

Chapter 4

Threatened and migratory birds



An assessment was completed of the potential impacts on threatened and migratory birds from the project as part of the Environment Effects Statement (EES) (Technical Report D: Terrestrial ecology impact assessment, hereafter referred to as the original terrestrial ecology EES study).

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 and considered the potential impacts of the project on marine birds, including seabirds that forage in the shallow waters of Corio Bay (The Technical Report D: *Addendum - Peer Review* (hereafter referred to as the addendum)). The addendum was submitted to the Inquiry and Advisory Committee (IAC) during the EES panel hearing, therefore it was not exhibited with the EES. This is because the work reported on therein was completed by Nature Advisory after exhibition of the EES (March, 2022).

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 would they be indirectly impacted. Marine investigations conducted for the EES 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 of short duration (8 weeks) and therefore would not impact on the Ramsar site or on elements of the food chain for migratory shorebirds or other waterbirds (e.g. 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, however, concluded that it was not able to determine whether the impacts of the project on aquatic birds, including shorebirds and marine birds, would 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)). For this reason, 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 captured and assessed (IAC Report No. 1, section 9.4 (iv)). This Chapter provides a summary of the supplementary threatened and migratory birds study that has been undertaken in response to Recommendation 9 in **Table 4-1** of the Minister for Planning's Directions (Minister's Directions) for the Viva Energy Gas Terminal Project (the project) Supplementary Statement.

This Chapter summarises the outcomes of the following technical assessments:

- Technical Report A: Supplementary marine environment impact assessment.
- Technical Report B: Supplementary threatened and migratory birds impact assessment.
- The objectives of this Chapter are to:
- Provide a summary of the technical response to Recommendation 9 of the Minister's Directions.
- Integrate the outcomes of the supplementary threatened and migratory birds study with the original terrestrial ecology EES study and addendum.
- Provide an update to the proposed EES mitigation measures where necessary.

Overview

The Minister's Direction relevant to the supplementary threatened and migratory birds study is Recommendation 9, which requires further assessment of impacts by:

- c. Establishing a complete list of threatened and migratory bird species that could potentially be affected by the project (and consider including the black swan).
- d. Having the list peer reviewed.
- e. 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 (EAAF).
- f. Considering the revised marine modelling.

A consolidated list of threatened and migratory bird species that could potentially be affected by the project was developed and an assessment of the likelihood of the species occurring in the study area undertaken. This list consists of 73 species of threatened and migratory birds that have the potential to occur in the study area: five terrestrial species; four raptors (birds of prey); 32 migratory shorebird species; 12 species of waterbird (including the non-threatened Black Swan); and 20 species of seabird. In accordance with Recommendation 9b of the Minister's Directions, this list was submitted for peer review by Stantec Australia Pty Ltd.

The shorebird survey data from the original terrestrial ecology EES study was further analysed and it was concluded that none of the shorebird survey sites, individually or collectively, are internationally important for any of the four migratory shorebird species recorded during the

surveys, as the counts do not reach the 1% of the flyway population threshold. Only one survey site, at Avalon Coastal Park, would be considered important habitat in Australia or the EAAF based on survey data collected for the Sharp-tailed Sandpiper. All survey sites (except the site on the refinery foreshore adjacent to an existing refinery discharge point) are located in a Ramsar site and therefore are by definition considered internationally important habitat for migratory birds.

The revised marine modelling in the supplementary marine study (Technical Report A: *Supplementary marine environment impact assessment*) resulted in no change to the EES conclusions. Consequently, the conclusions of EES Technical Report D and the addendum remain unchanged and apply to the consolidated list of migratory and threatened birds developed as described above. As such, it was concluded that no residual impacts on the ecological character of the Ramsar site, seagrass or food availability for threatened and 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.

It was determined that none of the threatened and migratory birds with potential to occur in the study area are likely to be impacted by the project.

4.1 Methodology

4.1.1 Minister’s Directions

Table 4-1 of the Minister’s Directions consolidates the recommendations for further work to inform the Supplementary Statement. The Minister’s Direction relevant to the supplementary threatened and migratory birds is presented in **Table 4-1** below.

Table 4-1 Minister’s Direction relevant to the supplementary threatened and migratory bird technical study

Recommendation	Description	Section addressed
Recommendation 9	Undertake further assessment of impacts on threatened and migratory bird species by:	
	Establishing a complete list of threatened and migratory bird species that could potentially be affected by the project (and consider including the black swan)	Section 4.3.1
	Having the list peer reviewed	Section 4.3.1
	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 4.3.2
	Considering the revised marine modelling	Section 4.3.3

A summary of the tasks that were undertaken to address the four items of further work is provided below:

- Methodology for Recommendation 9a: Develop a consolidated list of threatened and migratory bird species that could potentially be affected by the project utilising searches of the Victorian Biodiversity Atlas (VBA) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (PMST) and undertake an assessment of the likelihood of the species to occur in the study area.
- Methodology for Recommendation 9b: Submit the list of threatened and migratory bird species for peer review by Stantec Australia Pty Ltd (Stantec), engaged as the independent peer reviewer by the Department of Transport and Planning (DTP).
- Methodology for Recommendation 9c: Undertake additional analysis of the shorebird survey data from the EES to determine whether the surveyed sites are an important site for any particular migratory bird species in Australia or the EAAF.
- Methodology for Recommendation 9d: Consider potential direct and indirect impacts from the

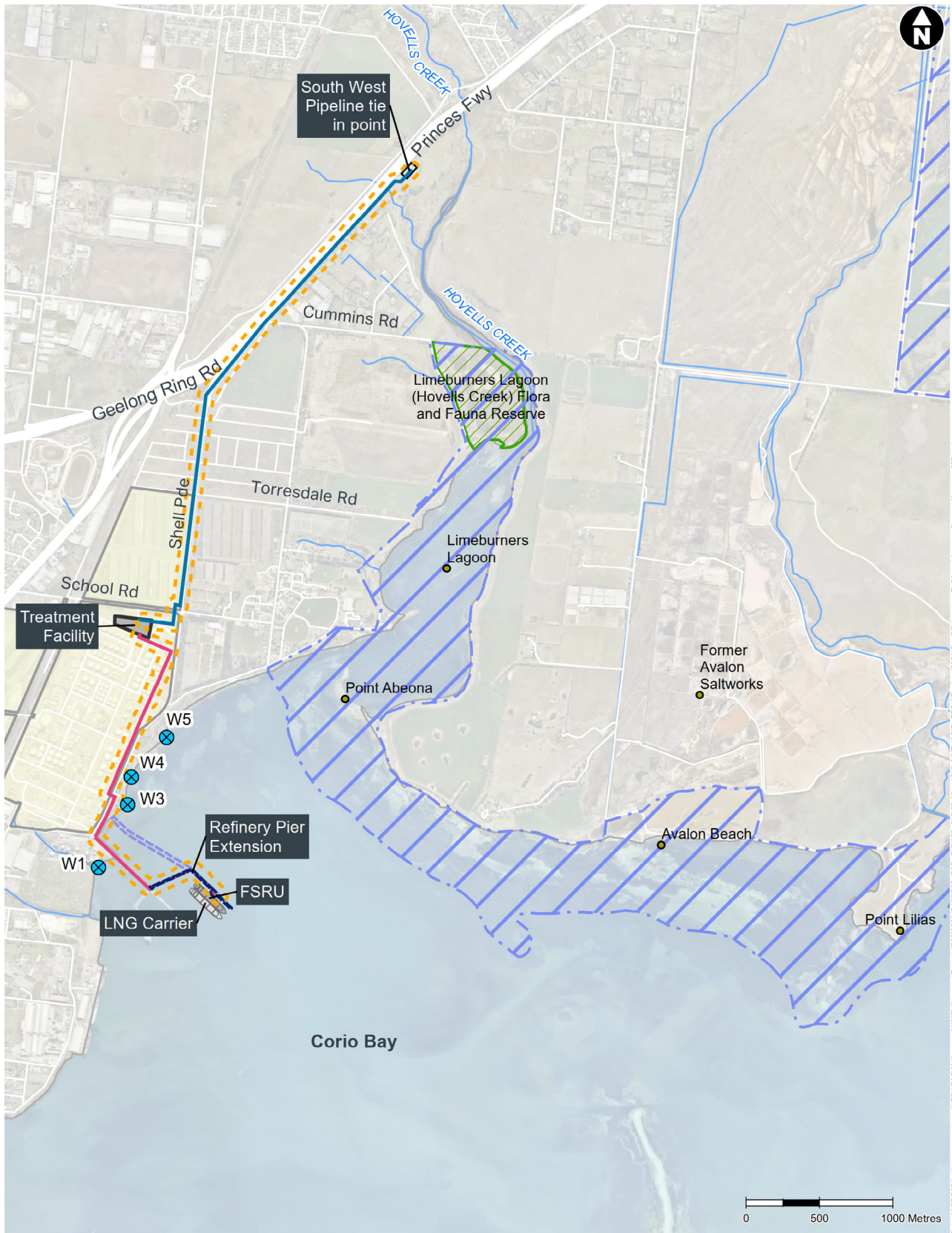
project on the consolidated list of threatened and migratory bird species and with consideration to further marine modelling work undertaken as part of the supplementary marine environment study.

- Identify any additional mitigation measures, if necessary.

4.1.2 Study area

The study area for the supplementary threatened and migratory bird study is defined by the:

- Project area: as shown in **Figure 4-1** including terrestrial (i.e., onshore pipeline, treatment facility and tie-in point) and marine (i.e., the FSRU which would be moored at the Refinery Pier extension) components; and,
- Offsite environment: including parts of Corio Bay, Limeburners Bay and beyond to Avalon Beach. These areas were included as part of the study area due to the project’s proximity to a wetland of international significance (Ramsar site) and because potential marine impacts associated with the project could impact on the Ramsar site, for example, impacts on the food chain for threatened and migratory birds.



- - - Onsite Area
- ⊗ Existing Discharge Point
- Offsite Coastal Locations
- Aboveground Pipeline
- Underground Pipeline
- - - Seawater Transfer Pipe
- - - Refinery Pier Extension
- - - Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site
- Viva Energy owned land
- Parks and reserves



Figure 4-1 Project overview

4.2 Summary of the original terrestrial ecology EES impact assessment

The existing conditions assessment in Section 5 of the original terrestrial ecology EES study provided baseline conditions to enable an assessment of the potential impacts to terrestrial ecology from the project. The findings of this EES study are summarised below.

The project would be located adjacent to, and on, Viva Energy's Geelong Refinery in a heavily industrialised setting. The land component of the project outside of the refinery comprises areas dominated by exotic grassy and herbaceous species alongside areas of planted native and exotic woody vegetation. Patches of native vegetation occur within and proximal to the pipeline alignment. The project is also sited within the marine environment of Corio Bay, which is connected to the Limeburners Bay and Avalon Beach components of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site although the project site is approximately one kilometre from the Ramsar site. The assessment determined that construction activities for the project would involve the removal of 0.091 hectares (ha) of native vegetation, represented by the Western (Basalt) Plains Grassland Community, which is a threatened ecological community and may impact on a small extent of marginal foraging habitat for Swift Parrot and Grey-headed Flying-fox (planted eucalypts). However, it was concluded that construction activities would not result in a significant impact to these ecological values. Mitigation measures such as establishing No-Go Zones to protect vegetation and avoiding large-scale excavations in proximity to trees would be implemented.

It was also concluded that terrestrial ecological values of the Ramsar site, in particular, migratory shorebirds and other waterbirds, would not be directly impacted by the project as there is no infrastructure to be located in, or near, the wetland

other than piping within the existing refinery. Noise and light spill from the project were also assessed and found to have no adverse impacts on Ramsar values.

Potential indirect impacts on terrestrial ecological values in Corio Bay and the Ramsar site were also evaluated in the EES study. In particular, the potential for the project to impact on the food chain (plankton, larvae, fish etc.) of migratory shorebirds and other waterbirds. Marine investigations conducted for the EES 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 to the dredged area and not impact on the Ramsar site or to elements of the food chain for terrestrial species, for example, seagrass meadows in Corio Bay.

The original marine EES study excluded birds from the impact assessment on threatened and migratory marine species. Following an independent peer review of the original terrestrial ecology EES study, further assessment was undertaken which included marine birds (seabirds) that forage in the shallow, marine waters of Corio Bay and therefore are also influenced by impacts on the marine environment. It was concluded in the addendum that the inclusion of seabirds in the impact assessment did not change the outcomes of the original terrestrial ecology EES study.



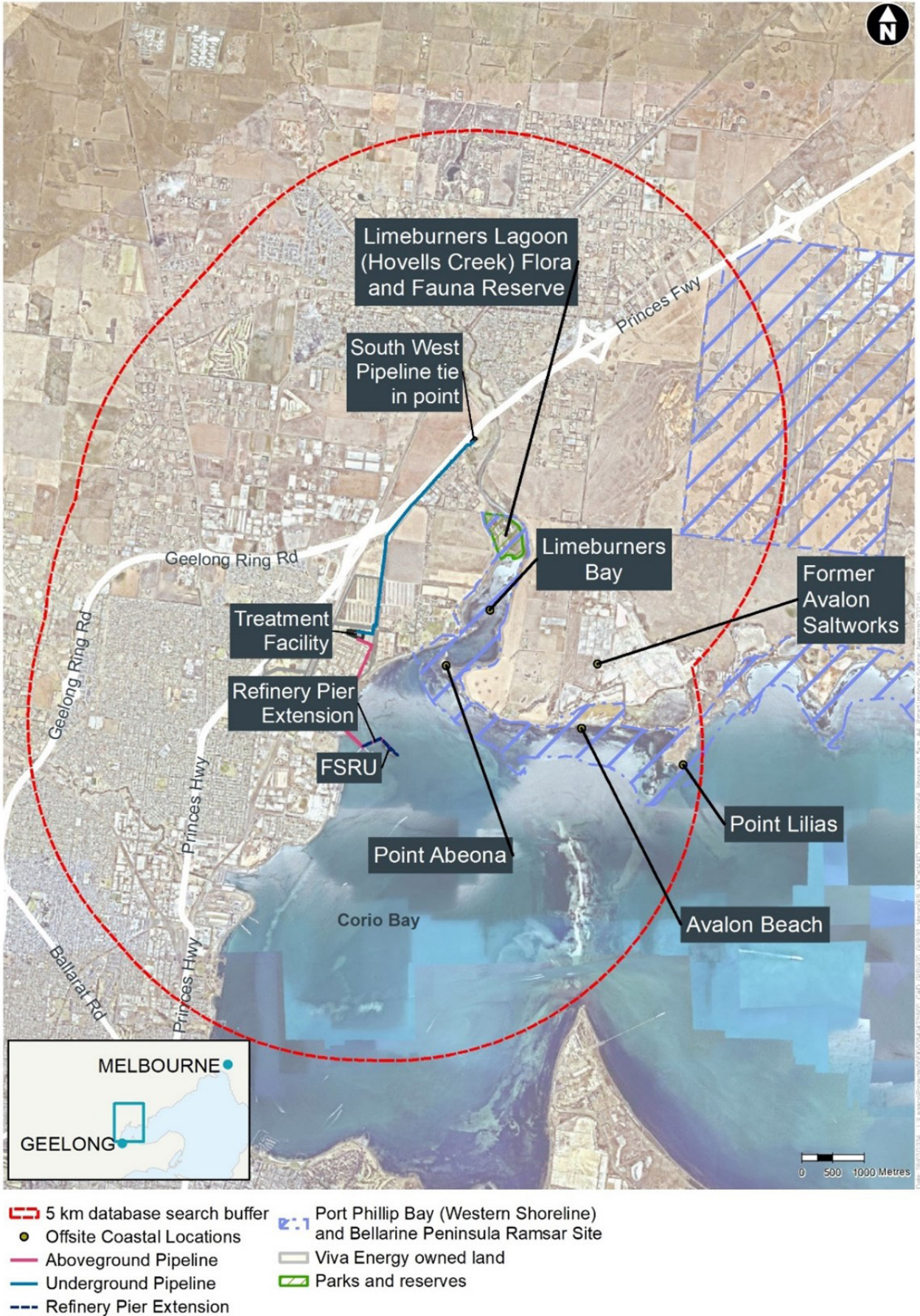


Figure 4-2 Database search area

4.3 Outcomes of supplementary tasks

The following sections present the outcomes of the tasks undertaken in the supplementary threatened and migratory birds impact assessment in response to Recommendation 9 of the Minister's Directions

4.3.1 List of threatened and migratory bird species

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

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

The consolidated list of threatened and migratory bird species and the assessed likelihood of the species occurring in the study area is provided in Appendix A of Technical Report B: *Supplementary threatened and migratory birds impact assessment*.

The database searches were based on a 5 km buffer area around the 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 4-2**.

Species considered to have potential to be affected by the project are the species assessed as having potential to occur in the study area (i.e., with a likelihood rating of possible, likely or present). The following sections list the threatened and migratory bird species with the potential to occur in the study area.

4.3.1.1 Project area (terrestrial)

- Fork-tailed Swift *Apus pacificus* – migratory under the EPBC Act
- Eastern Great Egret *Ardea alba modesta* – vulnerable under the *Flora and Fauna Guarantee Act 1988* (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 has not been considered as a MNES for the purposes of this project)
- 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

4.3.1.2 Project area (marine)

has been modified by the presence of Refinery Pier and associated port and industrial activity. As such, the habitat is unlikely to support many threatened and migratory bird species. The following species are those that may occur in this area, but only occasionally, and as part of wider activity in the surrounding marine environment:

- White bellied Sea-eagle (endangered under the FFG Act) may hunt over the area, but the project area is marginal habitat for this species. White-bellied Sea-eagles are sensitive to human habitation and may therefore prefer areas away from the existing refinery and Refinery 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) have been recorded roosting on the seawater intake that extends approximately 100 m from the shore immediately adjacent to the existing Refinery Pier (VBA). 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) regularly forage over shallow marine waters of Corio Bay and were observed during shorebird surveys at the former Avalon Saltworks, the W5 outfall in proximity to the Project Area and Point Aboena. Crested Terns may forage along the shoreline and over the marine waters of the Project Area and may roost on anthropogenic structures.

Additionally, Black Swan *Cygnus atratus* 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 have been observed in small numbers at the W5 outfall during shorebird surveys and may occasionally venture into the shallower waters of the marine component of the project area

4.3.1.3 Offsite environment

- There is thirty-two species of migratory shorebirds identified to potentially occur in association with the Project Area or offsite environment. Six of these species are also listed as threatened under both the EPBC Act and FFG Act, twelve species are also listed as threatened under the FFG Act only, twelve species are not listed as threatened. One species (Latham's Snipe *Gallinago hardwickii*) was not considered as a threatened species because its threatened status under the EPBC Act occurred after the EPBC Act referral decision for the project. For this reason, it has not been considered as a MNES for this 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.
- There is 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 embayment's. 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 it opportunistically during rough weather. 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 anthropogenic structures.

- There are twelve species of waterbird including Black Swan (not threatened but species of note), five species of duck, three species of egret, Glossy Ibis *Plegadis falcinellus*, Brolga *Antigone rubicunda* and Lewin's Rail *Lewinia pectoralis*. Most of these species are likely to utilise the inshore ponds and wetlands of the Ramsar site rather than the shoreline or in Corio Bay. Black Swans are known to congregate in large numbers in Limeburners Bay.
- Four species of raptor (birds of prey): Black Falcon, White-bellied Sea-Eagle, Little Eagle and Eastern Osprey *Pandion cristatus*. These species 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 occasionally are Rufous Needle-tail, White-throated Needletail and Orange-bellied Parrot *Neophema chrysogaster* and may be occasional visitors to Limeburners Bay and the former Avalon Saltworks.

In accordance with the Minister's Directions, an independent peer reviewer (Stantec) was engaged by DTP to undertake an independent peer review of the list of threatened and migratory bird species (refer to Attachment I: Peer Report B). The peer reviewer concluded that the list of threatened and migratory species presented in Appendix A of Technical Report B: *Supplementary threatened and migratory birds impact assessment* is sound. A summary is also provided in Section 4.1.4.3 of Technical Report B: *Supplementary threatened and migratory birds impact assessment*.

4.3.2 Further analysis of EES shorebird survey data

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

- 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

A baseline assessment of migratory shorebirds within, and adjacent to, the project was undertaken as part of the original terrestrial ecology EES study. 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 to capture any Double-banded Plover *Charadrius bicinctus* which migrate from New Zealand to Australia over autumn and winter (March to August).

Six survey sites were established, as shown in **Figure 4-3** and monitoring focused on waders, 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 survey sites included four major sites and two minor sites.

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).
- Sites 3P and 3T– Avalon Beach (east) – (P) point and (T) 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 migratory shorebird species were identified during the surveys: Sharp-tailed Sandpiper *Calidris acuminata*, Red-necked Stint *Calidris ruficollis*, Curlew Sandpiper *Calidris ferruginea* and Common Sandpiper *Actitis hypoleucos*.

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 EAAF, the findings of the surveys were assessed against:

- The definition of internationally and 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).

None of the shorebird survey sites individually or collectively would be considered internationally important for any of the four migratory species recorded during the surveys, as the counts do not reach the 1% of flyway population threshold for internationally important habitat.

Based on the analysis undertaken, it was determined that only one survey site, Site 3T Avalon Coastal Reserve would be considered important habitat in Australia or the EAAF. This determination is on the basis of the survey count, meeting the 0.1% of flyway population threshold for nationally important habitat for the Sharp-tailed Sandpiper. Site 3T is only partially located within the Ramsar site, however the area of the former Avalon Saltworks (i.e., Avalon Coastal Reserve) adjacent to the site boundary is currently being considered for inclusion.

All sites except Site 5 Refinery Discharge Point W5 are located within the Ramsar site and are therefore by definition considered internationally important habitat for migratory shorebirds, however based on the survey data alone none of these sites support enough individuals of a species of migratory shorebird to be an important site in Australia or the EAAF.

Consistent with the findings of the EES, Site 5 located on the refinery foreshore adjacent to the project area is the only site that is not considered important habitat for shorebirds at either an international or national level.

The analysis of the survey data did not change the assessment outcomes of the original terrestrial ecology EES study in relation to the significance of the study area. When assessing project impacts shorebird habitats at all sites surveyed (except Site 5) were considered internationally important due to being located in a Ramsar site.

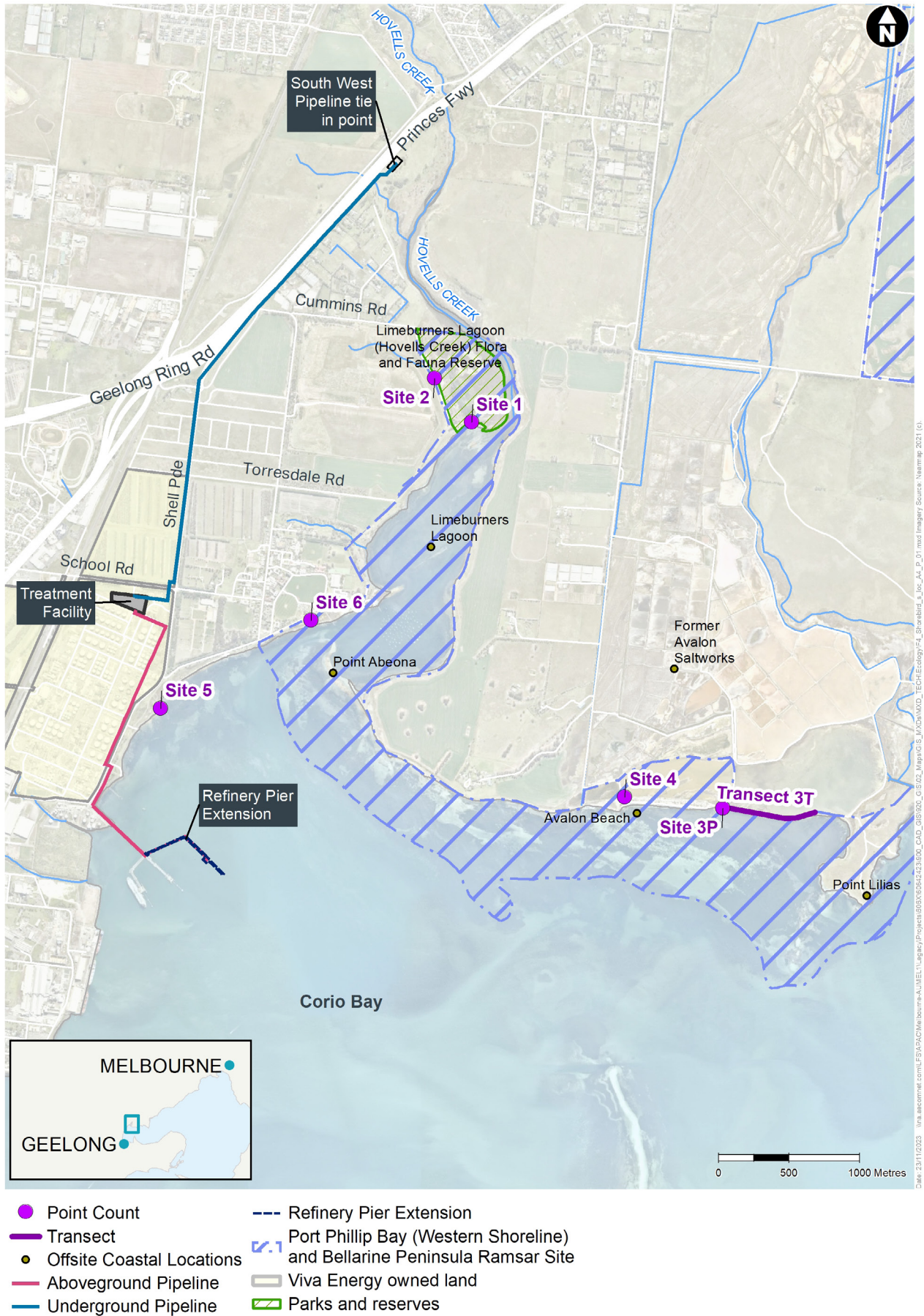


Figure 4-3 Shorebird survey locations.

4.3.3 Consideration of the revised marine modelling

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

d. Considering the revised marine modelling

Threatened and migratory bird species determined likely to occur within 5 km of the project may be impacted indirectly as a result of potential impacts of the project to the marine environment.

Key risks include:

- The proximity of the project to the Ramsar site.
- The effects of operational wastewater discharges.
- The entrainment of fish larvae and plankton.
- The effects of dredging on seagrass.

These risks were originally assessed as part of EES Technical report A: *Marine ecology and water quality impact assessment*. As part of the supplementary statement, the marine assessment's regional hydrodynamic model was revised and the potential impacts from wastewater discharges, entrainment and sediment transport were re-assessed. These supplementary assessments are presented in Technical Report A: *Supplementary marine environment impact assessment* and are summarised in supplementary statement Chapter 3: *Marine environment* Sections 3.3.3, 3.3.5 and 3.3.6 respectively.

The results of the revised marine modelling showed no change to the conclusions presented in EES Technical report A: *Marine ecology and water quality impact assessment*. Consequently, the conclusions of EES Technical report D: *Terrestrial ecology impact assessment* and the addendum remain unchanged. These conclusions apply to the consolidated list of threatened and migratory birds prepared to address Recommendation 9 (Section 4.3.1). These conclusions are:

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

- Re-use 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 site.
- Direct discharge from the FSRU to Corio Bay through a 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.
- No seagrass would be directly removed by dredging activities at Refinery Pier. The predicted extent of elevated suspended solids concentrations resulting from dredging activity covers much the same area as shown in the original EES, with low concentrations of suspended solids at the edge of the Ramsar site. All seagrass in the Ramsar site (zero to 2m depth) would always receive sufficient light for growth. The accretion of sediment on seagrass beds in the Ramsar site is from zero to 2mm, which is expected to have negligible to very minor impact as seagrass naturally traps and accumulates sediment.
- 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 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.

4.4 Integrated assessment

Section 6 of the original terrestrial ecology EES study and the addendum described the potential impacts on ecological values both in the project area and the offsite environment.

The assessment considered the following impact pathways for terrestrial impacts associated with onshore components of the project (primarily the pipeline):

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

Potential marine impacts associated with the FSRU and extension to Refinery Pier, and potential changes to the offsite marine environment which may affect intertidal areas and the ecological character of the Ramsar site 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 FSRU operation.
- Changes to water quality (chlorine) and temperature from FSRU wastewater discharges.
- Entrainment of plankton and fish larvae by FSRU seawater intake.
- Light disrupting movement of birds.
- Additional shipping movements and associated risk of fuel and chemical spills and marine pest introductions.

An integrated assessment of potential impacts on threatened and migratory birds, including marine species not previously assessed in the EES, is described below for the terrestrial and marine components of the project area and the offsite environment of the study area.

4.4.1 Project area (terrestrial)

The original terrestrial ecology EES study identified a small extent of marginal habitat for Eastern Great Egret in the project area: along the refinery foreshore, in the swale drain on Macgregor Court and around the dam near the pipeline tie-in point at Lara City Gate. 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 and Little Eagle) may hunt over the project area, however it was concluded that construction of the pipeline would be 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. Similarly, Rufous Fantail may occur on occasion when on passage, and Swift Parrot and Gang-gang Cockatoo may use planted trees for winter foraging on an occasional and opportunistic basis. The construction footprint would avoid most planted trees but would remove a maximum of 0.354 ha of planted overstorey trees. It was concluded that foraging and loafing resources are available elsewhere in the landscape and, as all these species are highly mobile, are unlikely to be affected by the project.

4.4.2 Project area (marine)

Threatened and migratory terns and White-bellied Sea-eagle may forage along the refinery shoreline and over the marine waters of the project area on occasion. Little Terns and Fairy Terns have been recorded roosting on existing structures including the refinery seawater intake channel adjacent to Refinery Pier. However, it was considered likely that activity associated with the existing refinery and Refinery Pier is likely to discourage regular occurrence in the project area.

Black Swans were observed in small numbers at refinery discharge point W5 along the refinery shoreline adjacent to the project area during the EES shorebird surveys and may venture into the shallower waters of the marine component of the project area on occasion.

It was concluded that construction and operation of the project would be unlikely to significantly impact these species.

4.4.3 Offsite environment

4.4.3.1 Potential impacts on migratory shorebirds and seabirds

Coastal seabirds 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. Crested Terns were observed at the former Avalon saltworks, refinery discharge point W5 on the refinery shoreline and Point Aboena during the EES shorebird surveys.

Shorebirds, however, 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.

As discussed in **Section 4.3.3**, the revised marine modelling undertaken as part of the supplementary marine study showed no change to the EES conclusions. The impact assessment for the offsite environment provided in the original terrestrial ecology EES study and the addendum described the potential impacts on migratory shorebirds and seabirds and concluded:

- Dredging activity is unlikely to affect seagrass meadows or food resources and therefore 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.
- Noise from construction activities or operation of the FSRU is unlikely to affect the ecological character of the Ramsar site or the foraging behaviour of migratory shorebirds as levels during dredging, piling and FSRU operation are not modelled to exceed those currently experienced in the environments of the Ramsar site.
- Operation noise of the FSRU would be lower than noise levels currently experienced on the foreshore near Geelong Grammar School and in the Avalon foreshore 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. The predicted noise levels are also 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*.
- Noise from construction activities or operation of the FSRU is unlikely to significantly affect seabirds in Corio Bay. 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 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.
- Light associated with construction or operation of the project in the existing modified environment is unlikely to significantly affect migratory shorebirds or seabirds. Light spill would be localised therefore migratory shorebird habitat and ecological character of the Ramsar site is unlikely to be affected by light during construction and operation. 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 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.
- 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. This is because:
 - Discharge from the FSRU through the existing refinery would not change the existing chlorine plume from the refinery which does not extend to Limeburners Bay or the Ramsar site. Re-use of cooled seawater from the FSRU within the refinery would reduce the existing temperature difference between the current refinery discharge and Corio Bay. Historical discharge - and therefore project discharge - has not had adverse effects on the marine ecosystem and therefore 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 the 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.
- Potential entrainment of fish larvae and plankton from the Ramsar site and Limeburners Bay is negligible. 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.
- 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.

The results of the updated seagrass mapping undertaken in Technical Report A: *Supplementary marine environment impact assessment* demonstrated that a limited amount of seagrass would be removed during installation of the seawater transfer pipe. Approximately 0.5 ha of seagrass would be lost during installation of the seawater transfer pipe.

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.

4.4.3.2 Potential impacts on waterbirds

It was considered likely that most of the waterbird species would occur in the inshore ponds and wetlands of the Ramsar site and it has been concluded that those areas, which are remote from the project area, would not be affected by noise, light or discharges 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 are known to 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 Corio Bay 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 is unlikely to affect seagrass or the food chain.
- Dredging activity is unlikely to affect seagrass meadows or the food chain.
- Noise from construction activities or operation of the FSRU is unlikely to affect the ecological character of the Ramsar site or the foraging behaviour as levels during dredging, piling and FSRU operation are not modelled to exceed those currently experienced in the environments of the Ramsar site.
- Light associated with construction or operation of the project in the existing modified environment is unlikely to affect waterbirds. Light spill would be localised therefore habitat is unlikely to be affected by light during construction or operation.

4.4.3.3 Potential impact on raptors

It was concluded that raptors are unlikely to be impacted by the project as these species are not reliant on the marine habitat of Corio Bay, and the Ramsar site is unlikely to be affected for the reasons outlined above.

4.4.3.4 Potential impacts on terrestrial (non-aquatic) species

It was concluded that terrestrial birds occurring in the offsite environment are unlikely to be impacted by the project as these species are not reliant on the marine habitat of Corio Bay and the Ramsar site is unlikely to be affected for the reasons outlined above.

4.5 Mitigation measures

The supplementary threatened and migratory birds impact assessment considered the consolidated list of threatened and migratory birds that could potentially be affected by the project, together with the revised marine modelling and found that the conclusions reached in the EES remain unchanged and apply to the consolidated list, including species not previously assessed in the EES.

Therefore, no mitigation measures have been added and no changes have been made to the original terrestrial ecology mitigation measures, MM-TE01 to MM-TE12, the marine ecology and water quality mitigation measures, MM-ME01 to MM-ME18 and the two light spill mitigation measures MM-LS01 and MM-LS02 (formerly incorrectly numbered MM-LS03).

Refer to Chapter 9: *Environmental Management Framework* for a list of the mitigation measures related to the topics covered by the supplementary statement.

4.6 Conclusion

The original terrestrial ecology EES study concluded that terrestrial ecological values of the Ramsar site, in particular migratory shorebirds and other waterbirds, would not be directly impacted.

With consideration to the original marine environment EES study, it was concluded that existing and future marine discharges, and the 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 of short eight-week duration and not impact on the Ramsar site or on elements of the food chain for migratory shorebirds or other waterbirds, for example, seagrass meadows in Corio Bay.

With consideration to the supplementary statement, the further analysis of the shorebird survey data did not change the assessment outcomes of the original terrestrial ecology EES study in relation to the significance of the study area. When assessing project impacts shorebird habitats at all sites surveyed (except Site 5 located on the refinery foreshore adjacent to the project area) were considered internationally important due to being located in a Ramsar site.

The revised marine modelling undertaken as part of the supplementary marine impact assessment has not predicted increased impacts on the marine environment, and therefore on the Ramsar site or on the consolidated list of threatened and migratory bird species prepared to address Recommendation 9 of the Minister's Directions.

The supplementary marine assessment identified that approximately 0.5 ha of seagrass would be removed during construction of the seawater transfer pipe. Seagrass is considered native vegetation and the area of seagrass to be removed includes a mixture of *H. nigricaulis*, listed as a threatened species under the FFG Act. The local and temporary loss of a very small area of seagrass and marine invertebrates is unlikely to affect migratory shorebirds and seabirds.

None of the threatened and migratory birds with potential to occur in the project area, or in the offsite environment of the study area, are likely to be impacted by the project.

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