018.	Unlikely
<b>Raptors (birds of prey)</b>												
Grey Goshawk*	<i>Accipiter novaehollandiae</i>	-	en	-	2016	3	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabit rainforests, open forests, swamp forests, woodlands and plantations, most abundant where forest or woodland provide cover for hunting from perches. in Vic., most common in Otway ranges (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Unlikely	No habitat on or adjacent to the Project Area.	Unlikely
Grey Falcon	<i>Falco hypoleucos</i>	VU	vu	Likely	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits and semi-arid zones; mainly on sandy and stony plains of inland drainage systems, lightly timbered with acacia. Hunt far into open areas, over spinifex, tussock grasslands and low shrublands. In Victoria, few records mostly in north and northwestern regions (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Unlikely	No VBA records of this bird of prey within 5 km of the Project Area. Vagrant species to the Port Phillip Bay area and no suitable habitat occurs in the Project Area.	Unlikely
Black Falcon	<i>Falco subniger</i>	-	cr	-	2019	46	Nature Advisory (2022) describes the habitat requirements as: <i>Woodlands, open country and terrestrial wetlands; in arid and semi-arid zones; mainly over open plains and undulating land with large tracts of low vegetation. It is more commonly found in north-western Victoria and is only occasionally found in southern Victoria. It is a highly mobile species, moving in response to food availability and seasonal conditions (Marchant &amp; Higgins 1993).</i>	Possible	Unlikely	Present	Suitable habitat occurs in the Project Area. Black Falcon was observed hunting over the Limeburners Lagoon (Hovells Creek) Flora and Fauna Reserve during shorebird surveys (AECOM, 2022c) and is likely to also hunt over the Project Area.	Unlikely



Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	-	en	-	2019	28	Nature Advisory (2022) describes the habitat requirements as: <i>Maritime habitats, terrestrial large wetlands and coastal lands of tropical and temperate Australia and offshore islands, ranging far inland only over large rivers and wetlands. The eagles usually breed on coast and offshore islands and inland beside large lakes or rivers, usually in tall trees in or near water, also in cliffs, rock pinnacles and escarpments (Marchant &amp; Higgins 1993).</i>	Possible	Possible	Present	Suitable habitat occurs in the Project Area. White-bellied Sea-eagle may occasionally hunt over Project Area and rest in trees or on structures in the offsite environment. The species is sensitive to human habitation (O'Donnell and Debus 2012) and may therefore prefer areas away from the existing refinery and pier. A White-bellied Sea-eagle juvenile was observed at Point Aboena during shorebird surveys (AECOM, 2022c).	Unlikely
Little Eagle	<i>Hieraaetus morphnoides</i>	-	vu	-	2016	220	Nature Advisory (2022) describes the habitat requirements as: <i>Over wooded and forested lands and open country of Aust. Range extending into arid zone. Most abundant in open forest and woodland (Marchant &amp; Higgins 1993).</i>	Possible	Unlikely	Possible	Suitable habitat occurs in the Project Area. May hunt over Project Area and it is possible the species could nest in large trees in the local area. There are very few, if any, large trees within 200m of the pipeline. Little Eagles prefer more intact areas of woodland, rarely nest in isolated trees and tend to prefer tall mature trees (Larkin et al. 2020) Species may hunt over the offsite environment but the general lack of trees reduces the suitability of the habitat for this species.	Unlikely
Square-tailed Kite*	<i>Lophoictinia isura</i>	-	vu	-	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>It occurs mainly in open forests and woodlands and in Victoria utilises habitats with box-ironbark, peppermint, Stringybark and River Red Gum eucalypt associations. The rarest and least seen bird in Victoria, mainly occur in the far east of the state, though occasionally recorded in central and western parts of the state (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Unlikely	No habitat on or adjacent to the Project Area. Nature Advisory (2022) VBA search area detected last record in 2018.	Unlikely
Eastern Osprey	<i>Pandion cristatus</i>	Mi	-	Likely	2016	6	Nature Advisory (2022) describes the habitat requirements as: <i>Rare vagrant to Victoria (Marchant &amp; Higgins 1993). Littoral and coastal habitats and terrestrial wetlands. They are mostly found in coastal areas but occasionally travel inland along major rivers (Johnstone &amp; Storr 1998; Marchant &amp; Higgins 1993; Olsen 1995). They require extensive areas of open fresh, brackish or saline water for foraging (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Possible	No suitable habitat within or adjacent to the Project Area. Rare, vagrant species in Port Phillip Bay. Potential to occur in the offsite environment in association with the habitats of the Ramsar site. VBA records from Avalon Beach and the former Avalon saltworks area.	Unlikely
<b>Shorebirds</b>												
Common Sandpiper	<i>Actitis hypoleucos</i>	Mi, Ma	vu	Known	2016	9	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits a wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands. In Victoria, mostly found Westport and Port Phillip Bay (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Present	Occurs further east on the Port Phillip Bay coast but habitat in and immediately adjacent to the Project Area is not suitable. Unlikely to occur. Suitable wetland habitat with muddy margins for foraging is present in the offsite environment (Ramsar site). One Common Sandpiper was recorded at Avalon Beach during migratory shorebird surveys (AECOM 2022c).	Unlikely

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		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Ruddy Turnstone	<i>Arenaria interpres</i>	Mi, Ma	en	Known	2018	20	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Likely	Habitat in and immediately adjacent to the Project Area is not suitable. Likely to occur in habitat of the offsite environment although not recorded during shorebird surveys as Limeburners Bay or former Avalon saltworks.	Unlikely
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Mi, Ma	-	Known	2018	140	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Present	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Sharp-tailed Sandpipers were recorded at Avalon Beach and Limeburners Bay during shorebird surveys and was the most abundant of the migratory shorebirds detected during the surveys (AECOM 2022).	Unlikely
Sanderling	<i>Calidris alba</i>	Mi	-	-	2017	5	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits open sandy beaches exposed to sea-swells; also on exposed sandbars and spits (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Sanderling are likely to occur in the offsite environment in association with the habitats of the Ramsar site (Limeburner's Bay/Lagoon, former Avalon saltworks).	Unlikely
Red Knot	<i>Calidris canutus</i>	EN, Mi, Ma	en	Known	2018	17	Nature Advisory (2022) describes the habitat requirements as: <i>In Australasia, the Red Knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps (DAWE 2020).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Red Knot are likely to occur in the offsite environment in association with the habitats of the Ramsar site (Limeburner's Bay/Lagoon and former Avalon saltworks). Has been previously recorded at Limeburners Lagoon (AECOM 2022c).	Unlikely

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		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Curlew Sandpiper	<i>Calidris ferruginea</i>	CR, Mi, Ma	cr	Known	2019	174	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits wide range of coastal or inland wetlands with varying levels of salinity, mainly muddy margins or rocky shores of wetlands (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Present	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Curlew Sandpiper were recorded at Avalon Beach during shorebird surveys (AECOM 2022c) and are likely to occur elsewhere in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Pectoral Sandpiper	<i>Calidris melanotos</i>	Mi, Ma	-	Known	2018	8	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Pectoral Sandpiper are likely to occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Little Stint*	<i>Calidris minuta</i>	Mi	-	-	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Mudflats, sandflats, sheltered coastal estuaries, islets, freshwater lakes, lagoons and saltworks (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Possible	No suitable habitat in or immediately adjacent to the Project Area. No VBA records within 5 km of the Project Area. Nature Advisory (2022) VBA search area detected last record in 2010. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Rare, vagrant species in Port Phillip Bay (Nature Advisory 2022) which may occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Ruff (Reeve)	<i>Calidris pugnax (previously Philamachus pugnax)</i>	Mi, Ma	-	Known	2009	7	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Ruff are likely to occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely

Common Name	Scientific Name	Status		Source			Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA (Most recent)	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Red-necked Stint	<i>Calidris ruficollis</i>	Mi, Ma	-	Known	2018	192	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Present	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Red-necked Stint were recorded at Avalon Beach and the former Avalon saltworks during shorebird surveys and was the most second most abundant of the migratory shorebirds detected during the surveys (AECOM 2022c). Red-necked Stint are also known to occur at Limeburners Lagoon (AECOM 2022c).	Unlikely
Long-toed Stint	<i>Calidris subminuta</i>	Mi, Ma	-	Known	2015	7	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits a variety of terrestrial wetlands it prefers shallow freshwater or brackish wetlands with areas of muddy shorelines and growth of various vegetation (Higgins &amp; Davies 1996).</i> Small numbers regularly visit Australia but mainly northern and western Australia (Menkhorst et al. 2017).	Unlikely	Unlikely	Possible	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Long-toed Stint may occur in the offsite environment in association with the habitats of the Ramsar site (Limeburners Bay/Lagoon and former Avalon Saltworks) on occasion.	Unlikely
Great Knot	<i>Calidris tenuirostris</i>	CR, Mi, Ma	cr	Known	1978	2	Nature Advisory (2022) describes the habitat requirements as: <i>In Australasia, the species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. They are occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, saltlakes and non-tidal lagoons. The Great Knot rarely occurs on inland lakes and swamps (DAWE 2020).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Great Knot likely to occur in the offsite environment in association with the habitats of the Ramsar site (Limeburners Bay/Lagoon and former Avalon Saltworks).	Unlikely
Double-banded Plover	<i>Charadrius bicinctus</i>	Mi, Ma	-	Known	2018	26	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits wide range of coastal or inland wetlands with varying levels of salinity, mainly muddy margins or rocky shores of wetlands (Marchant &amp; Higgins 1993).</i> Migrant from New Zealand to Australia in winter (March to August).	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Double-banded Plover likely to occur in the offsite environment in association with the habitats of the Ramsar site (Limeburners Bay/Lagoon and former Avalon Saltworks).	Unlikely

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Greater Sand Plover	<i>Charadrius leschenaultii</i>	VU, Mi, Ma	vu	Likely	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Entirely coastal; mainly on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks. In Vic. Mostly in Corner Inlet, Westernport and Port Phillip Bay (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Possible	No suitable habitat in or immediately adjacent to the Project Area. No VBA records within 5 km of the Project Area. Nature Advisory (2022) VBA search area detected last record in 1996. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Greater Sand Plover may occur in the offsite environment in association with the habitats of the Ramsar site (Limeburners Bay/Lagoon and former Avalon Saltworks).	Unlikely
Lesser Sand Plover	<i>Charadrius mongolus</i>	EN, Mi, Ma	en	Known	1979	2	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits beaches of sheltered bays, harbours, and estuaries with large intertidal sandflats or mudflats. Regularly seen in Corner Inlet, Westernport and Port Phillip Bay (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Possible	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Lesser Sand Plover may occur in the offsite environment in association with the habitats of the Ramsar site (Limeburners Bay/Lagoon and former Avalon Saltworks).	Unlikely
Latham's Snipe	<i>Gallinago hardwickii</i>	VU#, Mi, Ma	-	Known	2019	99	Nature Advisory (2022) describes the habitat requirements as: <i>Occurs in wide variety of permanent and ephemeral wetlands; it prefers open freshwater wetlands with dense cover nearby, such as the edges of rivers and creeks, bogs, swamps, waterholes. The species is wide spread in southeast Australia and most of its population occurs in Victoria, except in the northwest of the state (Naarding 1983; Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Likely	No suitable habitat in, or adjacent to, the Project Area. Likely to occur in the offsite environment in inland wetlands at Limeburners Lagoon (Hovells Creek) Flora and Fauna Reserve and the former Avalon saltworks. Latham's Snipe was listed as vulnerable under the EPBC Act on 5 January 2024 after the referral decision for the Gas Terminal Project and is therefore considered a migratory but not threatened MNES in this instance.	Unlikely
Oriental Pratincole*	<i>Glareola maldivarum</i>	Mi, Ma	-	-	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Open country near water, occur on plains, floodplains, grassland, terrestrial wetlands, and artificial wetlands (Higgins &amp; Davies 1996).</i> Listed marine as <i>Glareola maldivarum</i> . Widespread in northern areas of Australia, occasional records in southern Australia at sparsely scattered sites	Unlikely	Unlikely	Possible	No suitable habitat within or adjacent to Project Area. Rare, vagrant species in Port Phillip Bay. No VBA records within 5 km of the Project Area. May occur in association with the habitats of the Ramsar site in the offsite environment on occasion.	Unlikely
Swinhoe's Snipe**	<i>Gallinago megala</i>	Mi, Ma	-	Likely	-	-	Few definite records exist for this species which breeds in Siberia and migrates during the non-breeding season to wetlands and grasslands in Australia. Distribution in the Australian Bird Guide (Menkhorst et al. 2017) and in DCCEEV Species Profile and Threats Database is indicated as being restricted to northern Australia.	Unlikely	Unlikely	Unlikely	Possible vagrant visitor to southern Australia. No records on VBA within 5 m of the Project Area.	Unlikely

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Pin-tailed Snipe**	<i>Gallinago stenura</i>	Mi	-	Likely	-	-	Migrates from breeding grounds in Russia to wetlands on coastal plains on north-west Australia for the non-breeding season (Menhkorst et al. 2017). Species distribution in Australia is not well known.	Unlikely	Unlikely	Unlikely	Possible vagrant visitor to southern Australia. No records on VBA within 5 m of the Project Area.	Unlikely
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	Mi, Ma	-	Known	2015	2	Nature Advisory (2022) describes the habitat requirements as: <i>Sheltered coastal embayment, including lagoons. Often near sewerage ponds, saltworks, creeks, swamps, and lakes near coast, usually with bare flats (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Possible	Rare, vagrant visitor to Port Phillip Bay which may occur in the offsite environment in association with the habitats of the Ramsar site. No suitable habitat in the Project Area.	Unlikely
Bar-tailed Godwit	<i>Limosa lapponica</i>	Mi, Ma	vu	Known	2017	10	Nature Advisory (2022) describes the habitat requirements as: <i>Mainly coastal species, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Likely	No suitable habitat or adjacent to the Project area. Occurs further east on the Port Phillip Bay Coast and likely to occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit	<i>Limosa lapponica baueri</i>	VU, Mi, Ma	-	Known	-	-	Subspecies <i>L. l. baueri</i> occurs primarily in New Zealand and the northern and eastern Australia.	Unlikely	Unlikely	Unlikely	Occurs further east on the Port Phillip Bay Coast and likely to occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Black-tailed Godwit	<i>Limosa limosa</i>	Mi, Ma	cr	Known	2019	4	Nature Advisory (2022) describes the habitat requirements as: <i>Mainly coastal species, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats. In Vic. Found mainly round Port Phillip Bay (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Likely	No suitable habitat or adjacent to the Project area. Occurs further east on the Port Phillip Bay Coast and may occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Eastern Curlew	<i>Numenius madagascariensis</i>	CR, Mi, Ma	cr	Known	2013	29	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits sheltered coasts, especially estuaries, embayment, harbours, inlets and coastal lagoons with large intertidal mudflats or sandflats, often with beds of sea grass (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or adjacent to the Project Area. Occurs further east on the Port Phillip Bay Coast and may occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Little Curlew*	<i>Numenius minutus</i>	Mi	-	Likely	1986	2	Nature Advisory (2022) describes the habitat requirements as: <i>Occurs in short, dry grasslands and sedgelands with scattered shallow freshwater pools. Occasionally occurs in open woodland with grassy or burn understorey. Can be found in coastal swamps and on sheltered coasts on mudflats or sandflats (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Possible	Rare, vagrant species in Port Phillip Bay. No suitable habitat in or adjacent to the Project Area. May occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Whimbrel	<i>Numenius phaeopus</i>	Mi	en	-	1986	2	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabit intertidal mudflats of sheltered coasts, harbours, lagoons, estuaries and river deltas. Prefer mudflats with mangrove, but also occur on open, unvegetated mudflats. In Victoria, small numbers occur at Gippsland lakes; most from Corner Inlet, Westernport and Port Phillip Bays (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Possible	Rare, vagrant species in Port Phillip Bay. No suitable habitat in or adjacent to the Project Area. May occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely



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Pacific Golden Plover	<i>Pluvialis fulva</i>	Mi, Ma	vu	Known	2013	18	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits sandy, muddy or rocky shores, usually coastal, rarely far inland. Often on beaches and mudflats, sandflats and occasionally rock shelves (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Pacific Golden Plover likely to occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Grey Plover	<i>Pluvialis squatarola</i>	Mi, Ma	vu	Known	2017	5	Nature Advisory (2022) describes the habitat requirements as: <i>Entirely coastal, but occasionally inland. Mainly on marine shores, inlets, estuaries and lagoons where there are nearby large tidal mudflats for feeding and sandy beaches for roosting (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Grey Plover likely to occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Red-necked Phalarope	<i>Phalaropus lobatus</i>	Mi, Ma	-	Known	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Usually pelagic. Mainly inhabit shallow, fresh, brackish or saline near-coastal wetlands with muddy edges (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Possible	Rare, vagrant species in Port Phillip Bay. No suitable habitat in or adjacent to the Project Area. May occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Australian Painted-snipe	<i>Rostratula australis</i>	EN, Mi, Ma	cr	Known	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Generally inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass or sometimes tea-tree (Melaleuca). Sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (DAWE 2020).</i> Listed - overfly marine area as <i>Rostratula benghalensis (sensu lato)</i>	Unlikely	Unlikely	Possible	No suitable habitat in or adjacent to the Project Area. Rare, vagrant species in Port Phillip Bay. May occur in the offsite environment in association with inshore wetland habitats of the Ramsar site.	Unlikely
Hooded Plover*	<i>Thinornis cucullatus</i>	VU, Ma	vu	May	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding. Widespread and scattered across coastal Victoria. Numbers reduced due to disturbance by recreational activities on beaches (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Unlikely	No VBA records in 5 km of the Project Area. Nature Advisory (2022) VBA search area detected last record in 2007. No suitable habitat in or adjacent to the Project Area. No suitable sandy beach habitat in the offsite environment. Rare, vagrant species in Port Phillip Bay.	Unlikely

Common Name	Scientific Name	Status		Source			Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Grey-tailed Tattler	<i>Tringa brevipes</i>	Mi, Ma	cr	Known	2015	37	Nature Advisory (2022) describes the habitat requirements as: <i>Often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide. It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves. The species is rarely recorded in Victoria, however sightings have been reported in Gippsland, and east of McLaughlans Beach. The largest populations in Victoria are located at Corner Inlet, west to Westport and Port Phillip Bays (DAWE 2020).</i> Listed marine as <i>Heteroscelus brevipes</i>	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Grey-tailed Tattler recorded at former Avalon saltworks (VBA). May occur in the offsite environment in association with the habitats of the Ramsar site.	Unlikely
Wood Sandpiper	<i>Tringa glareola</i>	Mi, Ma	en	Known	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits well vegetated, shallow, freshwater wetlands, such as swamps, lakes, pools, and waterholes; typically with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reed. In Victoria, they are mostly from Port Phillip bay and in mid-Murray valley (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Possible	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Wood Sandpiper may occur in the offsite environment in association with the habitats of the Ramsar site. Most VBA records are from Point Wilson and the Western Treatment Plant further east along the coast.	Unlikely
Common Greenshank	<i>Tringa nebularia</i>	Mi, Ma	en	Known	2019	164	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Present	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Common Greenshank known to occur adjacent to the offsite environment in association with the habitats of the Ramsar site. Known to occur at Limeburners Lagoon/Bay and at Avalon Beach and former Avalon saltworks although not recorded during shorebird surveys (AECOM 2022c).	Unlikely

Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsites)	Rationale	
Marsh Sandpiper	<i>Tringa stagnatilis</i>	Mi, Ma	en	Known	2019	86	Nature Advisory 2022) describes the habitat requirements as: <i>Inhabits sandy, muddy or rocky shores, usually coastal, rarely far inland. Often on beaches and mudflats, sandflats and occasionally rock shelves (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Marsh Sandpiper likely to occur in the offsite environment in association with the habitats of the Ramsar site. Known to occur at former Avalon saltworks (VBA) although most VBA records are from the Western Treatment Plant area.	Unlikely
Terek Sandpiper	<i>Xenus cinereus</i>	Mi, Ma	en	Known	1988	4	Nature Advisory 2022) describes the habitat requirements as: <i>Inhabits saline intertidal mudflats in sheltered estuaries, harbours and lagoons; on islets, mudbanks, sandbanks or spits. In Victoria, they occur in Corner Inlet, Westport Bay and Port Phillip Bay (Higgins &amp; Davies 1996).</i>	Unlikely	Unlikely	Possible	No suitable habitat in or immediately adjacent to the Project Area. Shoreline around the existing pier is disturbed and modified. Shorebird survey did not detect migratory shorebird activity adjacent to the existing refinery pier (AECOM 2022c). Terek Sandpiper may occur in the offsite environment in association with the habitats of the Ramsar site. Most recent VBA records are from the Western Treatment. Records from Avalon saltworks are from 1985 and 1986.	Unlikely
<b>Waterbirds</b>												
Magpie Goose	<i>Anseranas semipalmata</i>	-	vu	-	2019	894	Nature Advisory (2022) describes the habitat requirements as: <i>Terrestrial and aquatic habitats, but activities centred on wetlands, mainly those on floodplains of rivers (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Unlikely	No suitable wetland habitat in or adjacent to the Project Area.	Unlikely
Brolga	<i>Antigone rubicunda</i>	-	en	-	2020	53	Nature Advisory (2022) describes the habitat requirements as: <i>Wetlands that include permanent open water and deep freshwater marsh. Between 500 and 700 Brolgas are known to occur in southwestern Victoria (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Possible	No suitable habitat in or adjacent to the Project Area. May occur occasionally in inshore lagoons of Limeburners Lagoon and former Avalon Beach saltworks.	Unlikely
Eastern Great Egret (also Great Egret)	<i>Ardea alba modesta</i>	Ma	vu	-	2020	368	Nature Advisory (2022) describes the habitat requirements as: <i>It occurs in a range of coastal and terrestrial wetlands, including freshwater wetlands with vegetation such as bulrush and requires trees for roosting and nesting (Marchant &amp; Higgins 1990).</i>	Possible	Unlikely	Present	Marginal foraging habitat occurs along foreshore or along drain on Cummins Road or around dam the near Lara City Gate, thus may occur near pipeline. Habitat in the terminal component of the Project Area is unsuitable. Species likely to be encountered along the foreshore of Corio Bay and at inshore wetlands of the offsite environment. Eastern Great Egret was recorded along the foreshore of Corio Bay and inshore wetlands of the offsite environment during shorebird surveys. Species recorded at refinery outfall W5, Point Aboena, Limeburners Bay, Limeburners Lagoon Nature Conservation Reserve	Unlikely

Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
											and former Avalon saltworks (AECOM 2022c). A single bird observed on all occasions except one survey where two individuals were observed at the former Avalon saltworks. Eastern Great Egret are also regularly observed along the Corio Bay foreshore near Geelong (Jonathan Billington, AECOM, pers obs.).	
Plumed Egret	<i>Ardea intermedia plumifera</i>	-	cr		2022	8	Nature Advisory (2022) describes the habitat requirements as: <i>It mainly inhabits terrestrial wetlands; only occasionally visit coastal wetlands and forages amongst aquatic vegetation in shallow water and requires trees for roosting and nesting. It often occurs in wetlands that contain vegetation, including bulrush (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Present	Habitat in and immediately adjacent to the Project Area is not suitable. Recorded in the lagoons at the former Avalon saltworks during shorebird surveys (AECOM 2022c). May occasionally forage along the foreshore of Corio Bay elsewhere in the Ramsar site in the offsite environment.	Unlikely
Hardhead	<i>Aythya australis</i>	-	vu	-	2019	523	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits large, deep waters where vegetation is abundant, particularly deep swamps and lakes, pools and creeks. Also occur on freshwater meadows, seasonal swamps with abundant aquatic flora, reed swamps, wooded lakes and swamps, rice fields, and sewage ponds (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Present	No habitat on or adjacent to the Project Area. Likely to occur in offsite environment in association with the ponds of the former Avalon saltworks and Limeburners Lagoon where the species has been previously recorded (VBA).	Unlikely
Musk Duck	<i>Biziura lobata</i>	-	vu	-	2019	141	Nature Advisory (2022) describes the habitat requirements as: <i>It inhabits terrestrial wetlands, estuarine habitats and sheltered inland waters. Almost entirely aquatic; preferring deep water of large swamps, lakes and estuaries, where conditions are stable and aquatic flora abundant (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Present	No habitat on or adjacent to the Project Area. Likely to occur in offsite environment in association with the ponds of the former Avalon saltworks and Limeburners Lagoon where the species has been previously recorded (VBA).	Unlikely
Australasian Bittern	<i>Botaurus poiciloptilus</i>	EN	cr	Known	1990	3	Nature Advisory (2022) describes the habitat requirements as: <i>Terrestrial wetlands, including a range of wetland types but prefers permanent water bodies with tall dense vegetation, particularly those dominated by sedges, rush, reeds or cutting grass (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Unlikely	No habitat in or adjacent to the Project Area. No suitable habitat in the offsite environment. VBA records mostly from Western Treatment Plant, Moolap Salt Works, Point Henry and The Spit Wildlife Reserve.	Unlikely
Black Swan	<i>Cygnus atratus</i>	-	-	-	2021	726	Black Swans occur in pairs, family groups or large flocks on shallow wetlands across Australia (Menkhorst et al. 2017). Black Swans roost mostly over water, but occasionally on shore (DELVWP 2020), and eat aquatic plants, mainly algae but also seagrass (Menkhorst et al. 2017). Their excrement forms a food source for the seagrass community and scavenging animals such as worms, shrimp, molluscs and crabs (VFA, 2021). The Black Swan is one of the species specifically mentioned as contributing to the	Unlikely	Possible	Present	The Black Swan is not listed as threatened, migratory or marine under the EPBC Act or FFG Act. However, the population of Black Swan occupying Limeburner's Bay is notable given its size. Over 400 individuals were observed in Limeburners Bay in single counts on three of the shorebird survey days in February and March 2021 (AECOM 2022c). On one occasion (in March 2021) over 680 Black Swan were recorded in Limeburner's Bay. No signs	Unlikely

Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
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							Ramsar site fulfilling one of the listing criteria (waterbird breeding). Black Swans are known to regularly breed at the Western Treatment Plant (Lake Borrie), in seagrass at Swan Bay and submerged vegetation at Reedy Lake (DELWP 2018; 2020). Black Swan as present for the, but the species is not known for breeding in the Point Wilson/Limeburners Bay segment of the Ramsar site (DELWP 2020).				of breeding activity were observed during the shorebird survey. Black Swan were observed in smaller numbers (<70) at W5 outfall during shorebird surveys (AECOM 2022c) and may occasionally occur in the shallower waters of the marine component of the Project Area.	
Little Egret	<i>Egretta garzetta</i>	-	en	-	2020	231	Nature Advisory (2022) describes the habitat requirements as: <i>It occurs in a range of coastal and terrestrial wetlands, including freshwater wetlands with vegetation such as bulrush and requires trees for roosting and nesting (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Present	Habitat in and immediately adjacent to the Project Area is not suitable. Habitat in the offsite environment is suitable. Little Egret was recorded in Limeburners Bay, at the former Avalon saltworks and the Corio Bay foreshore at Point Aboena during shorebird surveys (AECOM 2022c).	Unlikely
Australian Little Bittern	<i>Ixobrychus dubius</i>	-	en	-	1990	1	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits terrestrial wetlands, mainly in dense emergent vegetation in freshwater swamps, lakes and watercourses (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Unlikely	Rare, vagrant species in Port Phillip Bay.	Unlikely
Lewin's Rail	<i>Lewinia pectoralis</i>	-	vu	-	2014	5	Nature Advisory (2022) describes the habitat requirements as: <i>Occurs in a variety of densely vegetated wetland habitats, fresh or saline, and usually with areas of standing water. Requires shallow water areas for foraging (Marchant &amp; Higgins 1993).</i>	Unlikely	Unlikely	Possible	No habitat in or adjacent to the Project Area. Most VBA records within 5 km of the Project Area are from the Western Treatment Plant. May occur in the offshore environment in inland wetland habitats of the Ramsar site.	Unlikely
Blue-billed Duck	<i>Oxyura australis</i>	-	vu	-	2019	99	Nature Advisory (2022) describes the habitat requirements as: <i>Terrestrial wetlands and prefers deep permanent, well vegetated water bodies. V (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or adjacent to the Project Area. Likely to occur in the offsite environment in association with inland wetland habitats of the Ramsar site.	Unlikely
Glossy Ibis	<i>Plegadis falcinellus</i>	Mi	-	-	2019	8	Nature Advisory (2022) describes the habitat requirements as: <i>Prefer freshwater inland wetlands, in particular, permanent or ephemeral water bodies and swamps with abundant vegetation (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Likely	No suitable habitat in the Project Area. No habitat on or adjacent to the Project Area. Likely to occur in the offsite environment in inshore habitats of the Ramsar site.	Unlikely
Australasian Shoveler	<i>Spatula rhynchotis</i>	-	vu	-	2019	250	Nature Advisory (2022) describes the habitat requirements as: <i>Large and deep permanent bodies of water and aquatic flora abundant. Also occurs on billabongs, watercourses and flood waters on alluvial plains, freshwater meadows, shallow swamps, reed swamps, wooded lakes, sewage farms and farm dams (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or adjacent to the Project Area. Likely to occur in the offsite environment in association with inland wetland habitats of the Ramsar site (former Avalon saltworks).	Unlikely

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Freckled Duck	<i>Stictonetta naevosa</i>	-	en	-	2019	87	Nature Advisory (2022) describes the habitat requirements as: <i>Terrestrial wetlands; prefer fresh, densely vegetated waters, particularly floodwater swamps and creeks vegetated with lignum or cane grass. During dry seasons or droughts, move off ephemeral breeding swamps and occupy large permanent waters (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Likely	No suitable habitat in or adjacent to the Project Area. Likely to occur in the offsite environment in association with inland wetland habitats of the Ramsar site (former Avalon saltworks).	Unlikely
<b>Seabirds</b>												
Common Noddy**	<i>Anous stolidus</i>	Mi, Ma	-	Likely	-	-	Common Noddy is a pelagic tern of tropical and warm tropical seas which breeds in large island colonies (Menkhorst et al. 2017). Common Noddy occurs mainly in the ocean off the Queensland coast but can also be found off the north-west and central Western Australian coast. Rarely encountered off the coast of Northern Territory. (DoE 2024)	Unlikely	Unlikely	Unlikely	While the SPRAT modelled distribution (on which the PMST relies) includes pockets around Adelaide and Melbourne where the species may occur, Menkhorst et al. (2017) do not identify those areas as part of the species' range. No VBA records occur within 5 km of the Project Area.	Unlikely
Flesh-footed Shearwater**	<i>Ardenna carneipes</i>	Mi, Ma	-	Likely	-	-	Seabird that is uncommon in Victoria. May enter Port Phillip Bay on rare occasions, particularly during rough weather. Mainly occurs in the subtropics over continental shelves and occasionally in inshore waters. Species breeds on islands in burrows and is known to breed at Phillip Island in Victoria (DAWE 2020). Listed marine as <i>Puffinus carneipes</i> .	Unlikely	Unlikely	Possible	No VBA records within 5 km of the Project Area. Foraging may occur within the offsite environment in the deeper parts of Corio Bay on rare occasions. Unlikely to occur in the Project Area due to lack of suitable habitat (pipeline) and existing anthropogenic disturbances (terminal).	Unlikely
Sooty Shearwater**	<i>Ardenna grisea</i>	Mi, Ma	-	May	-	-	Seabird that is an occasional visitor to Victoria. May enter Port Phillip Bay on rare occasions, particularly during rough weather. Abundant in the Southern Ocean during summer, particularly around New Zealand. Nests in colonies on islands and headlands and migrates to the Northern Hemisphere during the Australian winter (DAWE 2020). Listed marine as <i>Puffinus griseus</i>	Unlikely	Unlikely	Possible	No VBA records within 5 km of the Project Area. Foraging may occur within the offsite environment in the deeper parts of Corio Bay on rare occasions. Unlikely to occur in the Project due to lack of suitable habitat (pipeline) and existing anthropogenic disturbances (terminal).	Unlikely
Short-tailed Shearwater*	<i>Ardenna tenuirostris</i>	Mi	-	-	2013	8	Nature Advisory (2022) describes the habitat requirements as: <i>Marine, pelagic seabird that migrates from subantarctic and Antarctic waters to breed in Australia, most notably on mainland Victoria and Bass Strait (Marchant &amp; Higgins 1990). Breeds in large colonies, with nests constructed within burrows in the ground. Known to cover great distances to forage, with feeding locations sometimes hundreds of kilometres from the coast (Einoder &amp; Goldsworthy 2005).</i> Short-tailed Shearwater breeds on Tasmanian offshore islands and off the coast of southern Australia (DAWE 2020).	Unlikely	Unlikely	Likely	Occasional birds foraging over shallow marine waters of Corio Bay.	Unlikely



Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
White-winged Black Tern*	<i>Chlidonias leucopterus</i>	Mi	-	-	2019	7	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabits coastal seas, exposed rocky coasts, and sandy beaches of sheltered coasts, especially those with banks, spits or flats composed of sand or shingle. In Victoria, this species is regularly recorded in Port Phillip Bay at Altona, Werribee and Lake Connewarre, and further west at Lake Murdeduke and L. Terangpom (Higgins &amp; Davies 1996).</i> White-winged Black-terns normally breed only in the northern hemisphere and does not breed in Australia (DoE 2024).	Unlikely	Unlikely	Likely	Occasional birds foraging over shallow marine waters of Corio Bay.	Unlikely
Antipodean Albatross**	<i>Diomedea antipodensis</i>	VU, Mi, Ma	-	Likely	-	-	Pelagic seabird which spends most of its life on the open ocean and rarely ventures close to land. Common visitor to the waters off south-eastern Australia (Menkhorst et al. 2017).	Unlikely	Unlikely	Unlikely	No VBA records within 5 km of the Project Area. No suitable habitat in the Project Area and unlikely to occur in the offsite environment.	Unlikely
Southern Royal Albatross**	<i>Diomedea epomophora</i>	VU, Mi, Ma	cr	Likely	-	-	Pelagic seabird which spends most of its life on the open ocean and rarely ventures close to land. Uncommon off Victoria and rarely seen from land (Menkhorst et al. 2017).	Unlikely	Unlikely	Unlikely	No VBA records within 5 km of the Project Area. No suitable habitat in the Project Area and unlikely to occur in the offsite environment.	Unlikely
Wandering Albatross**	<i>Diomedea exulans</i>	VU, Mi, Ma	cr	Likely	-	-	Pelagic seabird which spends most of its life on the open ocean and rarely ventures close to land. Regularly occurs over continental slope and pelagic waters off southern Australia (Menkhorst et al. 2017).	Unlikely	Unlikely	Unlikely	No VBA records within 5 km of the Project Area. No suitable habitat in the Project Area and unlikely to occur in the offsite environment.	Unlikely
Northern Royal Albatross**	<i>Diomedea sanfordi</i>	EN, Mi, Ma	-	Likely	-	-	Pelagic seabird which spends most of its life on the open ocean and rarely ventures close to land. Uncommon/rare off coast of mainland Australia (Menkhorst et al. 2017).	Unlikely	Unlikely	Unlikely	No VBA records within 5 km of the Project Area. No suitable habitat in the Project Area and unlikely to occur in the offsite environment.	Unlikely
Gull-billed Tern**	<i>Gelochelidon nilotica macrotarsa</i>	Mi, Ma	en	-	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>Shallow freshwater and saline wetlands; intertidal mudflats, also in sheltered inshore marine waters where they roost on sandbars and beaches (Higgins &amp; Davies 1996).</i> Originally listed under FFG Act as <i>Sterna nilotica</i> (DEECA 2024). Also known as Australian Gull-billed Tern <i>Gelochelidon macrotarsa</i> (Atlas of Living Australia). Subspecies <i>macrotarsa</i> is the Australian subspecies. Widespread in Australia but more common in north. Tends to move north during winter. Breeds in colonies on large ephemeral lakes, marshes and coasts creating nests in a ground scrape. Does not normally plunge dive for fish like other white terns rather largely feeds on insects taken in flight and often hunts over wet grasslands for amphibians and small mammals (Menkhorst et al. 2017; Atlas of Living Australia).	Unlikely	Possible	Likely	Occasional birds foraging over shallow marine waters of Corio Bay. Nature Advisory (2022) VBA search area detected last record in 2008.	Unlikely

Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
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Caspian Tern	<i>Hydroprogne caspia</i>	Mi, Ma	vu	-	2018	61	Nature Advisory (2022) describes the habitat requirements as: <i>Sheltered coastal embayment, including harbours, lagoons, inlets, estuaries and river deltas, usually with sandy or muddy margins (Higgins &amp; Davies 1996).</i> Listed marine as <i>Sterna caspia</i> Breed in spring and summer in small colonies mainly on offshore coastal islands (Menkhorst et al. 2017). Nest on ground among gravel and sand and feed mainly on fish which they dive for (Atlas of Living Australia).	Unlikely	Likely	Likely	Occasional birds foraging over shallow marine waters of Corio Bay. May rest on anthropogenic structures. Caspian Terns have been observed at Limeburners Lagoon (Hovells Creek) Flora and Fauna Reserve and in Limeburners Bay (AECOM 2022c).	Unlikely
Southern Giant-Petrel, Southern Giant Petrel**	<i>Macronectes giganteus</i>	EN, Mi, Ma	en	May	-	-	Pelagic seabird which spends most of its life on the open ocean but also occurs in inshore waters, occasionally found in large bays.	Unlikely	Unlikely	Possible	No VBA records within 5 km of the Project Area. No suitable habitat in or adjacent to the Project Area. May forage in the offsite marine environment in the deeper parts of Corio Bay on rare occasions.	Unlikely
Northern Giant Petrel**	<i>Macronectes halli</i>	VU, Mi, Ma	en	Likely	-	-	Pelagic seabird which spends most of its life on the open ocean but also occurs in inshore waters, occasionally found in large bays.	Unlikely	Unlikely	Possible	No VBA records within 5 km of the Project Area. No suitable habitat in or adjacent to the Project Area. May forage in the offsite marine environment in the deeper parts of Corio Bay on rare occasions.	Unlikely
Fairy Prion (southern)	<i>Pachyptila turtur subantarctica</i>	VU	-	Known	-	-	Two forms of this seabird occur in southern Australian waters – the locally breeding nominate species ( <i>P. turtur</i> ) and <i>subantarctica</i> which is slightly larger and paler. Southern subspecies of Fairy Prion breeds on Macquarie Island and other sub-Antarctic islands dispersing north in winter – spring during the non-breeding period to sub-tropical waters off the coast of south-eastern Australia. Species can often be seen from land particularly after strong onshore winds. Also commonly beach-wrecked in south-east Australia (Menkhorst et al. 2017). Nominate species known to breed on offshore islands off Tasmania and in Bass Strait and are present in surrounding waters year-round (Menkhorst et al. 2017).	Unlikely	Unlikely	Possible	No suitable habitat in or adjacent to the Project Area. May be an occasional visitor to Port Phillip Bay. Nominate species more likely to occur than the southern subspecies listed under the EPBC Act.	Unlikely
White-faced Storm-Petrel*	<i>Pelagodroma marina</i>	-	en	-	-	-	Nature Advisory (2022) describes the habitat requirements as: <i>A small, pelagic seabird which migrates from tropical and subtropical waters of the Pacific and Indian Oceans, to the temperate waters in the southern hemisphere. On Mud Islands, birds begin arriving at the colony in early September, and depart in mid-March. In Victoria, breeding occurs on Mud Island and South Channel Fort in Port Phillip Bay and on Tullaberga Island in East Gippsland. The species is not seen within Port Phillip Bay outside of the colonies (Marchant &amp; Higgins 1990).</i>	Unlikely	Unlikely	Possible	No suitable habitat in or adjacent to the Project Area. Occasional birds foraging over shallow marine waters of Corio Bay. Nature Advisory (2022) VBA search area detected last record in 2016.	Unlikely

Common Name	Scientific Name	Status		Source			Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Sooty Albatross	<i>Phoebastria fusca</i>	VU, Mi, Ma	cr	Likely	-	-	Seabird which spends most of its life on the open ocean and rarely ventures close to land. An occasional visitor to Victoria.	Unlikely	Unlikely	Unlikely	No VBA records within 5 km of the Project Area. No suitable habitat in the Project Area and unlikely to occur in the offsite environment.	Unlikely
Gould's Petrel, Australian Gould's Petrel**	<i>Pterodroma leucoptera leucoptera</i>	EN	-	May	-	-	Pelagic seabird which spends most of its life on the open ocean and rarely ventures close to land. Vagrant visitor to Victoria.	Unlikely	Unlikely	Unlikely	No VBA records within 5 km of the Project Area. No suitable habitat in or adjacent to the Project Area.	Unlikely
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	Mi	-	-	1992	1	Pelagic seabird which spends most of its life on the open ocean and beyond the continental shelf and rarely ventures close to land (Menkhorst et al. 2017).	Unlikely	Unlikely	Possible	No suitable habitat in or adjacent to the Project Area. Rare, vagrant species in Port Phillip Bay. May occasionally and opportunistically forage in Corio Bay.	Unlikely
Arctic Jaeger	<i>Stercorarius parasiticus</i>	Mi	-	-	2016	16	Nature Advisory (2022) describes the habitat requirements as: <i>Marine, Antarctic to subantarctic waters. Adults present near Antarctic breeding colonies all year (Marchant &amp; Higgins 1990).</i> The most inshore of the jaegers which enters bays, can be easily observed from land and are less common in offshore waters (Menkhorst et al. 2017).	Unlikely	Unlikely	Possible	No suitable habitat in or adjacent to the Project Area. Occasional birds foraging over shallow marine waters of Corio Bay.	Unlikely
Pomarine Jaeger*	<i>Stercorarius pomarinus</i>	Mi	-	-	2014	2	Pelagic seabird which spends most of its life on the open ocean to the continental shelf and generally avoids sheltered bays. Uncommon off southern mainland. (Menkhorst et al. 2017).	Unlikely	Unlikely	Possible	No suitable habitat in or adjacent to the Project Area. Rare, vagrant species in Port Phillip Bay. May occasionally and opportunistically forage in Corio Bay.	Unlikely
Common Tern*	<i>Sterna hirundo</i>	Mi	-	-	1990	3	Nature Advisory (2022) describes the habitat requirements as: <i>Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins &amp; Davies 1996).</i> Breeds in northern hemisphere and occurs in Australia from around September to April. Roosts on ocean beaches, rock platforms and structures such as jetties and posts (Menkhorst et al. 2017).	Unlikely	Possible	Likely	No suitable habitat in the pipeline component of the Project Area. Occasional birds foraging over shallow marine waters of Corio Bay.	Unlikely
Little Tern	<i>Sternula albifrons</i>	Mi, Ma	cr	May	2019	69	Nature Advisory (2022) describes the habitat requirements as: <i>Sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand spits. In Victoria, they are found mainly on the east coast between Mallacoota and Corner Inlet, rare elsewhere (Higgins &amp; Davies 1996).</i> Listed marine as <i>Sterna albifrons</i> . Most Little Terns seen in Australia from around October to March are non-breeding migrants from Asian breeding grounds. Smaller populations breed in Australia in	Unlikely	Possible	Present	No suitable habitat in the pipeline component of the Project Area. Birds regularly foraging over shallow marine waters of Corio Bay. Likely to occasionally hunt along the shoreline of Corio Bay adjacent to the Project Area and throughout the offsite environment. May rest on anthropogenic structures in the offsite environment. There are VBA records on the outfall structure next to existing refinery pier.	Unlikely

Common Name	Scientific Name	Status		Source			Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
							summer, autumn and winter. Nests in colonies in open sandy settings close to the tideline on beaches. Roost in flocks on sandy beaches and forages over shallow, sheltered coastal waters (Menkhorst et al. 2017)					
Fairy Tern	<i>Sternula nereis</i>	VU	cr	Known	2019	122	Nature Advisory (2022) describes the habitat requirements as: <i>Generally restricted to sheltered coasts both on the mainland, and inshore and offshore islands. Occurs in embayment, such as harbours, inlets, bays, estuaries, lagoons, and ocean beaches. Also found on lakes and salt ponds (Higgins &amp; Davies 1996).</i>  Nests colonially mainly on beaches and ridges just above tideline, occasionally on nearshore rocky islands or stacks. Forages over shallow, coastal waters (Menkhorst et al. 2017).	Unlikely	Possible	Present	No suitable habitat in the pipeline component of the Project Area. Birds regularly foraging over shallow marine waters of Corio Bay. Likely to occasionally hunt along the shoreline of Corio Bay adjacent to the Project Area and throughout the offsite environment. May rest on anthropogenic structures in the offsite environment. There are VBA records on the outfall structure next to existing refinery pier.  Subspecies <i>Sternula nereis nereis</i> (Australian Fairy Tern) is listed as threatened under the EPBC Act. Species <i>Sternula nereis</i> is listed as threatened under the FFG Act. For this assessment <i>Sternula nereis</i> records on the VBA area considered to represent the EPBC Act listed subspecies.	Unlikely
Buller's Albatross, Pacific Albatross**	<i>Thalassarche bulleri</i>	VU, Mi, Ma	en	May	-	-	Pelagic seabird which spends most of its life on the open ocean but also occurs in inshore waters.	Unlikely	Unlikely	Unlikely	No VBA records in 5 km of the Project Area.	Unlikely
Northern Buller's Albatross, Pacific Albatross**	<i>Thalassarche bulleri platei</i>	VU, Ma	en	May	-	-	Listed marine as <i>Thalassarche</i> sp. Nov.	Unlikely	Unlikely	Unlikely	No suitable habitat in the Project Area and unlikely to occur in the offsite environment.	Unlikely
Indian Yellow-nosed Albatross	<i>Thalassarche carteri</i>	VU, Mi, Ma	en	Likely	1979	1	Seabird which occurs in inshore waters out to the continental slope. Regularly observed from land (Menkhorst et al. 2017).	Unlikely	Unlikely	Possible	No suitable habitat in or adjacent to the Project Area. May forage in Corio Bay.	Unlikely
Shy Albatross	<i>Thalassarche cauta</i>	EN, Mi, Ma	en	Likely	-	-	Pelagic seabird which spends most of its life on the open ocean, occasionally found in large bays and known from inshore and deeper parts of Port Phillip Bay.	Unlikely	Unlikely	Possible	No VBA records within 5 km of the Project Area. No suitable habitat in or adjacent to the Project Area. May forage in Corio Bay.	Unlikely
Grey-headed Albatross	<i>Thalassarche chrysostoma</i>	EN, Mi, Ma	en	May	-	-	Pelagic seabird which spends most of its life on the open ocean over deep pelagic waters and occasionally the continental shelf. Rarely observed from land and a rare visitor to southern mainland states (Menkhorst et al. 2017).	Unlikely	Unlikely	Unlikely	No VBA records in 5 km of the Project Area. No suitable habitat in or adjacent to the Project Area and unlikely to occur in the offsite environment.	Unlikely
Campbell Albatross, Campbell Black-browed Albatross	<i>Thalassarche impavida</i>	VU, Mi, Ma	-	Likely	-	-	Pelagic seabird which spends most of its life on the open ocean and rarely ventures close to land.	Unlikely	Unlikely	Unlikely	No VBA records within 5 km of the Project Area. No suitable habitat in the Project Area and unlikely to occur in the offsite environment.	Unlikely
Black-browed Albatross	<i>Thalassarche melanophrys</i>	VU, Mi, Ma	-	Likely	-	-	Pelagic seabird which spends most of its life on the open ocean but also occurs in inshore waters.	Unlikely	Unlikely	Possible	No VBA records within 5 km of the Project Area. No suitable habitat in or adjacent to the Project Area. May forage in Corio Bay.	Unlikely

Common Name	Scientific Name	Status			Source		Habitat	Likelihood of occurrence				Potential impact
		EPBC Act	FFG Act	PMST	VBA Most recent	VBA # records		Terrestrial (pipeline)	Marine (FSRU)	Marine (offsite)	Rationale	
Salvin's Albatross	<i>Thalassarche salvini</i>	VU, Mi, Ma	-	Likely	-	-	Pelagic seabird which spends most of its life on the open ocean.	Unlikely	Unlikely	Unlikely	No VBA records within 5 km of the Project Area. No suitable habitat in the Project Area and unlikely to occur in the offsite environment.	Unlikely
White-capped Albatross	<i>Thalassarche steadi</i>	VU, Mi, Ma	-	Known	-	-	Pelagic seabird which spends most of its life on the open ocean.	Unlikely	Unlikely	Unlikely	No VBA records within 5 km of the Project Area. No suitable habitat in the Project Area and unlikely to occur in the offsite environment.	Unlikely
Crested Tern*	<i>Thalasseus bergii</i>	Mi, Ma	-	-	2020	196	Nature Advisory (2022) describes the habitat requirements as: <i>Common along Australian coastlines. Almost always strictly marine, though occasional records do emanate from inland Australia (Marchant &amp; Higgins 1990).</i> Listed marine as <i>Sterna bergii</i> Nests in colonies on islands and roosts on sandy beaches, rocks and anthropogenic structures. Forages over coastal seas, sometimes far offshore (Menkhorst et al. 2017).	Unlikely	Possible	Present	No suitable habitat in the pipeline component of the Project Area. Birds regularly foraging over shallow marine waters of Corio Bay. Crested Terns were observed during shorebird surveys at the former Avalon saltworks, W5 outfall in proximity to the Project Area and Point Aboena (AECOM 2022c).	Unlikely





