

Chapter 10

Conclusion



This chapter presents the key findings of the proposed Viva Energy Gas Terminal Project (the project) Supplementary Statement.

10.1 Environmental matters to be assessed

The Directions provided by the Minister for Planning set out the specific environmental matters to be investigated and documented in the Supplementary Statement.

To address the Minister's Directions, five technical studies have been undertaken. The specialist studies are included as technical appendices to this Supplementary Statement.

The Minister's Directions identified the following areas of potential environmental impact as requiring further consideration, modelling or analysis.

- The potential of the project to cause adverse effects on the marine environment of Corio Bay in regard to its impact on water quality (wastewater discharge and sediment mobilisation); the impact of entrainment of plankton and larvae; the potential impacts on seagrass caused by dredging and the potential for dredging to impact the Ramsar site.
- The potential of the project to impact on threatened and migratory bird species;
- The potential of the project to impact on noise levels, and cumulative noise levels, at nearby sensitive receivers;
- The potential impacts on air quality; and
- The potential impacts on underwater Aboriginal cultural archaeology and intangible Aboriginal cultural values.



10.2 Key findings

The Minister’s Directions set out 12 specific recommendations for further work to be undertaken and documented in the Supplementary Statement. The 12 recommendations were related to four subject areas: marine environment (including threatened and migratory birds), noise, air quality and Aboriginal cultural heritage.

Five specialist technical studies have been undertaken across these subject areas in response to the Minister’s Directions:

- Supplementary marine environment impact assessment.
- Supplementary threatened and migratory birds impact assessment.
- Supplementary noise impact assessment.
- Supplementary air quality impact assessment.
- Underwater Aboriginal cultural archaeological assessment.

The table below presents the Minister’s Directions recommendations for further work and the key findings of each of the Supplementary Statement technical studies.

Table 10-1 Key findings of the Supplementary Statement

Topic	Key findings	Further information
Recommendation 1		
Undertake further survey work to better establish the existing environment and the impacts of existing wastewater discharges from the refinery to enable better understanding of project impacts.		
The survey work should:		
<ul style="list-style-type: none"> a. Cover intertidal, littoral and subtidal habitats that could potentially be affected by the project, including the Ramsar site. b. Update seagrass mapping to include the intertidal zone and information on the different seagrass species. c. Be carried out over a period of at least 12 months before construction or dredging starts, with a minimum of four sampling runs (one in each season) to address seasonal variability. d. Establish a better baseline for monitoring during and after the project to confirm predicted outcomes on shoreline and benthic communities, including seagrasses and macroalgae. 		
Marine Environment	<p>The existing environment was assessed by measuring existing discharge plumes from the Geelong refinery and by undertaking further seagrass mapping.</p> <p>The existing plumes were defined from extensive temperature measurements in the four existing refinery discharge points and within the discharge plumes. Measurements were taken monthly between July 2023, and January 2024, at hundreds of locations within the discharge points, on a range of tide conditions using a highly sensitive temperature probe. This allowed for the accurate measurement of temperature contours in the existing refinery discharges on a more extensive basis than conducted for the original EES.</p> <p>As the chlorine levels in the existing refinery discharge plumes are below the level of detection, chlorine levels in the plumes were calculated using the measured temperature rise relative to ambient seawater, the known ratio of chlorine to temperature in the discharges and the known decay rates of chlorine and temperature with time.</p>	<p>Chapter 3: <i>Marine environment</i></p> <p>Technical Report A: <i>Supplementary marine environment impact assessment</i></p>



Topic	Key findings	Further information
Marine Environment	<p>The measured existing temperature plumes and calculated chlorine plumes were compared to guideline values for Corio Bay and the Ramsar site. The detailed measurements showed that the existing +5°C temperature contour from the refinery extends only 150m from discharge point W5. The +3°C contour extends approximately 560m to the north along the shore from W5. The +2°C contour, representing the guideline value for protection of the Ramsar site values, extends a further 90m north along the shore but does not reach the Ramsar site.</p> <p>For all existing chlorine discharges, the inferred 10 µg/L chlorine contour for protection of environmental values within Corio Bay is reached within the mixing zone defined in the refinery’s current EPA operating licence. The inferred 4.3µg/L chlorine contour which reflects the guideline value for protection of the Ramsar site values extends approximately 200 m from the W1 discharge point and approximately 60m from W5. The 4.3µg/L chlorine contour does not reach the Ramsar site.</p> <p>These results are consistent with the original EES, where the existing temperature and chlorine discharge plumes were predicted to be below guideline limits at the Ramsar site.</p> <p>Towed underwater camera transects were run throughout northern Corio Bay with a total of around 11,300 images analysed which built on the data collected for the original EES. These surveys were undertaken in winter, spring and summer.</p> <p>The results of the supplementary surveys showed that the main seagrass species in Corio Bay are a combination of <i>Nanozostera Muelleri</i> in the intertidal zone and <i>Heterozostera nigricaulis</i>, <i>Halophila australis</i> and <i>Althenia marina</i> in the subtidal zone.</p> <p>A comparison of seagrass distribution and cover along the shoreline within the existing discharges and at the Ramsar site showed no significant difference. The existing refinery discharges have had no measurable effect on seagrass when compared with seagrass condition at reference sites in the Ramsar site.</p> <p>Tasks 1c and 1d do not form part of the Supplementary Statement and will need to be carried out 12-months prior to the commencement of dredging or construction to provide the most accurate and representative baseline for project monitoring during and after construction. These tasks will form part of the secondary approvals process.</p>	<p>Chapter 3: Marine environment</p> <p>Technical Report A: Supplementary marine environment impact assessment</p>

Topic	Key findings	Further information
<p>Recommendation 2</p> <p>Refine calibration of the regional hydrodynamic model so that it more accurately reproduces observed water levels, currents, tidal range, and tidal exchange in Corio Bay. Consider:</p> <ol style="list-style-type: none"> The selection of the most appropriate wind data. More detailed horizontal resolution to represent the Hopetoun and North Channels more accurately. More detailed vertical resolution to represent discharge plumes in shallow waters more accurately. The effects of the presence of the Floating Storage Regasification Unit (FSRU) on currents. Peer review of the model calibration 		
<p>Marine Environment</p>	<p>A regional hydrodynamic model was developed during the EES to support the assessment of potential impacts on Corio Bay. The model was used to simulate existing currents, temperatures and salinities in Corio Bay, predict the path and dispersion of wastewater discharge plumes, simulate the potential transport and dispersion of plankton from different regions of the bay, predict the entrainment of plankton during operation of the FSRU and predict the fate and transport of fine sediments likely to be mobilised during dredging.</p> <p>Following the EES, the IAC concluded that because the regional hydrodynamic model underpins the assessment of the project’s marine impacts, further work should be undertaken to refine the calibration of the model so that it more closely reproduces observed tidal range, tidal exchange and currents to provide a more reliable basis on which to assess the project’s effects on the marine environment.</p> <p>In the Supplementary Statement, the regional hydrodynamic model was refined with a horizontal grid of 20m by 20m and a vertical grid of 0.5m to a depth of 4m. This improved the resolution of tides and other sea level variations at the model boundary in Port Phillip Bay. A fully loaded FSRU as a blockage to current flow was also included in the refined model.</p> <p>A new CALMET wind file which combines and interpolates between measured wind fields at Geelong Racecourse, Avalon Airport, Point Wilson and the Geelong refinery was created and adopted in the refined model.</p> <p>The refined regional model more accurately reproduced observed water levels, currents, tidal range and tidal exchange in Corio Bay.</p> <p>The refined regional hydrodynamic model was used to re-run the wastewater discharge model, entrainment model and sediment transport model in the Supplementary Statement.</p> <p>Temperature plumes predicted by the refined regional hydrodynamic model were compared with the measured temperature plumes from the supplementary studies. The comparison showed that the refined regional hydrodynamic model predicted plumes with the same shape, temperature and extent as the measured plumes.</p> <p>As required by the Minister’s Directions an expert and independent peer review conducted on the refined regional hydrodynamic model concluded that it was appropriate and fit for purpose to model the existing environment in Corio Bay and predict relevant project impacts.</p>	<p>Chapter 3: <i>Marine environment</i></p> <p>Technical Report A: <i>Supplementary marine environment impact assessment</i></p>

Topic	Key findings	Further information
<p>Recommendation 3</p> <p>Re-run the wastewater discharge modelling with revised inputs based on the refined hydrodynamic model. Consider:</p> <ul style="list-style-type: none"> a. Revising the nearfield modelling of discharges from the diffuser to address the matters raised by Dr McCowan in his written evidence (D75). b. The Inquiry and Advisory Committee’s (IAC) recommended default guideline values (DGV) for chlorine discharges (7.2 microgram per litre in Corio Bay generally, including the Project area; 2.2 microgram per litre at the Ramsar site). 		
<p>Marine Environment</p>	<p>The refined regional hydrodynamic model (as per Recommendation 2) was re-run to simulate the project’s wastewater discharges. The wastewater discharge modelling relates to the discharge of seawater from the FSRU into Corio Bay, through the existing refinery discharge points, or alternatively, from the diffuser to be located under the new pier.</p> <p>The re-run model confirmed the original EES finding that, as a result of FSRU cooling water being used in the refinery, there would be a smaller temperature plume along the shoreline when compared to the current situation and that the plume would not reach the Ramsar site.</p> <p>Consistent with the original EES modelled findings, future chlorine discharges were modelled with the refined hydrodynamic model, arriving at the same conclusion that chlorine levels would be the same as at present from the refinery. The chlorine plume would also be smaller in extent due to lower temperature of the discharge and would not extend to the Ramsar site.</p> <p>The reuse of discharge from the FSRU in the refinery for cooling water purposes would be maximised to ensure that the residual chlorine discharge to Corio Bay is minimised as far as reasonably practicable and there is a reduction in temperature plume from existing refinery discharge (refer to MM-ME01). To provide additional input on the assertions made in the IAC hearing that the dilution predictions for the alternative diffuser discharge arrangement were flawed, an analysis of the near-field modelling from the original EES was undertaken by an independent specialist modeller using Visjet, a different near-field model. The independent analysis confirmed the predicted dilution of 20:1 in the original EES.</p> <p>The predicted chlorine dilution of 20:1 would reduce the expected chlorine discharge concentration from the diffuser 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.</p>	<p>Chapter 3: <i>Marine environment</i></p> <p>Technical Report A: <i>Supplementary marine environment impact assessment</i></p>

Topic	Key findings	Further information
<p>Recommendation 4</p> <p>Consider undertaking further targeted investigations into the effects of existing chlorine discharges from the refinery to confirm likely project impacts resulting from chlorination by-products, including measurement of chlorination by-product concentrations in:</p> <ul style="list-style-type: none"> a. Seawater. b. Biota that have high susceptibility to contamination. 		
<p>Marine Environment</p>	<p>During the EES, mussels were collected from six sites in northern Corio Bay and analysed for a wide range of chlorine residuals including trihalomethanes (THMs), haloacetic acids and bromophenols. Mussel collection sites included Refinery Pier, directly within the dispersing plume, samples from navigational markers around the dredged channel and two reference sites further out in the bay.</p> <p>The results showed no detectible levels of chlorine residuals in the mussels.</p> <p>To provide further data in relation to bioaccumulation of chlorine in biota, the IAC recommended that the mussel bioaccumulation study conducted for the original EES was repeated for the supplementary studies.</p> <p>As part of the Supplementary Statement, locally farmed mussels were deployed for four weeks at seven sites within the mapped extent of existing refinery plumes. Testing of the mussels showed no detectible levels of chlorine residuals, consistent with the findings of the original EES.</p> <p>The results indicate that the chlorine discharged from the refinery either decays or is volatilised in a short period, and there is no accumulation of toxic by-products in mussels or, by inference, other marine life in Corio Bay.</p>	<p>Chapter 3: Marine environment</p> <p>Technical Report A: Supplementary marine environment impact assessment</p>
<p>Recommendation 5</p> <p>Re-run the entrainment modelling with revised inputs based on the refined hydrodynamic model.</p>		
<p>Marine Environment</p>	<p>The original EES assessed the potential for entrainment of plankton and fish larvae into the intake of the FSRU and concluded that there would not be any significant impacts to plankton and larvae populations. 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.</p> <p>The Supplementary Statement involved re-running the entrainment model from the EES using revised inputs based on the refined hydrodynamic model. Additionally, an eDNA survey was undertaken to expand the list of fish species in Corio Bay, particularly smaller species. Information on fish species in Corio Bay was also obtained from Professor Jenkins (Professorial Fellow in Fish Ecology at Melbourne University).</p> <p>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 intake 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.</p> <p>Overall, it was 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.</p> <p>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.</p>	<p>Chapter 3: Marine environment</p> <p>Technical Report A: Supplementary marine environment impact assessment</p>

Topic	Key findings	Further information
<p>Recommendation 6</p> <p>Re-run the sediment transport modelling with revised inputs based on the refined hydrodynamic model. Consider including a 'worst-case' scenario for sediment fractions and settling rates which includes the largest expected proportions of fine and very fine materials that have the slowest expected settling velocities.</p>		
<p>Marine Environment</p>	<p>To provide sufficient water depth at the Refinery Pier extension and within the swing basin for visiting LNG carriers to turn, the project requires 490,000 cubic metres of dredged material to be removed from approximately 12ha adjacent to the existing shipping channel. Dredging would occur over eight weeks. The original EES marine studies modelled the likely movement and settlement of sediments released during the proposed 8-week dredging campaign.</p> <p>Suspended solids modelling from the original EES predicted that there would be a small 7ha patch of 5mg/L suspended solids above ambient and a large 210ha patch of 2 mg/L suspended solids above ambient at the surface during dredging. There would be larger patches and higher concentrations on the seabed. The rate of sediment accretion on the seabed would be up to 0.2mm/day and would have negligible impact on the muddy seabed and the infauna or mobile marine communities.</p> <p>For the Supplementary Statement, sediment transport modelling was re-run using the refined regional hydrodynamic model. It was concluded that there would be a small area of 5ha adjacent to the dredging area where the suspended solids concentration would be 5mg/L above ambient and a large area of approximately 200ha where the suspended solids concentration would be 2mg/L above ambient. This area is marginally smaller than what was predicted in the EES.</p> <p>There would be larger areas and higher concentrations at the seabed than at the surface, but not at levels that would adversely impact on infauna or mobile marine communities that inhabit the muddy seabed. The rate of accretion is predicted to be up to 0.2mm/day, consistent with the original EES.</p> <p>To verify the model, parameters from an independent sediment transport model completed following the Corio Bay Channel Improvement Program were used as a comparison and both modelling programs predicted similar results.</p>	<p>Chapter 3: Marine environment</p> <p>Technical Report A: Supplementary marine environment impact assessment</p>

Topic	Key findings	Further information
<p>Recommendation 7</p> <p>Undertake further assessment of dredging impacts on seagrass based on:</p> <ul style="list-style-type: none"> a. The revised sediment transport modelling. b. 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). c. The updated seagrass mapping (Rec. 1b). 		
<p>Marine Environment</p>	<p>To further assess dredging impacts on seagrass, the IAC recommended that a minimum surface irradiance light threshold be applied to seagrass in the Ramsar site (20%) and Corio Bay (10%) to assess potential impacts of reduced light during dredging.</p> <p>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).</p> <p>The highest average 14-day suspended solids concentration in the Ramsar site was 5.9mg/L, including background. 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.</p> <p>The highest average 14-day suspended solids concentration in Corio Bay was 6.7mg/L. 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.</p> <p>Deep sparse seagrass near the dredging area may experience a minor setback in growth rates during the proposed eight weeks of dredging. Any seagrass growth slowed by turbidity would recover soon after completion of the dredging program.</p>	<p>Chapter 3: Marine environment</p> <p>Technical Report A: Supplementary marine environment impact assessment</p>
<p>Recommendation 8</p> <p>Confirm the EES conclusion that dredging will not impact the Ramsar site after considering:</p> <ul style="list-style-type: none"> a. The revised marine modelling. b. The revised assessment of impacts on seagrass. 		
<p>Marine Environment</p>	<p>The original EES determined that dredging would not impact the Ramsar site. The IAC recommended confirming the EES conclusions with consideration to the revised marine modelling and the revised assessment of impacts on seagrass.</p> <p>The pathways for any potential impact of dredging on the Ramsar site would be direct removal of seagrass in the Ramsar site, impacts associated with temperature and chlorine discharges during project operation or an increase in turbidity and light attenuation over the seagrass beds within the Ramsar site boundary.</p> <p>The area predicted to have a 5mg/L increase median suspended solids is approximately 5ha. The 5mg/L suspended solids contour would not extend into the Ramsar site and would not have any impact on seagrass in the site. The highest average suspended solids concentration predicted at the outer edge of the Ramsar site is approximately 3mg/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.</p> <p>There would be no direct removal of seagrass in the Ramsar site and no reduction in the area of seagrass in the Ramsar site from dredging. The predicted increases in turbidity would occur for short periods within the limited 8-week dredging period. This could have a minor effect in slowing the growth of seagrass in deeper waters near the dredging footprint, but the impact would be too small to be measured and of no ecological consequence. There is no change to the conclusion in the original EES that dredging would not impact the Ramsar site.</p>	<p>Chapter 3: Marine environment</p> <p>Technical Report A: Supplementary marine environment impact assessment</p>

Topic	Key findings	Further information
<p>Recommendation 9</p> <p>Undertake further assessment of impacts on threatened and migratory bird species by:</p> <ol style="list-style-type: none"> 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 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 considering the revised marine modelling 		
<p>Threatened and migratory birds</p>	<p>As part of the original terrestrial ecology study, a protected species database search was undertaken for an area within a 5km radius of the proposed project. The search zone included terrestrial and marine environments. Assessment of project impacts to species determined likely to occur within this search radius was undertaken and no significant impacts were identified, however the likelihood of occurrence assessment was limited to 50 metres either side of the proposed project pipeline, connecting the FSRU with the tie in point. As part of the Supplementary Statement, the 5km radius database search was repeated and the likelihood of occurrence assessment was undertaken for the entire search radius, including Limeburners Bay, Avalon Beach and Corio Bay. This enabled the assessment of project impacts against a consolidated list of threatened and migratory bird species likely to occur within 5km of the project.</p> <p>73 species of threatened and migratory birds have potential to occur in the study area:</p> <ul style="list-style-type: none"> • 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. <p>This list was peer reviewed in accordance with the Minister’s Directions and considered acceptable by the peer reviewer.</p> <p>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. As part of the Supplementary Statement, wastewater discharges, entrainment and sediment transport modelling were re-run using the refined regional hydrodynamic model. Outcomes of the revised marine modelling were assessed against the consolidated list of threatened and migratory birds. 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. Therefore, it was determined that 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.</p>	<p>Chapter 4: <i>Threatened and migratory birds</i></p> <p>Technical Report B: <i>Supplementary threatened and migratory birds impact assessment</i></p>

Topic	Key findings	Further information
<p>Recommendation 10</p>		
<p>Undertake the further assessment of noise impacts set out in mitigation measure MM-NV05 in Appendix G of the Inquiry and Advisory Committee’s Report No. 2.</p>		
<p>Noise</p>	<p>During the supplementary statement, attended and unattended noise monitoring was undertaken at background locations selected as being representative of Geelong Grammar School and other noise sensitive areas. The results of these monitoring surveys were used to recalculate the noise limits for the project. Recalculated noise limits were generally consistent with those determined in the EES noise study.</p> <p>Consistent with the conclusions of the EES noise study, project noise levels (i.e., noise levels at noise sensitive receivers that result from noise emissions of the project only) and dredging noise levels are predicted to be within the recalculated (operational) noise limits at all sensitive receiver locations at all times.</p> <p>During neutral weather conditions, the cumulative pre-existing industry and dredging noise levels are predicted to be within the noise limits at all sensitive receiver locations at all times.</p> <p>During neutral weather conditions, cumulative pre-existing industry and project operational noise levels are predicted to be within the noise limits at all sensitive receiver locations at all times.</p> <p>During noise enhancing weather conditions (i.e., weather conditions favourable to sound propagation), pre-existing industry noise exceeds the night period noise limit at Geelong Grammar School, and Corio and North Shore dwellings, noting that the Geelong refinery is not audible at North Shore.</p> <p>It was predicted that during noise enhancing weather conditions at Geelong Grammar School, there would be accumulative exceedence of the evening and night period limits from pre-existing industry and dredging noise, and at North Shore dwellings there would be a cumulative exceedance of the night period noise limit.</p> <p>Contingency measures would be implemented to minimise the risk of unreasonable noise due to cumulative impacts during both the evening and night periods.</p> <p>As pre-existing industry noise exceeds the night period noise limits under noise enhancing conditions at Geelong Grammar School and North Shore dwellings the supplementary noise study predicted that cumulative pre-existing industry and project noise levels would exceed the night period noise limits at these locations. However, for the project to not contribute to effective noise levels that may exceed the regulatory noise limits at Geelong Grammar School and North Shore dwellings it is required for project noise levels to be 10 dB below the night period noise limits. Project Noise Criteria have been proposed at 10dB below the noise limits which will ensure that project noise levels do not contribute to effective noise levels and consequently, do not contribute to cumulative impacts.</p> <p>The annexure to Technical Report D: Supplementary noise impact assessment contains a detailed analysis of noise attenuation and contingency measures. The annexure describes the (ongoing) iterative review of all reasonably practicable opportunities to reduce project noise emissions and demonstrates that noise attenuation and operational management measures can be implemented to ensure project noise levels are maintained within the proposed Project Noise Criteria.</p>	<p>Chapter 6: Noise Technical Report D: Supplementary noise impact assessment</p>

Topic	Key findings	Further information
<p>Recommendation 11</p> <p>Undertake sensitivity testing on the air quality modelling to confirm that operational impacts on air quality would be acceptable. Consider:</p> <ul style="list-style-type: none"> a. The significance of the wake effects of the floating storage and regasification unit (FSRU) b. A 'worst-case' scenario for air emissions (but based on the use of best available technology [BAT]) c. The implication of bubble limits and stack specific limits for sensitive receptors 		
<p>Air quality</p>	<p>To understand how the configurations and orientations of the FSRU may influence the significance of wake effects and associated predicted pollutant ground level concentrations at sensitive receptors, sensitivity testing for a number of different FSRU configurations and two different FSRU orientations with and without a Liquefied Natural Gas (LNG) carrier berthed alongside the FSRU was conducted as part of the supplementary study.</p> <p>The Esperanza FSRU, considered to be representative of current best available technology, with its bow facing southeast alongside an LNG carrier (modelled in the AQ EES study), was determined to be the worst-case operating scenario among all configurations and orientations assessed. As demonstrated in the AQ EES study, all modelled pollutants were predicted to comply with relevant criteria at all modelled locations for this scenario.</p> <p>It was determined that time-series pollutant concentrations resulting from the worst-case operating scenario for the Esperanza FSRU would not be discernible from background concentrations most of the time. Potential air quality impacts associated with the project would be minor. Emissions from a worst-case operating scenario would be compliant with all relevant regulatory criteria and would not cause significant adverse impacts on the surrounding environment.</p> <p>A combination of stack specific and bubble limits has been proposed which provides an emissions limit based on the use of best available technology. The applicability of bubble limits is subject to the development licence statutory approval process. EPA Victoria will ultimately determine the stack specific and/or annual bubble limits which would form part of the operating licence conditions for the FSRU following approval.</p>	<p>Chapter 5: Air quality</p> <p>Technical Report C: Supplementary air quality impact assessment</p>

Topic	Key findings	Further information
<p>Recommendation 12</p> <p>Undertake a cultural values assessment to identify intangible values relevant to the project (both onshore and offshore in Corio Bay) and an underwater Aboriginal cultural archaeological assessment for the proposed dredging areas to inform an updated cultural heritage management plan. Review and update mitigation measures and incorporated document to include any necessary changes to implement the updated cultural heritage management plan (CHMP) when approved.</p>		
<p>Aboriginal cultural heritage</p>	<p>The supplementary underwater Aboriginal cultural archaeological assessment reconstructed the submerged former landform of Corio Bay. This assessment determined that the project dredge footprint is situated within a drowned playa lake. Since human occupation of south-eastern Australia began, this lake has been filled with fresh, saline, or saltwater more often than it has been dry.</p> <p>The predominant site types that could have occurred were predicted to be stone artefacts, followed by shell middens. Examination and analysis particularly of the piston cores collected as part of this study, provide low confidence that any potential archaeological sites within the activity area have survived intact. Radiocarbon dating of shell samples indicated that the surface of late-Pleistocene lakebed has been truncated, that is re-worked, by marine inundation as well as waters flowing from the paleo-Hovell Creek watercourse.</p> <p>However, there is potential for stone artefacts to be present within erosional lag deposits that may have formed within depressions and other low points at a distance from their original location. It was concluded that there is a low risk of consequential impact from the project to lag deposits containing stone artefacts identified as being potentially present in the activity area.</p> <p>Since preparation of the underwater Aboriginal cultural archaeological assessment, and a subsequent peer review of the study by La Trobe University, there have been ongoing discussions between Viva Energy, WTOAC, First Peoples State Relations (FPSR) and the Department of Transport and Planning (DTP) related to the findings of the underwater Aboriginal cultural archaeological assessment.</p> <p>The peer review conducted by La Trobe University concluded that the overarching interpretation presented in the technical report regarding Corio Bay comprising a submerged former lake and associated lunette landform aligns well with the geophysical and geotechnical data.</p> <p>However, the peer review and subsequent feedback provided by WTOAC, has raised a number of issues which will require ongoing collaboration between Viva Energy, WTOAC and regulatory agencies to ensure that matters still in discussion can be further assessed. In general terms, the main issues requiring further discussion include:</p> <ul style="list-style-type: none"> • Consideration of further definition of the offshore landform, in particular, the presence of terraces in the nearshore area • Consideration of whether the presence of terraces would change the study finding that the only Aboriginal artefacts likely to have survived natural processes would be found in more recent lag deposits entering Corio Bay from watercourses and the like • Use of a maximum date of 35,000 years for people living in the region when there is evidence of earlier occupation and whether that would change the study conclusions • The suitability of radiocarbon dating as used in the specialist study due to issues with dating anything older than ~40,000 years. <p>After consideration of these issues and others raised in the peer review and acknowledging the validity of a number of the issues raised, the independent specialist concluded that the original study conclusions that the project would not have unacceptable impacts remained appropriate.</p>	<p>Chapter 7: <i>Underwater Aboriginal cultural archaeology</i></p> <p>Technical Report E: <i>Underwater Aboriginal cultural archaeology assessment</i></p> <p>Chapter 8: <i>Cultural Values Assessment summary</i></p>

Topic	Key findings	Further information
<p>Aboriginal cultural heritage</p>	<p>However, as there is still the need to further discuss the outstanding matters, ongoing collaboration with WTOAC and FPSR is proposed to identify and adopt appropriate management processes and measures to manage any potential impact. Viva Energy has incorporated a commitment to this ongoing collaboration into the project Environmental Management Framework (EMF) which requires the approval of the Minister for Planning and provides certainty to WTOAC and regulatory agencies that the ongoing matters will be collaboratively considered. As the updated underwater Aboriginal cultural heritage study, incorporating peer review inputs, maintains the original finding that the project will not have unacceptable impacts on heritage values, it is considered that further assessment of the outstanding matters in collaboration with WTOAC can continue while the EES Supplementary Statement process progresses.</p> <p>WTOAC has been sponsored by Viva Energy to produce a cultural values assessment (CVA) in response to Recommendation 12 of the Minister’s Directions for the Supplementary Statement. At present, the CVA is still in progress. It is recognised the process necessarily requires time and consideration without undue pressure or timelines. It involves knowledge being shared with various persons, and through means including engagement with a broader group of Traditional Owners, and particularly Elders. The respect for this timeline, while also progressing the Supplementary Statement, has been the subject of ongoing discussions between Viva Energy, WTOAC, FPSR and Department of Transport and Planning (DTP).</p> <p>As the CVA is still in preparation, an agreed set of pathways for any potentially impacted intangible value has not yet been established by WTOAC and FPSR. Viva Energy has expressed an ongoing commitment to working collaboratively with WTOAC and FPSR to have regard for the outcomes of the CVA when they become available, and how those outcomes can be given effect.</p> <p>Viva Energy has made several commitments which have been incorporated into the project Environmental Management Framework (EMF) as a clear demonstration of an ongoing commitment to collaborating with WTOAC to achieve appropriate outcomes. The commitments are to continue collaboration and provide support for implementation of appropriate outcomes and recommendations relevant to the project and to work with WTOAC and FPSR to identify and adopt appropriate measures to avoid or mitigate impacts of the project on cultural values.</p> <p>This proposed approach provides certainty to WTOAC and regulatory authorities that the ongoing collaboration will occur as the project EMF requires the approval of the Minister for Planning.</p>	<p>Chapter 7: <i>Underwater Aboriginal cultural archaeology</i></p> <p>Technical Report E: <i>Underwater Aboriginal cultural archaeology assessment</i></p> <p>Chapter 8: <i>Cultural Values Assessment summary</i></p>

10.3 Integration of results with the original EES studies

The purpose of this section is to summarise the integration of the results of the supplementary studies with the key outcomes from the original EES studies.

10.3.1 Marine Environment

As part of the original marine EES study, field investigations were carried out over a 12-month period to understand the baseline conditions of the marine environment. Field investigations included current, temperature and water quality monitoring, assessment of bathymetry, surveys of the seabed habitat and plankton and larvae surveys. The seabed and shoreline of Corio Bay have been substantially modified over the last 170 years with shipping channels being dredged, the western shoreline being established for industrial uses, the Port of Geelong being developed, and seawalls, marinas and jetties constructed as part of Geelong's urbanisation. Despite these developments, field investigations indicated that Corio Bay has good water quality and a diverse range of marine life that has adapted to the existing conditions of the Bay. Corio Bay has a dynamic and self-sustaining ecosystem which includes approximately 1,000 species of plants and animals.

The original marine EES study concluded that potential impacts related to construction activities (including dredging) such as turbidity, light attenuation, habitat modification and underwater noise would be temporary and localised and would not result in significant impacts to nearby populations and communities. Furthermore, it was considered likely that any altered conditions (e.g., turbidity, light availability) would return to original conditions within a short period of time after the construction activity ceases.

The findings of the supplementary marine environment study are consistent with the findings of the marine EES study with respect to dredging impacts. The results of the updated modelling, using the refined regional hydrodynamic model, were similar to the predictions presented in the original EES, which found that turbidity would cause only a small reduction in light reaching seagrass and all seagrass in the Ramsar site (zero to 2 m depth) would always receive sufficient light for growth. The Ramsar site would experience only a minor increase in turbidity and the change would be too small to cause an adverse impact on seagrass productivity.

The original marine EES study determined that the reuse of the cooled FSRU discharge water in the refinery during operation would result in no change to the total volume of seawater extracted from Corio Bay, no change to the volume of water discharged from the refinery, no change in residual chlorine levels and an improvement in the temperature of the discharge compared to the existing refinery discharge. As the refinery discharge has been occurring for 70 years, the original marine EES study was able to assess empirical evidence of potential effects of chlorine and temperature levels associated with these long-term discharges.

The field surveys undertaken for the original marine EES study did not identify evidence of negative impacts on marine ecology under the existing refinery discharge plumes. Seagrass in the vicinity of the plume was observed to be abundant and healthy; sea urchins, which are considered to be sensitive to chlorine, were abundant in the current discharge plumes; and tests on mussels from the vicinity showed no detectable residual chlorine. As such, this empirical evidence provided confidence that it would be highly unlikely that there would be adverse impacts on the marine environment from operation of the FSRU and reuse of the seawater in the refinery, as the proposed discharge is an overall improvement when compared within the quality of the existing discharges.

The findings of the supplementary marine environment study are also consistent with the findings of the marine EES study with respect to operational impacts. Through extensive temperature measurements it was determined that the existing refinery temperature and chlorine discharge plumes are within guideline values and do not reach the Ramsar site. Additional seagrass surveys undertaken adjacent to the refinery and at the Ramsar site showed that there was no significant difference in seagrass cover indicating that existing refinery discharges are not having a significant impact on seagrass. Tests on locally farmed mussels deployed within the existing discharge plumes showed no detectable chlorine by-products.

Consistent with the original marine EES study the re-run wastewater discharge model, using the refined regional hydrodynamic model, indicated that predicted temperature and chlorine discharge plumes from the discharge of the cooled FSRU wastewater following reuse in the refinery would be within guideline values and do not reach the Ramsar site.

Modelling undertaken for the original marine EES study showed that due to high dilution chlorine and temperature plumes from an alternative diffuser discharge arrangement would be localised within the shipping channel and well below temperature and chlorine guideline limits. The predicted 20:1 dilution was verified by an independent modelling specialist for the supplementary study and the re-run model confirmed the results of the original EES.

Entrainment modelling in the original marine EES study showed that the project would result in a slight increase to the proportion of plankton entrained in the FSRU seawater intake from the Ramsar site and northern and southern Corio Bay compared to the current refinery intake. Results from the supplementary study using the refined regional hydrodynamic model showed no significant difference in entrainment from the Ramsar site. However, these entrainment rates are considered negligible in comparison to natural predation and other losses.

The original EES did not identify any direct impacts to seagrass through removal. Seagrass mapping undertaken for the supplementary study has identified the potential removal/disturbance of approximately 0.5 hectares of seagrass as a result of excavation of a shallow trench for installation of the seawater transfer pipe. Seagrass would regrow from rhizomes present in the excavated sediment near the surface and from the disturbed area adjacent to the trench following replacement of the sediment when installation is complete. The loss of seagrass would be localised and temporary and three years after installation, seagrass cover on the alignment is expected to be the same as elsewhere in Corio Bay. As described in the original EES, a permit for 'taking' of listed species from public land under the FFG Act and planning permission under the Greater Geelong Planning Scheme Clause 52.17 Native vegetation (including offsets in accordance with the Guidelines for the removal, destruction or lopping of native vegetation, 2017) will be required.

To minimise the direct impact of the removal of seagrass a new mitigation measure MM-ME20 has been included requiring minimisation of seagrass disturbance and replanting along the alignment.

Overall, the findings of the supplementary study were found to be consistent with the findings of the marine environment impact assessment completed as part of the original EES and confirmed the initial conclusion that construction and operation of the project would not have significant environmental impacts with the proposed mitigation measures in place.

It is considered that the Supplementary Statement has further demonstrated that the project would be consistent with the EES evaluation objectives to avoid, minimise or offset potential adverse effects on the marine environment, including intertidal and marine species and habitat values; and to minimise adverse effects on water (in particular wetland, estuarine, intertidal and marine) quality and movement, and to the ecological character of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site.

10.3.2 Threatened and Migratory Birds

The original EES terrestrial ecology study determined that construction activities for the project would involve the removal of 0.091ha of native grassland vegetation and may impact on a small extent of marginal foraging habitat for Swift Parrot (planted eucalypts). However, it was concluded that construction activities would not result in a significant impact to these ecological values.

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, nor would they be indirectly impacted. Noise and light spill from the project were also assessed and found to have no adverse impacts on Ramsar values.

Marine investigations conducted for the original 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 on elements of the food chain for terrestrial species, for example, seagrass meadows in Corio Bay.

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 the Minister's Directions.

As noted above, the supplementary marine assessment identified that approximately 0.5 ha of seagrass would potentially be removed during installation of the seawater transfer pipe. However, it was concluded that 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.

It is considered that the Supplementary Statement has further demonstrated that the project would be consistent with the EES evaluation objectives to avoid and minimise potential adverse effects on native fauna and their habitats, especially listed threatened or migratory bird species; and to minimise adverse effects on the ecological character of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site.

10.3.3 Noise

Consistent with the findings of the EES noise study the supplementary noise study predicted that dredging noise levels would be within the regulatory noise limits. However, the further assessment undertaken in the supplementary study identified the potential for cumulative noise exceedances, from pre-existing industry and dredging noise, under noise enhancing weather conditions, at GGS for the evening and night periods and at North Shore dwellings during the night. Contingency measures will be implemented in accordance with mitigation measure MM-NV04 such that dredging operations would cease until the relevant period noise limits are met.

Consistent with the findings of the EES noise study the supplementary noise study predicted that project noise levels would be within regulatory noise limits. Furthermore, cumulative levels from pre-existing industry and project noise were predicted to be within the noise limits at all times in neutral weather conditions, and in noise enhancing weather conditions during the day and evening.

As pre-existing industry noise levels exceed the night period noise limit at GGS and North Shore dwellings in noise enhancing weather conditions, the supplementary noise study predicted that cumulative levels from pre-existing industry and project noise would exceed the night period noise limits at these locations. Project Noise Criteria have been proposed at 10dB below the noise limits to ensure that project noise levels do not contribute to effective noise levels set by the Regulations and consequently, do not contribute to cumulative impacts. Consistent with the requirements of mitigation measure MM-NV05 the annexure to the supplementary noise impact assessment report describes the (ongoing) iterative review of all reasonably practicable opportunities to reduce operational noise emissions and demonstrates that noise attenuation and operational management measures can be implemented to ensure project noise levels are maintained within the proposed Project Noise Criteria.

Continued implementation of mitigation measure MM-NV05 will ensure that noise emissions from project operational activities are managed such that Project Noise Criteria are met and the project does not contribute to cumulative noise impacts.

It is considered that the Supplementary Statement has further demonstrated that the project would be consistent with the EES evaluation objective to minimise potential adverse amenity effects at local and regional scales. Amenity impacts of the project are considered minor, particularly due to the siting of the project within an existing port and industrial area.

10.3.4 Air Quality

The modelling undertaken in the AQ EES study showed no exceedances of adopted air quality criteria at any of the sensitive receptors in the study area during operation of the FSRU. The original EES concluded that potential air quality impacts associated with project operations would be minor and localised in the vicinity of Refinery Pier and the refinery, meet regulatory requirements and emissions are unlikely to have regional or State significant effects on the air environment.

The findings of the supplementary assessment were consistent with the findings of the air quality impact assessment completed as part of the original AQ EES study and confirmed that operational impacts on air quality would be acceptable considering the significance of the wake effects of the FSRU and a worst-case scenario for air emissions. study area.

It is considered that the Supplementary Statement has further demonstrated that the project would be consistent with the EES evaluation objective to minimise potential adverse amenity effects at local and regional scales. Amenity impacts of the project are considered minor, particularly due to the siting of the project within an existing port and industrial area.

10.3.5 Aboriginal cultural heritage

The Aboriginal cultural heritage EES study concluded that with implementation of the CHMP and its associated management conditions, potential impacts on known Aboriginal cultural heritage would be negligible and on unknown Aboriginal places low to moderate (i.e., impacts would not be significant) as the likelihood of encountering unknown Aboriginal cultural heritage either onshore or offshore is highly unlikely.

The supplementary study for the additional assessment of underwater Aboriginal cultural archaeology concluded that any artefacts which might have been part of such archaeological sites could be found within erosional lag deposits. These are artefacts which have been displaced from their original locations through wave or erosional activities. Consequently, there is a low risk of significant impact from the project on artefacts within lag deposits potentially present in the activity area.

A peer review of the underwater Aboriginal cultural archaeology study, and subsequent inputs from WTOAC, have identified several outstanding matters requiring further consideration. After consideration of these matters, the independent specialist has concluded that the original study conclusions that the project would not have unacceptable impacts remains appropriate.

However, as there is still the need to further discuss the outstanding matters, ongoing collaboration with WTOAC and FPSR is proposed to identify and adopt appropriate management processes and measures to manage any potential impacts. As the updated underwater Aboriginal cultural heritage study, incorporating peer review inputs, maintains the original finding that the project will not have unacceptable impacts on heritage values, it is considered that further assessment of the outstanding matters in collaboration with WTOAC can continue while the EES Supplementary Statement process progresses.

WTOAC has been sponsored by Viva Energy to produce a cultural values assessment (CVA) in response to Recommendation 12 of the Minister's Directions for the Supplementary Statement. At present, the CVA is still in progress and outcomes will need to be considered during or after the Supplementary Statement assessment process.

Viva Energy has made several commitments incorporated into the project EMF which requires the approval of the Minister for Planning. The commitments are to collaborate with WTOAC to finalise the CVA and provide support for implementation of outcomes and recommendations relevant to the project and to identify and adopt appropriate measures to avoid or mitigate impacts of the project on cultural values.

Implementation of the proposed ongoing collaborative process will enable a full integration of measures to protect both tangible heritage and intangible heritage values.

It is considered that the project would be consistent with the evaluation objective to avoid or minimise adverse effects on Aboriginal cultural heritage by implementing appropriate management and mitigation measures via the appropriate pathway following ongoing collaboration between Viva Energy, WTOAC and FPSR.

10.4 Responding to the key findings

The assessment of potential impacts of the project on environmental assets has informed the development of an Environmental Management Framework (EMF) that includes Viva Energy's environmental commitments for the project.

10.4.1 Environmental Management Framework

The EMF is a framework for outlining the environmental commitments made by the project proponent to manage potential environmental impacts associated with the project and to clearly identify accountabilities for implementation. The Supplementary Statement EMF is informed by recommendations from the original EES studies, the recommendations of the IAC and the further work, including the five technical studies, conducted for the Supplementary Statement.

The mitigation measures set out in the Supplementary Statement EMF are the environmental commitments made by Viva Energy relevant to the supplementary studies a condition in the EMF will be given effect through the Planning Scheme amendment incorporated document which require the EMP to be approved by the Minister for Planning. Subject to a favourable assessment of the project by the Minister for Planning, would be given effect through the relevant statutory approvals including, but not limited to, the EPA Development Licences, the Pipeline Licence, Planning Scheme Amendment and the Marine and Coastal Act consent. These commitments, as well as conditions required by regulatory authorities, would also be included in management plans such as the CHMP, construction and operational environmental management plans and other subordinate management plans, and the proponent and its contractors would be responsible for their implementation.

The project would be delivered in accordance with these environmental commitments, including stakeholder and community engagement, project approvals, design, construction and operation.