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TOONDAH HARBOUR

APPENDIX 3 - C

DRAFT MNES MP
SUB-PLANS

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1. Draft Threatened and Migratory Terrestrial Species Management Plan

1.1. Soils, Sediments, and Contaminated Land Sub Plan

Desired Outcomes:

- ASS will be monitored and managed in accordance with industry guidelines so that there are no short or long-term impacts to habitats or fauna.
- Contaminated land will be managed in accordance with relevant guidelines so as to not impact on any sensitive environmental receptors including Moreton Bay.
- Chemicals and fuels will be stored in accordance with relevant safety data sheets and guidelines, and storage and use will be carried out in accordance with site-specific environmental authorities.

Potential impacts	Management and monitoring measures	Responsibility	Timing
Oxidation of PASS in reclamation and other parts of the Project footprint where excavations occur	▪ Implement an ASS management plan in accordance with relevant State and Federal guidelines including a monitoring program for the dredging and reclamation processes. ▪ Keep sediments saturated during the dredging process until they have been treated for potential acidity and placed within the reclamation area. ▪ Apply additional treatment as required to dredge material and soft upper sediments within the reclamation area. ▪ Carry out daily inspections of the reclamation area to check for visual signs of oxidation. ▪ Carry out ASS and PASS sampling and analysis in accordance with relevant State and Federal guidelines prior to carrying out any on land works. Apply treatment as required to neutralise acid generating potential. ▪ Conduct an ASS weathering trial to determine rates of reaction and liming requirements for ASS containing sediment.	Contractor	As required, during dredging and reclamation works
Disturbance of existing contaminated land through construction activities adjacent to GJ Walter Park,	▪ Carry out a DSI in accordance with relevant State and Federal guidelines prior to commencing works in areas identified as high or moderate risk by the PSI. ▪ Carry out groundwater monitoring during and post construction in accordance with the groundwater sub-plan. ▪ Soil investigation to assess fill materials and underlying natural soil within GJ Walter Park, the ferry terminals and dredge	Contractor	Prior to commencing works in high or moderate risk area During and post construction

Potential impacts	Management and monitoring measures	Responsibility	Timing
existing ferry terminals, trade college and dredge sediment pond	sediment pond. Geotechnical assessment of soil in these areas to determine suitability of material to retain on site as part of site development.		Pre / during construction
Fuel or other chemicals spills to ground or water during the construction process and ongoing uses	▪ Store fuels and chemicals in appropriate areas away from sensitive receptors on site in accordance with relevant standards and guidelines. ▪ Retain appropriate spill response materials on site including booms and absorbent materials. Spill kits are to be kept nearby to any fuel or chemical storage area. ▪ Installation and sampling of additional groundwater bores targeting the southern landfill area and fuel storages.	Civil Contractor	At all times during construction and operation
Disturbance of EMR-listed lots	▪ Conduct a feasibility analysis of EMR removal for each of the listed lots, with consideration of ongoing notifiable activities and intended future land use. ▪ Ensure all soil to be removed from EMR-listed lots is adequately assessed and removed under either a disposal permit or clean earth exemption.	Proponent / Contractor	During all construction

1.2. Surface Water Quality Sub Plan

Desired Outcomes:

- Tailwater will be managed within the bunded reclamation area with minimal releases so that there are no long-term impacts to water quality outside of the footprint.
- Stormwater will be managed onsite so that there are no long-term impacts to water quality outside of the footprint.
- Chemicals and fuels will be stored in accordance with relevant safety data sheets and Workplace Health and Safety Queensland's Managing risks of hazardous chemicals in the workplace.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Suspension of sediments from dredge material and soft upper sediments within the reclamation area into tailwater	▪ Carry out water quality testing of tailwater regularly to ensure no contaminants are present prior to re-use on site. ▪ If contaminants are present above human health trigger levels use appropriate treatments to remove from the water prior to re-use or transport water from site for disposal in an appropriate facility. ▪ Use geofabric lining with sheet piling to ensure fine sediment does not move through rockwalls. ▪ Develop a construction erosion and sediment control plan and utilise control devices where appropriate.	Reclamation Contractor	During Reclamation Works

Potential Impacts	Mitigation Measure	Responsibility	Timing
Stormwater runoff during construction and ongoing use reducing water quality in Moreton Bay through increased suspended solids and nutrients	▪ Develop a construction erosion and sediment control plan and utilise control devices where appropriate including regular monitoring of effectiveness. ▪ Implement stormwater management devices into the development in accordance with the conceptual stormwater management plan. ▪ Undertake a minimum of 2 years monitoring of stormwater treatment devices to ensure pollutant loads meet or exceed the predicted outputs.	Civil Contractor	Pre and during Construction
Fuel or other chemicals spills to ground or water during the construction process and ongoing uses	▪ Store fuels and chemicals in appropriate areas away from sensitive receptors on site in accordance with relevant standards and guidelines. ▪ Retain appropriate spill response materials on site including booms and absorbent materials. Spill kits are to be kept nearby to any fuel or chemical storage area.	Civil Contractor	During All Construction
Oxidation of PASS in reclamation and other parts of the Project footprint where excavations occur	▪ Implement an ASS management plan in accordance with relevant State and Federal guidelines including a monitoring program for the dredging and reclamation processes. ▪ Keep sediments saturated during the dredging process until they have been treated for potential acidity and placed within the reclamation area. ▪ Apply additional treatment as required to dredge material and soft upper sediments within the reclamation area. ▪ Carry out daily inspections of the reclamation area to check for visual signs of oxidation. ▪ Carry out ASS and PASS sampling and analysis in accordance with relevant State and Federal guidelines prior to carrying out any on land works. Apply treatment as required to neutralise acid generating potential.	Civil Contractor	During All Construction

Draft Water Quality Monitoring Plan

Potential impacts to water quality and marine ecology will be managed through an overall trigger action response plan (TARP). In this plan key sensitive receptors will be protected by:

- Using baseline data and modelling to develop trigger levels for a suite of parameters that provide an early warning of potential damage;
- Monitoring these parameters; and
- Providing actions in response to these triggers being met.

All monitoring will be in accordance with methods prescribed in the latest edition of the Monitoring and Sampling Manual (Monitoring and Sampling Manual 2009 Environmental Water (Policy) DES 2018), and a project-specific standard operating procedure that addresses the management of data quality and integrity, including effective calibration and

maintenance of water quality meters in accordance with their specifications and the Monitoring and Sampling Manual. Samples will be analysed by a NATA accredited laboratory so that data can be compared to the WQOs for Area C2. The results of water quality monitoring will be made publicly available, as close to real time as possible.

Where water quality parameters exceed predefined trigger levels, further investigation will be required. Where investigation indicates that there may be an adverse impact to key sensitive habitats, a management response will be implemented.

Overall impacts from the Project on sentinel key sensitive habitats in the surrounding area will also be monitored. This will include monitoring water quality, benthic photosynthetically active radiation (BPAR), and habitat condition.

Water Quality within the Marina

On connection of the interior waterways to the bay, the site will be inspected daily for visual and olfactory signs of poor water quality, including:

- Floating scums of algae;
- Slicks (oil, chemical);
- Litter;
- Excessive growth of algae; and
- Unpleasant odours.

Water quality will also be monitored monthly for the first twelve months in the areas of the marina with the longest flushing times (i.e. the north-western section of the internal waterway, the central marina, the middle entrance channel and at two background (control) points to the north and south of the Project). Turbidity, pH, conductivity and the percent saturation of dissolved oxygen will be measured in situ in surface water, and 1 m from the bottom. In addition, surface samples will be collected and analysed for the concentration of total nitrogen, oxides of nitrogen, ammonia, oxidised nitrogen, total phosphorus, filterable reactive phosphorus, chlorophyll *a*, and enterococci.

These water quality parameters will also be measured at these sites following two rainfall events each year (nominally > 20 mm within a 24 hour period), and where visual assessment indicates a deterioration in water quality.

Management Trigger: Dissolved Oxygen

After each monitoring event, the percent saturation of dissolved oxygen at each site within the marina will be compared to data from the control sites and to the water quality objectives (WQO).

Where the percent saturation of dissolved oxygen is within WQO (95% to 105%[1]) at the control sites, but is not within the WQO at a site within the marina:

- Monitoring of dissolved oxygen will be increased to daily until levels return to an acceptable level;
- The cause will be investigated by a suitably qualified water quality scientist or engineer; and
- The waterway will be managed to prevent the percent saturation of dissolved oxygen decreasing to less than 85%. Management measures may include aeration, and re-evaluation of stormwater management.

[1] Noting that in Area C2, the median of water quality parameters should comply with the WQO, not individual readings. Thus this will be an early alert.

Management Trigger: Nutrients, Chlorophyll a, and Enterococci

The annual median of the monthly concentration of nutrients, chlorophyll *a*, and enterococci from each site within the marina will be compared to the median from the control sites.

Where the median from each site within the marina is higher than the control sites, the medians from the marina will be compared to the WQO.

Indicative triggers for investigation based on this approach, and using background concentrations in Area C2 as a guide for likely median concentrations for the control sites, are presented in *Table 1*.

Table 1: Indicative Triggers for Investigation within the Marina.

Parameter (µg/L)	Modelled Increase*	Median in Area C21	WQO	Trigger for Investigation
Total nitrogen	<7	150	<160	160
Total phosphorous	<1.3	15	<20	20

[1] 50th percentile of Sites E0309, E0500 and E0501 in Area C2

* indicates differences with respect to existing concentrations

Where a median from within the marina is higher than the median from the control sites and exceeds the WQO, the cause and impacts will be investigated, and where necessary management actions implemented to rectify this (e.g. aeration, re-evaluation of stormwater management) implemented to improve it.

If after 12 months water quality does not comply with the expectations of the models, is significantly poorer than historical water quality, and/ or is poorer than at the control sites, water quality data will continue to be collected each month, until such time as these expectations are met.

If, after twelve months, water quality in the channels and marina complies with the expectation of the models, or is not significantly different to historical data or to water quality at the control sites, water quality data will only be collected after significant rainfall events (i.e. > 20 mm within a 24 hour period) for three years.

If, after twelve months, water quality in the channels and marina complies with the expectation of the models, or is not significantly different to historical data or to water quality at the control sites, water quality data will only be collected after significant rainfall events (i.e. > 20 mm within a 24 hour period) for three years.

Ongoing Use and Operations

After the completion of works comprising the establishment of the development footprint and the completion of dredging, monitoring of the marina will be required to assess any changes in water quality due to runoff and altered hydrodynamics. Water quality will be measured in the marina and ferry port harbour, Fison Channel and two background (control) locations, quarterly over two years for:

- Physico-chemical parameters measured in situ (i.e. dissolved oxygen, pH, salinity and turbidity);
- Nutrients (e.g. total nitrogen, total phosphorous, oxides of nitrogen, organic nitrogen, filtered reactive phosphorous, ammonia);
- Total suspended solids; and
- Chlorophyll *a*.

Where the median concentration of nutrients, chlorophyll *a*, or enterococci is higher than the background (control) conditions and exceeds the WQO, the cause and impacts will be investigated, and where necessary management actions implemented to rectify this.

1.3. Groundwater

Desired Outcomes:

- No impacts on marine or terrestrial environments outside of the Project footprint as a result of groundwater drawdown or other changes that may result from the Project.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Dewatering: lowering the groundwater table for access by other users/ potential GDEs	▪ Installation of temporary sheet piling to minimise propagation of drawdown from excavation dewatering. ▪ Removal of temporary sheet piling on completion of the northern reclamation to facilitate recovery of groundwater levels. ▪ Ongoing monitoring to characterise groundwater levels within the Project footprint prior and during construction.	Contractor	During reclamation works
Dewatering: changing hydraulic gradients between aquifers/seawater to facilitate mixing	▪ Ongoing monitoring to characterise baseline groundwater level and quality within the Project footprint. ▪ Develop water level and quality 'trigger' levels to inform monitoring criteria and groundwater management during development.	Contractor	Prior to the commencement of reclamation works
Dewatering: inducing contaminant mobilisation from buried landfill	▪ Ongoing monitoring of groundwater. ▪ If further investigation identifies significant risk of contamination, evaluate cost benefit of source removal prior to construction or post-construction groundwater treatment options.	Contractor	During reclamation works
Reclaimed dredged sediments as potential source of contamination to groundwater	▪ Construction of new groundwater monitoring bores within reclaimed platform. ▪ Dredged PASS will be treated onsite using lime prior to oxidation occurring.	Contractor	During reclamation works
Disturbance of ASS – potentially acidifying groundwater and mobilising metals	▪ Monitoring groundwater quality for changes at TDMB02A, TDMB02B, TDMB05A, TDMB05B. ▪ Construct and monitor new monitoring bores in the reclaimed platform.	Contractor	During reclamation and dredging
Sheet piling restricting	▪ Analysis of groundwater levels at monitoring bores to detect change in groundwater levels over time. Sheet piling being only a temporary measure on landward side of reclamation and removal after Project completion.	Contractor	During reclamation works

Potential Impacts	Mitigation Measure	Responsibility	Timing
groundwater throughflow			

Draft Groundwater Monitoring Plan

The EVs for the receiving environment have been described for the Toondah Harbour PDA based on the EPP(Water) for Redland Bay (Department of Environment and Resource Management, 2010). The Project WQOs will be defined, and trigger levels will be developed using the DSITI (2017) guidelines, following further baseline data collection and analysis prior to commencing construction. Ongoing baseline monitoring for water level and quality has been undertaken in the existing monitoring bore network over a bi-monthly period since April 2020. A further eight baseline monitoring rounds are expected to be undertaken.

The proposed strategy for monitoring impacts set out in the Table 2 has been designed to assess changes that may occur as result of the key impacts summarised in the Groundwater Section of the Draft EIS. The potential for impacts from the activities will be monitored with the groundwater bore network currently constructed for the Project assessment. The following monitoring objectives have been identified based on the key impacts:

- Objective A: Baseline groundwater levels and water quality around the Project and the MBRS;
- Objective B: lowering the groundwater table for other users/GDEs
- Objective C: changes to hydraulic gradients between aquifers/seawater to facilitate mixing
- Objective D: point sources of contamination from the existing landfill
- Objective E: contamination from reclaimed platform material;
- Objective F: acidifying groundwater and contaminant mobilisation due to disturbed PASS; and
- Objective G: groundwater drawdown (mounding) behind containment wall.

Table 2: Analysis Strategy for Project Groundwater Monitoring.

Bore ID	Eastings	Northings	Screened geology and logged constituents	Monitoring objective
TDMB01A	528184	6955485	Basalt (weathered)	A, B, C, E, F, G
TDMB01B	528189	6955488	Basalt (fresh rock)	A, B, C, E, F, G
TDMB02A	527792	6955061	Basalt (weathered)	A, B, C, F, G
TDMB02B	527793	6955066	Basalt (weathered)	A, B, C, F, G
TDMB03	527974	6955291	Basalt (weathered)	A, B, C, F, G
TDMB04A	528181	6955359	Quaternary sediments (sand/clay)	A, C, D, F, G
TDMB04B	528178	6955354	Basalt (weathered)	A, C, D, F, G
TDMB05A	528053	6954905	Quaternary sediments (fine sand – sandy clay)	A, B, C, F
TDMB05B	528041	6954905	Basalt (weathered)	A, B, C, F

The parameters to be monitored are provided in Table 4. The suite of parameters has been selected primarily to monitor possible changes in metal concentrations from land disturbance and dredging activities, as well as organic and volatile compounds to assess against machinery or anthropogenic contaminants. Water levels and general parameters will also be monitored to assess general changes in the groundwater system, such as the changes in freshwater seawater interface and flow directions. Once sufficient monitoring data have been collected, a statistical analysis (minimum, maximum,

median, mean 5th to 95th percentile, etc) of the baseline dataset will be conducted. The results will be used to understand the natural groundwater variations within the Toondah Harbour PDA to assist in development of trigger values using the DSITI (2017) guidelines. The derived trigger values will be adopted during the construction period as an allowable upper or lower concentration limit prior to triggering management actions or further groundwater investigations.

Existing water quality guideline values (ANZG 2018) and NEPM (2011) will be utilised for site assessment until such time as appropriate site-specific triggers are developed.

Table 4: Groundwater Analysis Suite Description.

Analysis	Description
GP (General parameters)	pH, DO, Temp, EC, TDS, major cations, and anions (Na^+, Ca^{2+}, K^+, Mg^{2+}, Cl^-, SO_4^{2-}, HCO_3^-, CO_3^{2-}) Alkalinity.
Br	Bromide (using HPLC method).
Organic and volatile compounds	BTEX, phenolic compounds, polynuclear aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and total recoverable hydrocarbons (TRH).
Metals	Arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, zinc, aluminium, antimony, barium, beryllium, boron, calcium, cobalt, iron, magnesium, molybdenum, potassium, selenium, silver, strontium, thallium, tin, vanadium.
Nutrients	Ammonia, nitrite, nitrate, total kjeldahl nitrogen, total phosphorus
Other parameters	Fluoride
SWLS	Standing water level data: Time-series groundwater levels. Corrected for barometric pressure effects.

1.4. Air Quality

Desired Outcomes:

- Minimal complaints from surrounding residents about air quality. If complaints occur, they are addressed efficiently.
- No impacts to the surrounding environment, including the MBRS, from dust or other air quality issues.

Potential Impact	Mitigation Measure	Responsibility	Timing
Dust generation from hauling material on and around the site during dredging and reclamation activities	▪ Set a maximum speed limit of 20 km/hr on site on unpaved/unsealed roads ▪ Install a wheel wash and rumble grid at entry points where trucks may pass on and off site. Ensure there is a sealed section of roadway between the wheel wash and exit point ▪ All trucks leaving and entering the site (whether loaded or unloaded) should be covered to ensure dust emissions from trucks are minimised	Contractor and all subcontractors	During dredging and reclamation

Potential Impact	Mitigation Measure	Responsibility	Timing
	▪ Bulk materials including cement and/or lime should be delivered in enclosed tankers and stored in suitable containers or covered to prevent escape ▪ Where possible ensure haul roads have a hard surface or are regularly watered to minimise emissions. Frequency of watering to be increased if emissions observed or during dry periods ▪ Carry out regular inspections of haul routes and keep records on site of inspections		
Dust generation from earthworks within the project footprint during all stages of works	▪ Earthworks near the closest receptors are to be minimised as far as practicable. Controls for sources which may include haul roads and stockpiles will be maximised if located near to receptors ▪ Barriers and/or fencing installed near potential sources of dust (stockpiles) to reduce the risk of dust impacts. Inspect fencing and barriers weekly to ensure they do not build up with particulate matter or are damaged ▪ Cover, seed or fence stockpiles, and revegetate or stabilise exposed areas with environmentally safe dust suppression sprays. Reapply if surface is disturbed or if dust emissions are observed ▪ Use water collected through the sediment dewatering process for dust suppression on reclaimed areas ▪ For exposed areas which will not be actively worked, cover or stabilise the areas with dust suppression agents or hydroseeding	Contractor	During construction
Vehicle and equipment emissions during all stages of works	▪ Ensure any activities from fixed equipment (e.g. screening activities) which operate over an extended period use best practice dust control, which may include enclosing equipment ▪ Avoid the use of diesel generators and rely on mains power where possible ▪ If cutting, grinding or sawing equipment is to be used, ensure dust suppression techniques are used, such as local extraction systems or water sprays ▪ For hardstand or sealed roads, water assisted sweepers and/or dry sweepers should be used to avoid the risk of building of materials which could be re-entrained	Contractor	During construction and operation
Safe material storage during all stages of works	▪ Bins and skips are covered where practicable ▪ Avoid storing materials on site that may lead to additional dust emissions, unless the materials are to be re used on site	Contractor	During construction and operation

Potential Impact	Mitigation Measure	Responsibility	Timing
	▪ Position stockpile areas as far as possible from sensitive receivers ▪ For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust		

Draft Air Quality Monitoring Plan

A dust management plan (DMP) will be prepared for the Project including at a minimum:

- On- and off-site inspection methodology for assessing the potential for impact on receptors and roads and to record findings of observations.
- A process for regular inspections of site operations to ensure compliance with the DMP – results of inspections and any follow up actions for areas of concern will be recorded.
- Installation of a real time air quality monitoring station at or near the most likely affected receptor to monitor Total Suspended Particulates and PM_{10}.

The proposed air quality monitoring program for the Project is recommended to consist of:

- Real time measurement methods complying with Australian Standards for TSP and PM_{10}.
- Six impact dust deposition gauges and one background location in line with Australian Standards for measurement of dust fall out.

As the highest risk relates to the Stage 1 activities, it is recommended that the monitoring be performed for at least the duration of the Stage 1 dredging and reclamation works. The requirement for air quality monitoring for Stage 2 should be reviewed based on the monitoring results from Stage 1 which will enable the efficacy of the mitigation measures to be evaluated. The monitoring criteria applicable to the Project is described in Schedule 1 of the *Environmental Protection (Air) Policy 2019* (OQPC, 2019a).

The proposed locations of air quality monitoring equipment for the Project are presented in in Section 11.5.1 of the Draft EIS.

1.5. Terrestrial Noise and Vibration

Desired Outcomes:

- No long-term disturbance to terrestrial fauna as a result of high noise generating activities.
- Impacts to ecologically sensitive receptors to be managed by careful programming of noisy works.
- Minimise human disturbance during high noise generating activities.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Ambient noise generation from installation of sheet piling and rock revetments for reclamation perimeter walls	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. migratory bird breeding season). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During sheet piling and rock revetments
Ambient and underwater noise generation from installation of vertical piles within the harbour area	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. migratory bird breeding season when most of the birds are away from Moreton Bay). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required. ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During vertical piling
Ambient noise generation from	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Ensure the crew is trained and suitably qualified.	All contractors	During dredging

Potential Impacts	Mitigation Measure	Responsibility	Timing
dredging activities at night	▪ Acoustic screens to be deployed around unloading dock. ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.		
Ambient noise generation from reclamation and construction of revetments for the marina and internal channels	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. during migratory bird breeding season). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During landforming and revetment construction

1.6. Lighting

Desired Outcomes:

- No long-term disturbance to terrestrial fauna as a result of lighting.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Short term increases in artificial lighting around the temporary unloading dock and other activities	▪ Lighting design to adhere to AS 4282 - Control of the obtrusive effects of outdoor lighting and the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds. ▪ Light downwards and not horizontally or vertically. ▪ Temporary fencing to be placed around the work compounds where lighting may affect sensitive receptors.	Contractor	During construction

Potential Impacts	Mitigation Measure	Responsibility	Timing
during construction.			
Increase in ambient light from urban areas (building, parkland, etc) and the upgraded ferry terminal including associated retail and commercial uses.	▪ Lighting design to adhere to AS 4282 - Control of the obtrusive effects of outdoor lighting and the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds. ▪ Luminaires selected for street and park lighting are to be dark sky compliant. ▪ Light downwards and not horizontally or vertically. ▪ Park and open space planting planning to assist with screening ground level visibility and avoid light spill onto surround areas.	Contractor and operator	During construction and operation

1.7. Waste Management

Desired Outcomes:

- Avoid impacts to terrestrial environments within and surrounding the Project footprint from waste during all periods of construction.
- Minimise waste escaping into the marine and terrestrial environments within and surrounding the Project footprint and avoid any spills outside of containment areas.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Generation of wastes from construction (building, civil and marine) works	▪ Develop waste management plans for each aspect of construction (dredging and reclamation, marine works, building works and civil works). ▪ Construction waste (with the exception of clean fill) is not to be disposed into the terrestrial environment of the port or the reclamation area. As outlined in the NAGD, dredge material is a natural resource that can be beneficially used for reclamation and not a waste. ▪ Specific waste management locations will be identified prior to the commencement of construction and designated collection bins or other appropriate containers will be supplied to facilitate waste segregation. ▪ Materials recycling or re-use on site will be encouraged. ▪ Loose waste and bins will be kept covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through the Project footprint. ▪ The Project footprint will be maintained in a clean and tidy manner and waste will be progressively removed from site and not allowed to stockpile.	Contractor / proponent	Pre-construction and construction

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ The collection and transport of waste from the Project footprint will be by licensed contractors and disposed of at waste disposal facilities licensed for the various waste streams. ▪ Avoid stockpiling concrete during demolition and ensure isolation of concrete from other waste. Concrete to be re-used as fill where possible. ▪ Demolition timber to be separated on site and recycled where possible. ▪ A complete inventory, including material safety data sheets, of chemicals to be used on site will be developed and maintained. ▪ Chemicals and fuels, including empty drums, are to be stored in appropriately bunded areas in accordance with relevant regulations. The volumes of these chemicals/fuels on site are to be kept below limits for notifiable activities, or if above these limits, appropriate permits and license are to be obtained. ▪ Any unknown or suspected contaminated material will be handled and disposed of in accordance with Project-specific contaminated land management plans and legislative requirements. ▪ The movement and quantities of wastes and recovered materials on/off site will be recorded in accordance with legislative requirements. ▪ Provide self-contained toilets (Portaloo or similar) on site for the duration of construction which will be transported and regularly serviced by a licensed contractor. ▪ Daily inspection and removal of litter from the site and adjacent areas. ▪ In the event of any of waste release into the environment (marine or terrestrial), the incident will be reported following the requirement of the EMP and the relevant incident response plan. Appropriate spill clean-up procedures will be followed.		
Generation of wastes from operations including residential, commercial and retail uses	▪ Develop waste management plans during detailed design for all open space and recreational areas including the foreshore park and boat ramp for non-motorised recreational vessels. ▪ Identify specific waste management locations in the Project footprint during detailed design. Supply designated collection bins or other appropriate containers to facilitate segregation and encourage waste recycling or re-use. ▪ Keep loose waste and bins covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through Project footprint.	Operator / contractor	During operations

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Install educational signage in parks and other recreational areas, explicitly stating the risk to wildlife of disposing of rubbish in the water. ▪ Collect and dispose of wastes from residential, commercial and retail development in accordance with council requirements and by licensed contractors at licensed waste disposal facilities. ▪ Remove any trade or regulated waste by a licensed trade waste contractor to a licensed reception facility. ▪ Comply with building standards and codes for urban sewer. Secondary containment of overflow devices to be incorporated in landscaping. ▪ Design commercial sites to incorporate storage bin areas that capture 'fugitive' waste. Lidded bins are appropriate for the waste stream to prevent vermin and wildlife impacts. ▪ Provide appropriate and sufficient containers for litter, including Tangler bins for the disposal of damaged fishing line and tackle at land-based recreational fishing locations within the Project footprint. ▪ Store chemicals and fuels, including empty drums, in appropriately bunded areas in accordance with relevant regulations. ▪ Handle chemical and fuels in accordance with the appropriate material safety data sheets and manufacturer specifications. Transport and store in containers that are fit for purpose. ▪ Handle and dispose of any contaminated material in accordance with legislative requirements.		
Generation of wastes from operations at the ferry terminal and marina	▪ Develop waste management plans for the marina and ferry terminal and include in lease and contract documentation. ▪ Provide a pump out facility for removal of sewage from recreational boats within the marina. ▪ Identify specific waste management locations in the Project footprint during detailed design. Supply designated collection bins or other appropriate containers to facilitate segregation of waste types and encourage waste recycling or re-use. ▪ Keep loose waste and bins covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through the Project footprint. ▪ Install educational signage in carparks and other communal areas, explicitly stating the risk to wildlife of disposing of rubbish in the water. ▪ Remove any trade or regulated waste by a licensed trade waste contractor to a licensed reception facility.	Operator / contractor	During operations

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Store chemicals and fuels, including empty drums, in appropriately bunded areas in accordance with relevant regulations. ▪ Handle chemical and fuels in accordance with the appropriate material safety data sheets and manufacturer specifications. Transport and store in containers that are fit for purpose. ▪ Handle and dispose of any contaminated material in accordance with legislative requirements.		

1.8. Terrestrial Ecology

Desired Outcomes:

- Minimise the number food trees cleared as a result of the development and no direct impacts (injury or death) on Koalas or other fauna by clearing.
- An overall increase in Koala and GHFF food trees within the Project area.
- Minimise risk of Koala death or injury on roads within the Project area.
- Avoid indirect impacts to fauna as a result of the Project.
- Avoid long term impacts to fauna within the Project area.

Potential impacts	Mitigation measure	Responsibility	Timing
Clearing of a small number of trees during civil works	▪ No trees will be removed without first being inspected by a registered fauna spotter-catcher. Koalas and other fauna to be relocated in accordance with QPWS permit requirements. ▪ All Koala sightings and behaviour to be recorded by site contractors and members of the public. ▪ Increase habitat for koala and other fauna by planting up to 1000 trees within the PDA boundary. ▪ Work with RCC to increase Koala food tree numbers in key Koala corridor locations connected to the Project area.	Contractor	During civil works
Direct injury (i.e. vehicle strike) during civil, building and marine works	▪ All contractors and site workers inducted with content addressing the importance of observing road speed limits, designated routes, and being alert for Koalas on the road. ▪ No construction traffic allowed to use Shore Street East. Ensure construction traffic uses only designated routes. ▪ Shore Street East designated as a 40km/hr road and fitted with electronic signage to indicate vehicle speed and warn of Koalas crossing.	Contractor	During civil, building, and marine works

Potential impacts	Mitigation measure	Responsibility	Timing
	▪ Install go slow zones and permanent attendant to 'walk' construction traffic through the area of Middle Street adjacent to GJ Walter Park during peak construction periods. ▪ Install permanent safe crossing infrastructure as part of Middle Street upgrades. ▪ Do not obstruct Koala access to food resources through impermeable fencing or other structures.		
Indirect disturbance from noise, dust and lighting during civil, building and marine works	▪ Dust management and monitoring to be carried out in accordance with Chapter 11 of the EIS. ▪ During high-risk periods for dust (i.e. completion of reclamation) food trees within the Project area will be inspected for dust deposition during prolonged dry periods (i.e. no rainfall for a four week period) and affected trees sprayed with water if necessary. ▪ Noise management and monitoring to be carried out in accordance with Chapter 12 of the EIS. ▪ Prior to the commencement of significant noise generating activity Koala monitoring will be undertaken to monitor changes in behaviour. Noise management to be adjusted in response to outcomes (i.e. add acoustic screens). ▪ Design and implement Project lighting in accordance with Chapter 13 of the EIS. ▪ Monitoring and management of adjacent bird habitats in accordance with Chapter 17 of the EIS. ▪ Stormwater management to be implemented and managed in accordance with Chapter 9 of the EIS.	Contractor	During civil, building, and marine works
Ongoing disturbance during operations and ongoing use	▪ Provide community education about the danger dogs pose to Koalas by providing information to buyers, installing public signage, and through embracing and supporting RCC initiatives (e.g. 'Koala Safe Neighbourhood Program' and the 'Leave it Program'). ▪ Educational signage in key locations with information about Koala behaviour and a 'do not disturb' message to visitors and residents. ▪ Prohibited and restricted invasive plants as specified in the *Biosecurity Act 2014* will not be included in landscape plantings. ▪ Consult with RCC to fund the installation and ongoing monitoring of Koala underpasses where Middle Street and Shore Street West cross Ross Creek. ▪ Provide funding to a Safe Koala Neighbourhoods Program for the Project area and surrounds that will include the installation of proven mitigation actions such as signage in locations deemed most effective.	Proponent / operator	During operations

Draft Terrestrial Fauna Monitoring Program

A number of monitoring will be implemented during construction and beyond with a focus on Koalas within the PDA to management measures respond to any behavioural changes that may result from the Project. Monitoring measures include:

- Monitoring Koala use of the Middle Street crossing with motion sensor cameras. Periodic monitoring of Koala/vehicle interactions at the terminus of guide fencing to determine the need to implement further measures (e.g. extension of guide fencing).
- Monitoring of Koalas within the Project area prior to significant noise-generating activity to pinpoint Koala locations in the Project area, and again the following morning to determine if habitat has been vacated. Following the pre-noise survey, ecologists will observe and record Koala behaviour of for a period of two hours and measure noise levels at each location.
- Inspect Koala habitat trees within the Project area for the presence of dust on leaves during prolonged dry periods (no significant rainfall for >4 weeks). Spray affected trees with water to remove dust if required.

2. Draft Threatened and Migratory Shorebird Species Management Plan

2.1. Soils, Sediments, and Contaminated Land

Desired Outcomes:

- Dredging will be managed so that there are no long-term impacts to habitats or fauna outside of the dredge area.
- A site-specific adaptive water quality monitoring program will be developed and implemented in accordance with relevant guidelines such as the NAGD therefore effectiveness is considered high.
- Tailwater will be managed within the bunded reclamation area with minimal releases so that there are no long-term impacts to habitats or fauna outside of the Project footprint.
- ASS will be monitored and managed in accordance with industry guidelines so that there are no short or long-term impacts to habitats or fauna.
- Contaminated land will be managed in accordance with relevant guidelines so as to not impact on any sensitive environmental receptors including Moreton Bay.
- Chemicals and fuels will be stored in accordance with relevant safety data sheets and guidelines, and storage and use will be carried out in accordance with site-specific environmental authorities.

Potential impacts	Management and monitoring measures	Responsibility	Timing
Dredging resulting in the suspension of contaminated sediments into the water column	▪ Implement a water quality monitoring program to monitor dredge plumes and sensitive receptors. Additional management measures will be initiated in response to exceedances of impact criteria (refer to Chapter 9 for more detail on the proposed water quality monitoring program).	Contractor	During dredging
Release of contaminants from dredge material and soft upper sediments within the reclamation area into tailwater	▪ Carry out water quality testing of tailwater regularly to ensure no contaminants are present prior to re-use on site. ▪ If contaminants are present above human health trigger levels use appropriate treatments to remove from the water prior to re-use or transport water from site for disposal in an appropriate facility.	Contractor	During dredging and reclamation
Oxidation of PASS in reclamation and other parts of the Project footprint	▪ Implement an ASS management plan in accordance with relevant State and Federal guidelines including a monitoring program for the dredging and reclamation processes.	Contractor	During reclamation

Potential impacts	Management and monitoring measures	Responsibility	Timing
where excavations occur	▪ Keep sediments saturated during the dredging process until they have been treated for potential acidity and placed within the reclamation area. ▪ Apply additional treatment as required to dredge material and soft upper sediments within the reclamation area. ▪ Carry out daily inspections of the reclamation area to check for visual signs of oxidation. ▪ Carry out ASS and PASS sampling and analysis in accordance with relevant State and Federal guidelines prior to carrying out any on land works. Apply treatment as required to neutralise acid generating potential. ▪ Conduct an ASS weathering trial to determine rates of reaction and liming requirements for ASS containing sediment.		
Disturbance of existing contaminated land through construction activities adjacent to GJ Walter Park, existing ferry terminals, trade college and dredge sediment pond	▪ Carry out a DSI in accordance with relevant State and Federal guidelines prior to commencing works in areas identified as high or moderate risk by the PSI. ▪ Carry out groundwater monitoring during and post construction to check for changes in water chemistry (refer to Chapter 10 for more detail on the proposed groundwater monitoring program). ▪ Soil investigation to assess fill materials and underlying natural soil within GJ Walter Park, the ferry terminals and dredge sediment pond. Geotechnical assessment of soil in these areas to determine suitability of material to retain on site as part of site development.	Contractor	During construction
Fuel or other chemicals spills to ground or water during the construction process and ongoing uses	▪ Store fuels and chemicals in appropriate areas away from sensitive receptors on site in accordance with relevant standards and guidelines. ▪ Retain appropriate spill response materials on site including booms and absorbent materials. Spill kits are to be kept nearby to any fuel or chemical storage area. ▪ Installation and sampling of additional groundwater bores targeting the southern landfill area and fuel storages.	Contractor	During construction and operations

2.2. Coastal Processes and Dredge Plumes

Desired Outcomes:

- Changes in coastal morphology will not impact on ecological values surrounding the Project footprint, such as shorebird use of the Cassim Island roost site.

Potential impacts	Management and monitoring measures	Responsibility	Timing
Changes to coastal erosion and accretion in areas outside of the Project footprint	▪ Monitor changes in coastal morphology in areas adjacent to the Project. Key areas include potential for sediment build up at the sheltered beach area north of the reclamation and erosion to the northwest of Cassim Island. If significant erosion around Cassim Island occurs, construction of the rockwall breakwater could be brought forward in the development cycle. Measures such as removal or placement of sand would be considered in the unlikely event of significant changes.	Proponent during construction Operator/contractor during operation	During construction and operation

2.3. Surface Water Quality

Desired Outcomes:

- Dredging will be managed so that there are no long-term impacts to water quality.
- No water quality issues within the internal waterways and marina related to poor flushing, such as algae outbreaks.
- Tailwater will be managed within the bunded reclamation area with minimal releases so that there are no long-term impacts to water quality outside of the footprint.
- Stormwater will be managed onsite so that there are no long-term impacts to water quality outside of the footprint.
- Chemicals and fuels will be stored in accordance with relevant safety data sheets and Workplace Health and Safety Queensland's Managing risks of hazardous chemicals in the workplace.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Dredging resulting in the suspension of sediments into the water column	▪ Implement the water quality monitoring program to monitor dredge plumes and sensitive receptors. Where exceedances of monitoring criteria occur dredging activities will be modified. This may include: o Moving the position of the dredge away from the sensitive habitat; o Stopping dredging to allow turbidity levels to drop or currents to reverse; and o Use of or other management measures to reduce turbidity, such as modifying the dredge technique, should the investigation triggers be reached frequently. ▪ Silt curtains to be utilised around the dredge area wherever practicable.	Dredge Contractor	During Dredging
Water quality issues within the marina and internal channels due to poor flushing	▪ Include culverts within the design of the Project linking internal waterways to the marina and Moreton Bay increasing flushing times within the Project footprint.	Proponent / Design Contractor	Detailed Design

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Implement the water quality monitoring program to monitor dredge plumes and sensitive receptors.		
Suspension of sediments from dredge material and soft upper sediments within the reclamation area into tailwater	▪ Carry out water quality testing of tailwater regularly to ensure no contaminants are present prior to re-use on site. ▪ If contaminants are present above human health trigger levels use appropriate treatments to remove from the water prior to re-use or transport water from site for disposal in an appropriate facility. ▪ Use geofabric lining with sheet piling to ensure fine sediment does not move through rockwalls. ▪ Develop a construction erosion and sediment control plan and utilise control devices where appropriate.	Reclamation Contractor	During Reclamation Works
Stormwater runoff during construction and ongoing use reducing water quality in Moreton Bay through increased suspended solids and nutrients	▪ Develop a construction erosion and sediment control plan and utilise control devices where appropriate including regular monitoring of effectiveness. ▪ Implement stormwater management devices into the development in accordance with the conceptual stormwater management plan. ▪ Undertake a minimum of 2 years monitoring of stormwater treatment devices to ensure pollutant loads meet or exceed the predicted outputs.	Civil Contractor	Pre and during Construction
Fuel or other chemicals spills to ground or water during the construction process and ongoing uses	▪ Store fuels and chemicals in appropriate areas away from sensitive receptors on site in accordance with relevant standards and guidelines. ▪ Retain appropriate spill response materials on site including booms and absorbent materials. Spill kits are to be kept nearby to any fuel or chemical storage area.	Civil Contractor	During All Construction
Oxidation of PASS in reclamation and other parts of the Project footprint where excavations occur	▪ Implement an ASS management plan in accordance with relevant State and Federal guidelines including a monitoring program for the dredging and reclamation processes. ▪ Keep sediments saturated during the dredging process until they have been treated for potential acidity and placed within the reclamation area. ▪ Apply additional treatment as required to dredge material and soft upper sediments within the reclamation area. ▪ Carry out daily inspections of the reclamation area to check for visual signs of oxidation. ▪ Carry out ASS and PASS sampling and analysis in accordance with relevant State and Federal guidelines prior to carrying out any on land works. Apply treatment as required to neutralise acid generating potential.	Civil Contractor	During All Construction

Potential impacts to water quality and marine ecology will be managed through an overall trigger action response plan (TARP). In this plan key sensitive receptors will be protected by:

- Using baseline data and modelling to develop trigger levels for a suite of parameters that provide an early warning of potential damage;
- Monitoring these parameters; and
- Providing actions in response to these triggers being met.

All monitoring will be in accordance with methods prescribed in the latest edition of the Monitoring and Sampling Manual (Monitoring and Sampling Manual 2009 Environmental Water (Policy) DES 2018), and a project-specific standard operating procedure that addresses the management of data quality and integrity, including effective calibration and maintenance of water quality meters in accordance with their specifications and the Monitoring and Sampling Manual. Samples will be analysed by a NATA accredited laboratory so that data can be compared to the WQOs for Area C2. The results of water quality monitoring will be made publicly available, as close to real time as possible.

Where water quality parameters exceed predefined trigger levels, further investigation will be required. Where investigation indicates that there may be an adverse impact to key sensitive habitats, a management response will be implemented.

Overall impacts from the Project on sentinel key sensitive habitats in the surrounding area will also be monitored. This will include monitoring water quality, benthic photosynthetically active radiation (BPAR), and habitat condition.

Potential Plumes from Dredging and Reclamation

Water quality will be measured up and down current of any active dredging and of any activities from the reclamation works (e.g. construction of bund walls) that may negatively impact water quality[2]. The scope and extent of any plumes from activities will be assessed visually (including the use of drones) throughout the construction phase.

Monitoring sites will include sites up and down-current of dredging and other earthworks activities, as well as sites in nearby sensitive habitats that may be impacted by changes in water quality. As in previous dredge campaigns at Toondah Harbour, to assist in correctly attributing the cause of any changes in turbidity, an up-current control site will be monitored, in addition to down-current sites at set distances from the current dredging activities. As the dredge moves throughout the campaign, and the position on any one day cannot currently be predicted, and as the direction of up and down current changes with the tide, it is not possible to map all possible monitoring locations.

Water quality depth profiles of turbidity, percent saturation of dissolved oxygen and pH will be collected at sites:

- 50 -100 m up-current of activities that result in the disturbance of sediment or water quality;
- ≤350 m down-current of activities; and
- 500 m down-current of activities and continuing every 250 m to the maximum distance of any visible plume.

Water quality depth profiles will be collected:

- Every day for four days at the commencement of each dredge campaign;
- Every day for four days prior to any reclamation activity that would result in a discharge;

[2] Noting that with the current design there are no discharges from the reclamation area, so ambient monitoring during standard reclamation activities would not be required.

- Every day for four days following any exceedance; and
- Once a week throughout standard dredging activity, and any reclamation activity that would result in a discharge.

Further:

- Each time water quality data is collected, GPS coordinates will be recorded for the up-current control site(s), location(s) of the activity, and downstream monitoring point(s);
- Data will be collected in depth profiles, with measurements at 2 m depth intervals where overall depth is >10 m, or 1 m depth intervals where the overall depth is <10 m, with the deepest reading taken at least 1 m above the substrate;
- Water quality measurements will only be collected during tidal flows, and will be at least one hour either side of the slack tide; and
- All monitoring will be of samples that are representative of the effects of the dredging activity.

Background values (BV) will be calculated as the average of the readings collected from depth profiles at the up-current point.

Triggers for investigation will be based on the comparison of BV to the value ≤350 m down-current of activities. The following investigation triggers are nominally recommended:

- Where the BV for turbidity is less than 100 NTU, then the trigger for investigation is defined as 10 NTU or more above the BV; and
- Where the BV is more than 100 NTU, then the trigger for investigation is defined as 10% or more above the BV.

These triggers have been used previously to monitor dredge activities in Toondah Harbour and no apparent impacts to the surrounding marine environment have been identified.

The pH at the monitoring point/s 350 m downstream of activities will also be compared to the prescribed minimum and maximum WQO for Area C2, and to the BV.

When an investigation trigger is reached or exceeded, the likely cause will be investigated and determined. The length of the plume will be recorded, and data will be collected and analysed from the nearby sensitive habitats (refer to Figure 16-11) to determine whether pH complies with the WQO, and whether there is a corresponding peak in turbidity or decrease in BPAR that may be due to the dredge or reclamation activities. Where other current data is available (e.g. data from the EHMP) it will also be used in this assessment.

Where the activities result in a plume that may negatively impact nearby sensitive habitats, management measures (including modifying or ceasing dredging) will be implemented to rectify the issue. Specific measures may include:

- Moving the position of the dredge away from the sensitive habitat;
- Stopping dredging to allow turbidity levels to drop or currents to reverse; and
- Use of or other management measures to reduce turbidity, such as using additional silt curtains or modifying the dredge technique, should the investigation triggers be reached frequently.

Water Quality within the Marina

On connection of the interior waterways to the bay, the site will be inspected daily for visual and olfactory signs of poor water quality, including:

- Floating scums of algae;
- Slicks (oil, chemical);

- Litter;
- Excessive growth of algae; and
- Unpleasant odours.

Water quality will also be monitored monthly for the first twelve months in the areas of the marina with the longest flushing times (i.e. the north-western section of the internal waterway, the central marina, the middle entrance channel and at two background (control) points to the north and south of the Project). Turbidity, pH, conductivity and the percent saturation of dissolved oxygen will be measured in situ in surface water, and 1 m from the bottom. In addition, surface samples will be collected and analysed for the concentration of total nitrogen, oxides of nitrogen, ammonia, oxidised nitrogen, total phosphorus, filterable reactive phosphorus, chlorophyll *a*, and enterococci.

These water quality parameters will also be measured at these sites following two rainfall events each year (nominally > 20 mm within a 24 hour period), and where visual assessment indicates a deterioration in water quality.

Management Trigger: Dissolved Oxygen

After each monitoring event, the percent saturation of dissolved oxygen at each site within the marina will be compared to data from the control sites and to the water quality objectives (WQO).

Where the percent saturation of dissolved oxygen is within WQO (95% to 105%[3]) at the control sites, but is not within the WQO at a site within the marina:

- Monitoring of dissolved oxygen will be increased to daily until levels return to an acceptable level;
- The cause will be investigated by a suitably qualified water quality scientist or engineer; and
- The waterway will be managed to prevent the percent saturation of dissolved oxygen decreasing to less than 85%. Management measures may include aeration, and re-evaluation of stormwater management.

Management Trigger: Nutrients, Chlorophyll a, and Enterococci

The annual median of the monthly concentration of nutrients, chlorophyll *a*, and enterococci from each site within the marina will be compared to the median from the control sites.

Where the median from each site within the marina is higher than the control sites, the medians from the marina will be compared to the WQO.

Indicative triggers for investigation based on this approach, and using background concentrations in Area C2 as a guide for likely median concentrations for the control sites, are presented in *Table 1*.

Table 1: Indicative Triggers for Investigation within the Marina.

Parameter (µg/L)	Modelled Increase*	Median in Area C21	WQO	Trigger for Investigation
Total nitrogen	<7	150	<160	160

[3] Noting that in Area C2, the median of water quality parameters should comply with the WQO, not individual readings. Thus this will be an early alert.

Parameter (µg/L)	Modelled Increase*	Median in Area C21	WQO	Trigger for Investigation
Total phosphorous	<1.3	15	<20	20

[1] 50th percentile of Sites E0309, E0500 and E0501 in Area C2

* indicates differences with respect to existing concentrations

Where a median from within the marina is higher than the median from the control sites and exceeds the WQO, the cause and impacts will be investigated, and where necessary management actions implemented to rectify this (e.g. aeration, re-evaluation of stormwater management) implemented to improve it.

If after 12 months water quality does not comply with the expectations of the models, is significantly poorer than historical water quality, and/ or is poorer than at the control sites, water quality data will continue to be collected each month, until such time as these expectations are met.

If, after twelve months, water quality in the channels and marina complies with the expectation of the models, or is not significantly different to historical data or to water quality at the control sites, water quality data will only be collected after significant rainfall events (i.e. > 20 mm within a 24 hour period) for three years.

If, after twelve months, water quality in the channels and marina complies with the expectation of the models, or is not significantly different to historical data or to water quality at the control sites, water quality data will only be collected after significant rainfall events (i.e. > 20 mm within a 24 hour period) for three years.

Ongoing Use and Operations

After the completion of works comprising the establishment of the development footprint and the completion of dredging, monitoring of the marina will be required to assess any changes in water quality due to runoff and altered hydrodynamics. Water quality will be measured in the marina and ferry port harbour, Fison Channel and two background (control) locations, quarterly over two years for:

- Physico-chemical parameters measured in situ (i.e. dissolved oxygen, pH, salinity and turbidity);
- Nutrients (e.g. total nitrogen, total phosphorous, oxides of nitrogen, organic nitrogen, filtered reactive phosphorous, ammonia);
- Total suspended solids; and
- Chlorophyll *a*.

Where the median concentration of nutrients, chlorophyll *a*, or enterococci is higher than the background (control) conditions and exceeds the WQO, the cause and impacts will be investigated, and where necessary management actions implemented to rectify this.

Monitoring Water Quality and BPAR at Key Habitats

In addition, to determine and manage any adverse impacts to nearby sensitive habitats, turbidity, pH, and benthic photosynthetically active radiation (BPAR) will be monitored at the sites where the ecological condition of key habitat is monitored (Chapter 16 – Marine Ecology; **Error! Reference source not found.**):

- The closest coral communities near Jercuruba (Peel Island)
- The closest coral communities near Coochiemudlo Island
- Coral communities on the north-east edge of the Cassim Island sandbar
- A coral control site east of Wellington Point
- Seagrass bed north of Oyster Point

- Seagrass bed north of the proposed development
- Seagrass control site north of Point Halloran, and a
- Seagrass control site at Wellington Point.

These sites will be surveyed prior to monitoring commencing to ensure they still support these habitats and varied as appropriate if habitat distribution has changed.

Water Quality

Turbidity, conductivity, Secchi depth, temperature and percent saturation of dissolved oxygen in surface waters will be monitored at each site. Each site will be monitored:

- Immediately prior to, and each month during dredging and reclamation activities
- Each quarter for two years once the final development footprint is established.

This data will be assessed together with the results of the marine ecological assessments at each site (Chapter 16 – Marine Ecology). Where there are significant changes to habitats at potentially impacted coral or seagrass habitats but not at the control sites, the reasons for these changes, including changes to water quality, will be investigated, and appropriate management actions applied.

BPAR

A variety of factors, including genetics, temperature, nutrient and sediment conditions may influence light thresholds (Collier *et al*. 2016). Light thresholds for the management of acute impacts have been developed for all the seagrasses species that occur in the MIA, including the dominant species *Zostera muelleri* and *Halophila ovalis* (Collier *et al*. 2016, Pearson *et al*. 2020, *Table 2*). These thresholds are conservative as they are higher than the maximum biological thresholds (Collier *et al*. 2016). Therefore, they provide an early warning of potential impact and an opportunity to investigate and instigate appropriate management actions to prevent impacts.

Table 2: Seagrass Light Thresholds for Species in the MIA.

Species	Classification	Suggested Management Threshold (Mol m^{-2} d^{-1})	Integration Time (days)*	Time to Impact (days)**	Confidence Score+	Application Area
Cymodocea serrulata	opportunistic	5	14	50	4	GBRWHA
Halophila decipiens	colonising	2	1	14	3	GBRWHA
Halophila ovalis^	colonising	2	7	14	3	GBRWHA
Halophila ovalis^	colonising	6	7	28	3	GBRWHA
Halodule uninervis	colonising / opportunistic	5	14	40	3	GBRWHA
Zostera muelleri	colonising / opportunistic	6	14	28	2	GBRWHA

Species	Classification	Suggested Management Threshold (Mol m^{-2} d^{-1})	Integration Time (days)*	Time to Impact (days)**	Confidence Score+	Application Area
Zostera muelleri	colonising / opportunistic	4.5	14	-	-	Gold Coast

*Averaging time used to describe light history and as first signal to trigger management plan

**Time to impact expected and a management plan should be implemented before this time

^Two thresholds are recommended for this species as it occupies diverse habitats (with a broad range in light levels) and is highly sensitive to disturbance. Both levels should be complied with.

+ A confidence score of 2 indicates a relatively high level of confidence, but based on studies from limited locations, 3 indicates somewhat confident, 4 indicates low confidence.

BPAR will be logged at deepest end of the *Z. muelleri* meadow at each of the four seagrass sites for 14 months prior to works commencing, and throughout the dredging and reclamation campaigns. Two autonomous loggers (OdysseyTM or similar) with wiper units to keep sensors clean will be used to measure BPAR at each site. Light will be recorded as instantaneous light (µmol m^{-2} s^{-1}) every 15 – 30 minutes and will be summed to daily light (mol m^{-2} d^{-1}), which integrates daily light exposure (Bryant *et al.* 2014, McKenzie *et al*. 2016). Daily light will then be reported as a rolling average of the previous 14 days.

Seagrass biomass, average leaf length and density will also be measured in five replicate quadrates each month at each site at the deepest edge of the *Z. muelleri* meadow, for 14 months prior to works commencing.

This data will be compared to data from existing studies to determine a conservative threshold to be used in combination with the water quality monitoring to manage dredging and reclamation activities.

The light threshold will be used to supplement the triggers and dredge management. Where BPAR is below the threshold at the potentially impacted sites for 14 days, an investigation of data will be triggered (including water quality, habitat, BPAR, weather and other relevant data) and possible causes identified.

Where investigation indicates the low BPAR is likely due to dredging or reclamation activities, measures (including modifying or ceasing dredging) will be implemented to rectify the issue.

2.4. Groundwater

Desired Outcomes:

- No impacts on marine or terrestrial environments outside of the Project footprint as a result of groundwater drawdown or other changes that may result from the Project.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Dredging and removal of marine sediments facilitating direct	None proposed as only limited and localised changes to groundwater quality, which is currently already dominated by seawater.	Contractor	During dredging

Potential Impacts	Mitigation Measure	Responsibility	Timing
mixing of seawater and groundwater			
Dewatering: inducing contaminant mobilisation from buried landfill	▪ Ongoing monitoring to characterise baseline groundwater level and quality within the Project footprint. ▪ Develop water level and quality 'trigger' levels to inform monitoring criteria and groundwater management during development. ▪ If further investigation identifies significant risk of contamination, evaluate cost benefit of source removal prior to construction or post-construction groundwater treatment options.	Contractor	During dewatering
Reclaimed dredged sediments as potential source of contamination to groundwater	▪ Installation of (temporary) sheet piling wall to restrict groundwater flow to the west. ▪ Construction of new groundwater monitoring bores within reclaimed platform. ▪ Complete additional baseline monitoring prior to construction to characterise baseline groundwater level and quality within the Project footprint. ▪ Develop water level and quality 'trigger' levels to inform monitoring criteria and groundwater management during development. ▪ Dredged PASS will be treated onsite using lime prior to oxidation occurring.	Contractor	During dredging and reclamation
Disturbance of ASS – potentially acidifying groundwater and mobilising metals	▪ Monitoring groundwater quality for changes at TDMB02A, TDMB02B, TDMB05A, TDMB05B. ▪ Construct and monitor new monitoring bores in the reclaimed platform.	Contractor	During dredging and reclamation

Draft Groundwater Monitoring Plan

The EVs for the receiving environment have been described for the Toondah Harbour PDA based on the EPP(Water) for Redland Bay (Department of Environment and Resource Management, 2010). The Project WQOs will be defined, and trigger levels will be developed using the DSITI (2017), guidelines following further baseline data collection and analysis prior to commencing construction. Ongoing baseline monitoring for water level and quality has been undertaken in the existing monitoring bore network over a bi-monthly period since April 2020. A further eight baseline monitoring rounds are expected to be undertaken.

The proposed strategy for monitoring impacts set out in the Table 3 below has been designed to assess changes that may occur as result of the key impacts summarised in the Groundwater Section of the Draft EIS. The potential for impacts from the activities will be monitored with the groundwater bore network currently constructed for the Project assessment. The following monitoring objectives have been identified based on the key impacts:

- Objective A: Baseline groundwater levels and water quality around the Project and the MBRS;

- Objective B: lowering the groundwater table for other users/GDEs
- Objective C: changes to hydraulic gradients between aquifers/seawater to facilitate mixing
- Objective D: point sources of contamination from the existing landfill
- Objective E: contamination from reclaimed platform material;
- Objective F: acidifying groundwater and contaminant mobilisation due to disturbed PASS; and
- Objective G: groundwater drawdown (mounding) behind containment wall.

Table 3: Analysis Strategy for Project Groundwater Monitoring.

Bore ID	Eastings (z56 m E)	Northings (z56 m S)	Screened geology and logged constituents (weathered products)	Monitoring objective
TDMB01A	528184	6955485	Basalt (weathered)	A, B, C, E, F, G
TDMB01B	528189	6955488	Basalt (fresh rock)	A, B, C, E, F, G
TDMB02A	527792	6955061	Basalt (weathered)	A, B, C, F, G
TDMB02B	527793	6955066	Basalt (weathered)	A, B, C, F, G
TDMB03	527974	6955291	Basalt (weathered)	A, B, C, F, G
TDMB04A	528181	6955359	Quaternary sediments (sand/clay)	A, C, D, F, G
TDMB04B	528178	6955354	Basalt (weathered)	A, C, D, F, G
TDMB05A	528053	6954905	Quaternary sediments (fine sand – sandy clay)	A, B, C, F
TDMB05B	528041	6954905	Basalt (weathered)	A, B, C, F

The parameters to be monitored are provided in Table 4. The suite of parameters has been selected primarily to monitor possible changes in metal concentrations from land disturbance and dredging activities, as well as organic and volatile compounds to assess against machinery or anthropogenic contaminants. Water levels and general parameters will also be monitored to assess general changes in the groundwater system, such as the changes in freshwater seawater interface and flow directions. Once sufficient monitoring data have been collected, a statistical analysis (minimum, maximum, median, mean 5^{th} to 95^{th} percentile, etc) of the baseline dataset will be conducted. The results will be used to understand the natural groundwater variations within the Toondah Harbour PDA to assist in development of trigger values using the DSITI (2017) guidelines. The derived trigger values will be adopted during the construction period as an allowable upper or lower concentration limit prior to triggering management actions or further groundwater investigations.

Existing water quality guideline values (ANZG 2018) and NEPM (2011) will be utilised for site assessment until such time as appropriate site-specific triggers are developed.

Table 4: Groundwater Analysis Suite Description.

Analysis	Description
GP (General parameters)	pH, DO, Temp, EC, TDS, major cations, and anions (Na^+, Ca^{2+}, K^+, Mg^{2+}, Cl^-, SO_4^{2-}, HCO_3^-, CO_3^{2-}) Alkalinity.
Br	Bromide (using HPLC method).
Organic and volatile compounds	BTEX, phenolic compounds, polynuclear aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and total recoverable hydrocarbons (TRH).

Analysis	Description
Metals	Arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, zinc, aluminium, antimony, barium, beryllium, boron, calcium, cobalt, iron, magnesium, molybdenum, potassium, selenium, silver, strontium, thallium, tin, vanadium.
Nutrients	Ammonia, nitrite, nitrate, total kjeldahl nitrogen, total phosphorus
Other parameters	Fluoride
SWLS	Standing water level data: Time-series groundwater levels. Corrected for barometric pressure effects.

2.5. Air Quality

Desired Outcomes:

- Minimal complaints from surrounding residents about air quality. If complaints occur, they are addressed efficiently.
- No impacts to the surrounding environment, including the MBRS, from dust or other air quality issues.

Potential Impact	Mitigation Measure	Responsibility	Timing
Dust generation from hauling material on and around the site during dredging and reclamation activities	▪ Set a maximum speed limit of 20 km/hr on site on unpaved/unsealed roads ▪ Install a wheel wash and rumble grid at entry points where trucks may pass on and off site. Ensure there is a sealed section of roadway between the wheel wash and exit point ▪ All trucks leaving and entering the site (whether loaded or unloaded) should be covered to ensure dust emissions from trucks are minimised ▪ Bulk materials including cement and/or lime should be delivered in enclosed tankers and stored in suitable containers or covered to prevent escape ▪ Where possible ensure haul roads have a hard surface or are regularly watered to minimise emissions. Frequency of watering to be increased if emissions observed or during dry periods ▪ Carry out regular inspections of haul routes and keep records on site of inspections	All contractors	During dredging and reclamation
Dust generation from earthworks within the project footprint during all stages of works	▪ Earthworks near the closest receptors are to be minimised as far as practicable. Controls for sources which may include haul roads and stockpiles will be maximised if located near to receptors ▪ Barriers and/or fencing installed near potential sources of dust (stockpiles) to reduce the risk of dust impacts. Inspect	All contractors	During construction

Potential Impact	Mitigation Measure	Responsibility	Timing
	fencing and barriers weekly to ensure they do not build up with particulate matter or are damaged ▪ Cover, seed or fence stockpiles, and revegetate or stabilise exposed areas with environmentally safe dust suppression sprays. Reapply if surface is disturbed or if dust emissions are observed ▪ Use water collected through the sediment dewatering process for dust suppression on reclaimed areas ▪ For exposed areas which will not be actively worked, cover or stabilise the areas with dust suppression agents or hydroseeding		
Vehicle and equipment emissions during all stages of works	▪ Ensure any activities from fixed equipment (e.g. screening activities) which operate over an extended period use best practice dust control, which may include enclosing equipment ▪ Avoid the use of diesel generators and rely on mains power where possible ▪ If cutting, grinding or sawing equipment is to be used, ensure dust suppression techniques are used, such as local extraction systems or water sprays ▪ For hardstand or sealed roads, water assisted sweepers and/or dry sweepers should be used to avoid the risk of building of materials which could be re-entrained	All contractors	During construction
Safe material storage during all stages of works	▪ Bins and skips are covered where practicable ▪ Avoid storing materials on site that may lead to additional dust emissions, unless the materials are to be re used on site ▪ Position stockpile areas as far as possible from sensitive receivers ▪ For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust	All contractors	During construction

Draft Air Quality Monitoring Plan

A dust management plan (DMP) will be prepared for the Project including at a minimum:

- On- and off-site inspection methodology for assessing the potential for impact on receptors and roads and to record findings of observations.
- A process for regular inspections of site operations to ensure compliance with the DMP – results of inspections and any follow up actions for areas of concern will be recorded.
- Installation of a real time air quality monitoring station at or near the most likely affected receptor to monitor Total Suspended Particulates and PM_{10}.

The proposed air quality monitoring program for the Project is recommended to consist of:

- Real time measurement methods complying with Australian Standards for TSP and PM_{10}.
- Six impact dust deposition gauges and one background location in line with Australian Standards for measurement of dust fall out.

As the highest risk relates to the Stage 1 activities, it is recommended that the monitoring be performed for at least the duration of the Stage 1 dredging and reclamation works. The requirement for air quality monitoring for Stage 2 should be reviewed based on the monitoring results from Stage 1 which will enable the efficacy of the mitigation measures to be evaluated. The monitoring criteria applicable to the Project is described in Schedule 1 of the *Environmental Protection (Air) Policy 2019* (OQPC, 2019a).

The proposed locations of air quality monitoring equipment for the Project are presented in in Section 11.5.1 of the Draft EIS.

2.6. Terrestrial Noise and Vibration

Desired Outcomes:

- No long-term disturbance to marine or terrestrial fauna as a result of high noise generating activities.
- Impacts to ecologically sensitive receptors to be managed by careful programming of noisy works.
- Minimise human disturbance during high noise generating activities.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Ambient and underwater noise generation from installation of sheet piling and rock revetments for reclamation perimeter walls	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. migratory bird breeding season). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During sheet piling and rock revetments

Potential Impacts	Mitigation Measure	Responsibility	Timing
Ambient and underwater noise generation from installation of vertical piles within the harbour area	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. migratory bird breeding season when most of the birds are away from Moreton Bay). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During vertical piling
Ambient noise generation from dredging activities at night	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Ensure the crew is trained and suitably qualified. ▪ Acoustic screens to be deployed around unloading dock. ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During dredging
Ambient noise generation from reclamation and construction of revetments for the marina and internal channels	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. during migratory bird breeding season). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible.	All contractors	During landforming and revetment construction

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required. ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.		

2.7. Lighting

Desired Outcomes:

- No long-term disturbance to marine or terrestrial fauna as a result of lighting.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Short term increases in artificial lighting around the temporary unloading dock and other activities during construction.	▪ Lighting design to adhere to AS 4282 - Control of the obtrusive effects of outdoor lighting and the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds. ▪ Light downwards and not horizontally or vertically. ▪ Avoid excessively bright points of light being directed towards Moreton Bay. ▪ Temporary fencing to be placed around the work compounds where lighting may affect sensitive receptors.	Contractor	During construction
Increase in ambient light from urban areas (building, parkland, etc) and the upgraded ferry terminal including associated retail and commercial uses.	▪ Lighting design to be adhere to AS 4282 - Control of the obtrusive effects of outdoor lighting and the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds. ▪ Luminaires selected for street and park lighting are to be dark sky compliant. ▪ Light downwards and not horizontally or vertically. ▪ Avoid excessively bright points of light being directed towards Moreton Bay. ▪ Avoid illumination of large vertical surfaces visible from Moreton Bay. ▪ Park and open space planting planning to assist with screening ground level visibility and avoid light spill onto surround areas.	Contractor and operator	During construction and operation

2.8. Waste Management

Desired Outcomes:

- Avoid impacts to the marine and terrestrial environments within and surrounding the Project footprint from waste during all periods of construction.
- Minimise waste escaping into the marine and terrestrial environments within and surrounding the Project footprint and avoid any spills outside of containment areas.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Generation of wastes from construction (building, civil and marine) works	▪ Develop waste management plans for each aspect of construction (dredging and reclamation, marine works, building works and civil works). ▪ Construction waste is not to be disposed to the marine environment at any time. ▪ Construction waste (with the exception of clean fill) is not to be disposed into the terrestrial environment of the port or the reclamation area. As outlined in the NAGD, dredge material is a natural resource that can be beneficially used for reclamation and not a waste. ▪ Specific waste management locations will be identified prior to the commencement of construction and designated collection bins or other appropriate containers will be supplied to facilitate waste segregation. ▪ Use of devices to prevent litter entering the water such as sediment fences and trash racks. ▪ Loose waste and bins will be kept covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through the Project footprint. ▪ The Project footprint will be maintained in a clean and tidy manner and waste will be progressively removed from site and not allowed to stockpile. ▪ The collection and transport of waste from the Project footprint will be by licensed contractors and disposed of at waste disposal facilities licensed for the various waste streams. ▪ Avoid stockpiling concrete during demolition and ensure isolation of concrete from other waste. Concrete to be re-used as fill where possible. ▪ Chemicals and fuels, including empty drums, are to be stored in appropriately bunded areas in accordance with relevant regulations. The volumes of these chemicals/fuels on site are to be kept below limits for notifiable activities or if above these limits, appropriate permits and license are to be obtained.	Contractor / proponent	Pre-construction and construction

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Any unknown or suspected contaminated material will be handled and disposed of in accordance with Project-specific contaminated land management plans and legislative requirements. ▪ Provide self-contained toilets (Portaloo or similar) on site for the duration of construction which will be transported and regularly serviced by a licensed contractor. ▪ Daily inspection and removal of litter from the site and adjacent areas. ▪ In the event of any of waste release into the environment (marine or terrestrial), the incident will be reported following the requirement of the EMP and the relevant incident response plan. Appropriate spill clean-up procedures will be followed.		
Generation of wastes from operations at the ferry terminal and marina	▪ Develop waste management plans for the marina and ferry terminal and include in lease and contract documentation. ▪ Provide a pump out facility for removal of sewage from recreational boats within the marina. ▪ Identify specific waste management locations in the Project footprint during detailed design. Supply designated collection bins or other appropriate containers to facilitate segregation of waste types and encourage waste recycling or re-use. ▪ Keep loose waste and bins covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through Project footprint. ▪ Install educational signage in carparks and other communal areas, explicitly stating the risk to wildlife of disposing of rubbish in the water. ▪ Remove any trade or regulated waste by a licensed trade waste contractor to a licensed reception facility. ▪ Store chemicals and fuels, including empty drums, in appropriately bunded areas in accordance with relevant regulations. ▪ Handle chemical and fuels in accordance with the appropriate material safety data sheets and manufacturer specifications. Transport and store in containers that are fit for purpose. ▪ Handle and dispose of any contaminated material in accordance with legislative requirements.	Operator / contractor	During operations

2.9. Migratory Shorebirds

Desired Outcomes:

- Minimise disturbance of shorebirds outside the project area, in particular at the adjacent roost sites.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Disturbance and loss of habitat as a result of dredging and reclamation	▪ Carry out water quality monitoring in accordance with Chapter 9 of the EIS. ▪ Implement lighting strategy during construction periods as outlined in Chapter 13 of the EIS. ▪ Clearly identify and delineate Project spatial boundaries to minimise physical disturbance of intertidal areas outside the Project footprint. ▪ No access allowed beyond the Project boundary. Use appropriate physical barriers if necessary. ▪ Implement educational programs for all construction workers highlighting the importance of roosting sites and ways shorebirds can be impacted. ▪ Carry out noise monitoring at sensitive areas including high tide roost sites during high noise generating activities such as pile driving. ▪ Activities that have a higher risk of disturbance (noise levels greater than 60 dBA) will be restricted to mid-April to August when fewer migratory shorebirds are present in Moreton Bay unless monitoring shows no birds are present or noise levels are lower than expected. ▪ Use vibration piling to install sheet piling where possible and minimise pile driving. ▪ All construction equipment will be maintained in good working condition and fitted with high performance mufflers in good condition.	Contractor	During construction and operations
Disturbance to roost sites and adjacent habitat from civil, marine and building works	▪ Appropriate barriers will be used and clearly communicated to ensure no access by workers or machinery to intertidal areas outside the Project footprint. ▪ Implement lighting strategy during construction periods as outlined in Chapter 13 of the EIS. ▪ Activities that have a higher risk of disturbance (noise levels greater than 60 dBA) will be restricted to mid-April to August when fewer migratory shorebirds are present in Moreton Bay unless monitoring shows no birds are present or noise levels are lower than expected.	Contractor	During all construction works

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ All construction equipment will be maintained in good working condition and fitted with high performance mufflers in good condition. ▪ Implement stormwater management and treatment in accordance with Chapter 9 of the EIS.		
Disturbance to roost sites during ongoing operations	▪ Implement lighting strategy into detailed design of open space and public areas as outlined in Chapter 13 of the EIS. ▪ Cassim Island will be designated as a sensitive shorebird habitat area with educational signage erected at the boat ramp for non-motorised vessels. Entry of watercraft within the Cassim Island sensitive shorebird habitat area during high tide will be discouraged. ▪ Put in place a barrier fence to prevent access to the rockwall to allow undisturbed use by shorebirds. ▪ Implement stormwater management and treatment in accordance with Chapter 9 of the EIS.	Operator / Contractor	During operations

Dredging and Reclamation

The monitoring program for dredging and reclamation activities will be undertaken for at least 5 years after commencement of works and must be carried out in years when any dredging operations or sheet piling occurs. Monitoring will include:

- Monthly monitoring of potential disturbance and migratory shorebird use of the Cassim Island and Nandeebie Claypan roost sites during high tide during the period September to April inclusive to determine if changes in migratory shorebird use of the roost sites occurs by comparison with the baseline
- Monthly monitoring of migratory shorebird responses to disturbance (from dredging and reclamation activities) at the Cassim Island and Nandeebie Claypan roost sites at high tide and tidal flat feeding habitat adjacent to the Project footprint at low tide during the period September to April inclusive
- Seasonal monitoring of benthic invertebrate community structure and abundance in tidal flat shorebird feeding areas that are adjacent to the Project footprint and within the potential zone of impact of the dredging and reclamation activities, and at comparable control sites outside the zone of influence of dredging and reclamation activities to determine if changes to benthic invertebrate community structure and abundance occurs by comparison with the baseline in a before-after-control-impact (BACI) design
- Monthly monitoring of migratory shorebird use of tidal flats adjacent to the Project footprint within the potential zone of impact of the dredging and reclamation activities and at comparable control sites outside the zone of influence of dredging and reclamation activities to determine if changes to migratory shorebird feeding densities occur by comparison with the baseline in a before-after-control-impact (BACI) design.

Civil, Tidal and Building Works

On completion of the dredging and reclamation program monitoring will continue for another 5-year period to identify any changes in migratory shorebird use as a result of construction activities. Monitoring will include:

- Monthly monitoring of potential disturbance and migratory shorebird use of the Cassim Island and Nandeebie Claypan roost sites during high tide during the period September to April inclusive to determine if changes in migratory shorebird use of the roost sites occurs by comparison with the baseline
- Monthly monitoring of migratory shorebird responses to disturbance (from civil construction activities) at the Cassim Island and Nandeebie Claypan roost sites at high tide and tidal flat feeding habitat adjacent to the Project footprint at low tide during the period September to April inclusive
- Monthly monitoring of migratory shorebird use of tidal flats that are adjacent to the Project footprint and within the potential zone of impact of the civil construction activities, and at comparable control sites outside the zone of influence of civil construction activities to determine if changes to migratory shorebird feeding densities occur by comparison with the baseline in a before-after-control-impact (BACI) design.

Monitoring will cease if results show that works are having no impact on shorebird usage of the roost sites and adjacent mudflats for a period of at least three years.

Ongoing Use and Operations

The monitoring plan during the ongoing use and operations phase should include the following components to monitor the impacts of the Project on migratory shorebirds for two years after the completion of the Project:

- Monthly monitoring of potential disturbance and migratory shorebird use of the Cassim Island, Nandeebie Claypan and Oyster Point roost sites during high tide during the period September to April inclusive to determine if changes in migratory shorebird use of the roost sites occurs by comparison with the baseline
- Monthly monitoring of migratory shorebird responses to disturbance (from ongoing use and operational activities) at the Cassim Island and Nandeebie Claypan roost sites at high tide and tidal flat feeding habitat adjacent to the Project footprint at low tide during the period September to April inclusive, bearing in mind that Nandeebie Claypan is currently abandoned as a roost site

Monthly monitoring of migratory shorebird use of tidal flats that are adjacent to the Project footprint and within the potential zone of impact of the ongoing use and operational activities, and at comparable control sites outside the zone of impact of ongoing use and operational activities during the period September to April inclusive to determine if changes to migratory shorebird feeding densities occur by comparison with the baseline in a before-after-control-impact (BACI) design. Monitoring frequency will be reviewed each year and will cease once it is demonstrated shorebird use has not deviated from baseline conditions.

3. Draft Threatened and Migratory Marine Species Management Plan

3.1. Soils, Sediments, and Contaminated Land

Desired Outcomes:

- Dredging will be managed so that there are no long-term impacts to habitats or fauna outside of the dredge area.
- A site-specific adaptive water quality monitoring program will be developed and implemented in accordance with relevant guidelines such as the NAGD therefore effectiveness is considered high.
- Tailwater will be managed within the bunded reclamation area with minimal releases so that there are no long-term impacts to habitats or fauna outside of the Project footprint.
- ASS will be monitored and managed in accordance with industry guidelines so that there are no short or long-term impacts to habitats or fauna.
- Contaminated land will be managed in accordance with relevant guidelines so as to not impact on any sensitive environmental receptors including Moreton Bay.
- Chemicals and fuels will be stored in accordance with relevant safety data sheets and guidelines, and storage and use will be carried out in accordance with site-specific environmental authorities.

Potential impacts	Management and monitoring measures	Responsibility	Timing
Dredging resulting in the suspension of contaminated sediments into the water column	▪ Implement a water quality monitoring program to monitor dredge plumes and sensitive receptors. Additional management measures will be initiated in response to exceedances of impact criteria (refer to Chapter 9 for more detail on the proposed water quality monitoring program).	Contractor	During dredging
Release of contaminants from dredge material and soft upper sediments within the reclamation area into tailwater	▪ Carry out water quality testing of tailwater regularly to ensure no contaminants are present prior to re-use on site. ▪ If contaminants are present above human health trigger levels use appropriate treatments to remove from the water prior to re-use or transport water from site for disposal in an appropriate facility.	Contractor	During dredging and reclamation
Oxidation of PASS in reclamation and other parts of the Project footprint where excavations occur	▪ Implement an ASS management plan in accordance with relevant State and Federal guidelines including a monitoring program for the dredging and reclamation processes. ▪ Keep sediments saturated during the dredging process until they have been treated for potential acidity and placed within the reclamation area.	Contractor	During dredging and reclamation

Potential impacts	Management and monitoring measures	Responsibility	Timing
	▪ Apply additional treatment as required to dredge material and soft upper sediments within the reclamation area. ▪ Carry out daily inspections of the reclamation area to check for visual signs of oxidation. ▪ Carry out ASS and PASS sampling and analysis in accordance with relevant State and Federal guidelines prior to carrying out any on land works. Apply treatment as required to neutralise acid generating potential. ▪ Conduct an ASS weathering trial to determine rates of reaction and liming requirements for ASS containing sediment.		
Disturbance of existing contaminated land through construction activities adjacent to GJ Walter Park, existing ferry terminals, trade college and dredge sediment pond	▪ Carry out a DSI in accordance with relevant State and Federal guidelines prior to commencing works in areas identified as high or moderate risk by the PSI. ▪ Carry out groundwater monitoring during and post construction to check for changes in water chemistry (refer to Chapter 10 for more detail on the proposed groundwater monitoring program). ▪ Soil investigation to assess fill materials and underlying natural soil within GJ Walter Park, the ferry terminals and dredge sediment pond. Geotechnical assessment of soil in these areas to determine suitability of material to retain on site as part of site development.	Contractor	During construction
Fuel or other chemicals spills to ground or water during the construction process and ongoing uses	▪ Store fuels and chemicals in appropriate areas away from sensitive receptors on site in accordance with relevant standards and guidelines. ▪ Retain appropriate spill response materials on site including booms and absorbent materials. Spill kits are to be kept nearby to any fuel or chemical storage area. ▪ Installation and sampling of additional groundwater bores targeting the southern landfill area and fuel storages.	Contractor	During construction and operations

3.2. Coastal Processes and Dredge Plumes

Desired Outcomes:

- Changes in coastal morphology will not impact on ecological values surrounding the Project footprint, such as shorebird use of the Cassim Island roost site.

Potential impacts	Management and monitoring measures	Responsibility	Timing
Changes to coastal erosion and accretion in areas outside of the Project footprint	▪ Monitor changes in coastal morphology in areas adjacent to the Project. Key areas include potential for sediment build up at the sheltered beach area north of the reclamation and erosion to the northwest of Cassim Island. If significant erosion around Cassim Island occurs, construction of the rockwall breakwater could be brought forward in the development cycle. Measures such as removal or placement of sand would be considered in the unlikely event of significant changes.	Proponent during construction Operator/contractor during operation	During construction and operation

3.3. Surface Water Quality

Desired Outcomes:

- Dredging will be managed so that there are no long-term impacts to water quality.
- No water quality issues within the internal waterways and marina related to poor flushing, such as algae outbreaks.
- Tailwater will be managed within the bunded reclamation area with minimal releases so that there are no long-term impacts to water quality outside of the footprint.
- Stormwater will be managed onsite so that there are no long-term impacts to water quality outside of the footprint.
- Chemicals and fuels will be stored in accordance with relevant safety data sheets and Workplace Health and Safety Queensland's Managing risks of hazardous chemicals in the workplace.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Dredging resulting in the suspension of sediments into the water column	▪ Implement the water quality monitoring program to monitor dredge plumes and sensitive receptors. Where exceedances of monitoring criteria occur dredging activities will be modified. This may include: o Moving the position of the dredge away from the sensitive habitat; o Stopping dredging to allow turbidity levels to drop or currents to reverse; and o Use of or other management measures to reduce turbidity, such as modifying the dredge technique, should the investigation triggers be reached frequently. ▪ Silt curtains to be utilised around the dredge area wherever practicable.	Dredge Contractor	During Dredging
Water quality issues within the marina and internal channels due to poor flushing	▪ Include culverts within the design of the Project linking internal waterways to the marina and Moreton Bay increasing flushing times within the Project footprint.	Proponent / Design Contractor	Detailed Design

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Implement the water quality monitoring program to monitor dredge plumes and sensitive receptors.		
Suspension of sediments from dredge material and soft upper sediments within the reclamation area into tailwater	▪ Carry out water quality testing of tailwater regularly to ensure no contaminants are present prior to re-use on site. ▪ If contaminants are present above human health trigger levels use appropriate treatments to remove from the water prior to re-use or transport water from site for disposal in an appropriate facility. ▪ Use geofabric lining with sheet piling to ensure fine sediment does not move through rockwalls. ▪ Develop a construction erosion and sediment control plan and utilise control devices where appropriate.	Reclamation Contractor	During Reclamation Works
Stormwater runoff during construction and ongoing use reducing water quality in Moreton Bay through increased suspended solids and nutrients	▪ Develop a construction erosion and sediment control plan and utilise control devices where appropriate including regular monitoring of effectiveness. ▪ Implement stormwater management devices into the development in accordance with the conceptual stormwater management plan. ▪ Undertake a minimum of 2 years monitoring of stormwater treatment devices to ensure pollutant loads meet or exceed the predicted outputs.	Civil Contractor	Pre and during Construction
Fuel or other chemicals spills to ground or water during the construction process and ongoing uses	▪ Store fuels and chemicals in appropriate areas away from sensitive receptors on site in accordance with relevant standards and guidelines. ▪ Retain appropriate spill response materials on site including booms and absorbent materials. Spill kits are to be kept nearby to any fuel or chemical storage area.	Civil Contractor	During All Construction
Oxidation of PASS in reclamation and other parts of the Project footprint where excavations occur	▪ Implement an ASS management plan in accordance with relevant State and Federal guidelines including a monitoring program for the dredging and reclamation processes. ▪ Keep sediments saturated during the dredging process until they have been treated for potential acidity and placed within the reclamation area. ▪ Apply additional treatment as required to dredge material and soft upper sediments within the reclamation area. ▪ Carry out daily inspections of the reclamation area to check for visual signs of oxidation. ▪ Carry out ASS and PASS sampling and analysis in accordance with relevant State and Federal guidelines prior to carrying out any on land works. Apply treatment as required to neutralise acid generating potential.	Civil Contractor	During All Construction

Draft Water Quality Monitoring Plan

Potential impacts to water quality and marine ecology will be managed through an overall trigger action response plan (TARP). In this plan key sensitive receptors will be protected by:

- Using baseline data and modelling to develop trigger levels for a suite of parameters that provide an early warning of potential damage;
- Monitoring these parameters; and
- Providing actions in response to these triggers being met.

All monitoring will be in accordance with methods prescribed in the latest edition of the Monitoring and Sampling Manual (Monitoring and Sampling Manual 2009 Environmental Water (Policy) DES 2018), and a project-specific standard operating procedure that addresses the management of data quality and integrity, including effective calibration and maintenance of water quality meters in accordance with their specifications and the Monitoring and Sampling Manual. Samples will be analysed by a NATA accredited laboratory so that data can be compared to the WQOs for Area C2. The results of water quality monitoring will be made publicly available, as close to real time as possible.

Where water quality parameters exceed predefined trigger levels, further investigation will be required. Where investigation indicates that there may be an adverse impact to key sensitive habitats, a management response will be implemented.

Overall impacts from the Project on sentinel key sensitive habitats in the surrounding area will also be monitored. This will include monitoring water quality, benthic photosynthetically active radiation (BPAR), and habitat condition.

Potential Plumes from Dredging and Reclamation

Water quality will be measured up and down current of any active dredging and of any activities from the reclamation works (e.g. construction of bund walls) that may negatively impact water quality[4]. The scope and extent of any plumes from activities will be assessed visually (including the use of drones) throughout the construction phase.

Monitoring sites will include sites up and down-current of dredging and other earthworks activities, as well as sites in nearby sensitive habitats that may be impacted by changes in water quality. As in previous dredge campaigns at Toondah Harbour, to assist in correctly attributing the cause of any changes in turbidity, an up-current control site will be monitored, in addition to down-current sites at set distances from the current dredging activities. As the dredge moves throughout the campaign, and the position on any one day cannot currently be predicted, and as the direction of up and down current changes with the tide, it is not possible to map all possible monitoring locations.

Water quality depth profiles of turbidity, percent saturation of dissolved oxygen and pH will be collected at sites:

- 50 -100 m up-current of activities that result in the disturbance of sediment or water quality;
- ≤350 m down-current of activities; and
- 500 m down-current of activities and continuing every 250 m to the maximum distance of any visible plume.

Water quality depth profiles will be collected:

- Every day for four days at the commencement of each dredge campaign;

[4] Noting that with the current design there are no discharges from the reclamation area, so ambient monitoring during standard reclamation activities would not be required.

- Every day for four days prior to any reclamation activity that would result in a discharge;
- Every day for four days following any exceedance; and
- Once a week throughout standard dredging activity, and any reclamation activity that would result in a discharge.

Further:

- Each time water quality data is collected, GPS coordinates will be recorded for the up-current control site(s), location(s) of the activity, and downstream monitoring point(s);
- Data will be collected in depth profiles, with measurements at 2 m depth intervals where overall depth is >10 m, or 1 m depth intervals where the overall depth is <10 m, with the deepest reading taken at least 1 m above the substrate;
- Water quality measurements will only be collected during tidal flows, and will be at least one hour either side of the slack tide; and
- All monitoring will be of samples that are representative of the effects of the dredging activity.

Background values (BV) will be calculated as the average of the readings collected from depth profiles at the up-current point.

Triggers for investigation will be based on the comparison of BV to the value ≤350 m down-current of activities. The following investigation triggers are nominally recommended:

- Where the BV for turbidity is less than 100 NTU, then the trigger for investigation is defined as 10 NTU or more above the BV; and
- Where the BV is more than 100 NTU, then the trigger for investigation is defined as 10% or more above the BV.

These triggers have been used previously to monitor dredge activities in Toondah Harbour and no apparent impacts to the surrounding marine environment have been identified.

The pH at the monitoring point/s 350 m downstream of activities will also be compared to the prescribed minimum and maximum WQO for Area C2, and to the BV.

When an investigation trigger is reached or exceeded, the likely cause will be investigated and determined. The length of the plume will be recorded, and data will be collected and analysed from the nearby sensitive habitats (refer to Figure 16-11) to determine whether pH complies with the WQO, and whether there is a corresponding peak in turbidity or decrease in BPAR that may be due to the dredge or reclamation activities. Where other current data is available (e.g. data from the EHMP) it will also be used in this assessment.

Where the activities result in a plume that may negatively impact nearby sensitive habitats, management measures (including modifying or ceasing dredging) will be implemented to rectify the issue. Specific measures may include:

- Moving the position of the dredge away from the sensitive habitat;
- Stopping dredging to allow turbidity levels to drop or currents to reverse; and
- Use of or other management measures to reduce turbidity, such as using additional silt curtains or modifying the dredge technique, should the investigation triggers be reached frequently.

Water Quality within the Marina

On connection of the interior waterways to the bay, the site will be inspected daily for visual and olfactory signs of poor water quality, including:

- Floating scums of algae;

- Slicks (oil, chemical);
- Litter;
- Excessive growth of algae; and
- Unpleasant odours.

Water quality will also be monitored monthly for the first twelve months in the areas of the marina with the longest flushing times (i.e. the north-western section of the internal waterway, the central marina, the middle entrance channel and at two background (control) points to the north and south of the Project). Turbidity, pH, conductivity and the percent saturation of dissolved oxygen will be measured in situ in surface water, and 1 m from the bottom. In addition, surface samples will be collected and analysed for the concentration of total nitrogen, oxides of nitrogen, ammonia, oxidised nitrogen, total phosphorus, filterable reactive phosphorus, chlorophyll *a*, and enterococci.

These water quality parameters will also be measured at these sites following two rainfall events each year (nominally > 20 mm within a 24 hour period), and where visual assessment indicates a deterioration in water quality.

Management Trigger: Dissolved Oxygen

After each monitoring event, the percent saturation of dissolved oxygen at each site within the marina will be compared to data from the control sites and to the water quality objectives (WQO).

Where the percent saturation of dissolved oxygen is within WQO (95% to 105%[5]) at the control sites, but is not within the WQO at a site within the marina:

- Monitoring of dissolved oxygen will be increased to daily until levels return to an acceptable level;
- The cause will be investigated by a suitably qualified water quality scientist or engineer; and
- The waterway will be managed to prevent the percent saturation of dissolved oxygen decreasing to less than 85%. Management measures may include aeration, and re-evaluation of stormwater management.

Management Trigger: Nutrients, Chlorophyll a, and Enterococci

The annual median of the monthly concentration of nutrients, chlorophyll *a*, and enterococci from each site within the marina will be compared to the median from the control sites.

Where the median from each site within the marina is higher than the control sites, the medians from the marina will be compared to the WQO.

Indicative triggers for investigation based on this approach, and using background concentrations in Area C2 as a guide for likely median concentrations for the control sites, are presented in *Table 1*.

Table 1: Indicative Triggers for Investigation within the Marina.

Parameter (µg/L)	Modelled Increase*	Median in Area C21	WQO	Trigger for Investigation
Total nitrogen	<7	150	<160	160

[5] Noting that in Area C2, the median of water quality parameters should comply with the WQO, not individual readings. Thus this will be an early alert.

Parameter (µg/L)	Modelled Increase*	Median in Area C21	WQO	Trigger for Investigation
Total phosphorous	<1.3	15	<20	20

[1] 50th percentile of Sites E0309, E0500 and E0501 in Area C2

* indicates differences with respect to existing concentrations

Where a median from within the marina is higher than the median from the control sites and exceeds the WQO, the cause and impacts will be investigated, and where necessary management actions implemented to rectify this (e.g. aeration, re-evaluation of stormwater management) implemented to improve it.

If after 12 months water quality does not comply with the expectations of the models, is significantly poorer than historical water quality, and/ or is poorer than at the control sites, water quality data will continue to be collected each month, until such time as these expectations are met.

If, after twelve months, water quality in the channels and marina complies with the expectation of the models, or is not significantly different to historical data or to water quality at the control sites, water quality data will only be collected after significant rainfall events (i.e. > 20 mm within a 24 hour period) for three years.

If, after twelve months, water quality in the channels and marina complies with the expectation of the models, or is not significantly different to historical data or to water quality at the control sites, water quality data will only be collected after significant rainfall events (i.e. > 20 mm within a 24 hour period) for three years.

Ongoing Use and Operations

After the completion of works comprising the establishment of the development footprint and the completion of dredging, monitoring of the marina will be required to assess any changes in water quality due to runoff and altered hydrodynamics. Water quality will be measured in the marina and ferry port harbour, Fison Channel and two background (control) locations, quarterly over two years for:

- Physico-chemical parameters measured in situ (i.e. dissolved oxygen, pH, salinity and turbidity);
- Nutrients (e.g. total nitrogen, total phosphorous, oxides of nitrogen, organic nitrogen, filtered reactive phosphorous, ammonia);
- Total suspended solids; and
- Chlorophyll *a*.

Where the median concentration of nutrients, chlorophyll *a*, or enterococci is higher than the background (control) conditions and exceeds the WQO, the cause and impacts will be investigated, and where necessary management actions implemented to rectify this.

Monitoring Water Quality and BPAR at Key Habitats

In addition, to determine and manage any adverse impacts to nearby sensitive habitats, turbidity, pH, and benthic photosynthetically active radiation (BPAR) will be monitored at the sites where the ecological condition of key habitat is monitored (Chapter 16 – Marine Ecology; **Error! Reference source not found.**):

- The closest coral communities near Jercuruba (Peel Island)
- The closest coral communities near Coochiemudlo Island
- Coral communities on the north-east edge of the Cassim Island sandbar
- A coral control site east of Wellington Point
- Seagrass bed north of Oyster Point

- Seagrass bed north of the proposed development
- Seagrass control site north of Point Halloran, and a
- Seagrass control site at Wellington Point.

These sites will be surveyed prior to monitoring commencing to ensure they still support these habitats and varied as appropriate if habitat distribution has changed.

Water Quality

Turbidity, conductivity, Secchi depth, temperature and percent saturation of dissolved oxygen in surface waters will be monitored at each site. Each site will be monitored:

- Immediately prior to, and each month during dredging and reclamation activities
- Each quarter for two years once the final development footprint is established.

This data will be assessed together with the results of the marine ecological assessments at each site (Chapter 16 – Marine Ecology). Where there are significant changes to habitats at potentially impacted coral or seagrass habitats but not at the control sites, the reasons for these changes, including changes to water quality, will be investigated, and appropriate management actions applied.

BPAR

A variety of factors, including genetics, temperature, nutrient and sediment conditions may influence light thresholds (Collier *et al*. 2016). Light thresholds for the management of acute impacts have been developed for all the seagrasses species that occur in the MIA, including the dominant species *Zostera muelleri* and *Halophila ovalis* (Collier *et al*. 2016, Pearson *et al*. 2020, *Table 2*). These thresholds are conservative as they are higher than the maximum biological thresholds (Collier *et al*. 2016). Therefore, they provide an early warning of potential impact and an opportunity to investigate and instigate appropriate management actions to prevent impacts.

Table 2: Seagrass Light Thresholds for Species in the MIA.

Species	Classification	Suggested Management Threshold (Mol m^{-2} d^{-1})	Integration Time (days)*	Time to Impact (days)**	Confidence Score+	Application Area
Cymodocea serrulata	opportunistic	5	14	50	4	GBRWHA
Halophila decipiens	colonising	2	1	14	3	GBRWHA
Halophila ovalis^	colonising	2	7	14	3	GBRWHA
Halophila ovalis^	colonising	6	7	28	3	GBRWHA
Halodule uninervis	colonising / opportunistic	5	14	40	3	GBRWHA
Zostera muelleri	colonising / opportunistic	6	14	28	2	GBRWHA

Species	Classification	Suggested Management Threshold (Mol m^{-2} d^{-1})	Integration Time (days)*	Time to Impact (days)**	Confidence Score+	Application Area
Zostera muelleri	colonising / opportunistic	4.5	14	-	-	Gold Coast

*Averaging time used to describe light history and as first signal to trigger management plan

**Time to impact expected and a management plan should be implemented before this time

^Two thresholds are recommended for this species as it occupies diverse habitats (with a broad range in light levels) and is highly sensitive to disturbance. Both levels should be complied with.

+ A confidence score of 2 indicates a relatively high level of confidence, but based on studies from limited locations, 3 indicates somewhat confident, 4 indicates low confidence.

BPAR will be logged at deepest end of the *Z. muelleri* meadow at each of the four seagrass sites for 14 months prior to works commencing, and throughout the dredging and reclamation campaigns. Two autonomous loggers (OdysseyTM or similar) with wiper units to keep sensors clean will be used to measure BPAR at each site. Light will be recorded as instantaneous light (µmol m^{-2} s^{-1}) every 15 – 30 minutes and will be summed to daily light (mol m^{-2} d^{-1}), which integrates daily light exposure (Bryant *et al.* 2014, McKenzie *et al*. 2016). Daily light will then be reported as a rolling average of the previous 14 days.

Seagrass biomass, average leaf length and density will also be measured in five replicate quadrates each month at each site at the deepest edge of the *Z. muelleri* meadow, for 14 months prior to works commencing.

This data will be compared to data from existing studies to determine a conservative threshold to be used in combination with the water quality monitoring to manage dredging and reclamation activities.

The light threshold will be used to supplement the triggers and dredge management. Where BPAR is below the threshold at the potentially impacted sites for 14 days, an investigation of data will be triggered (including water quality, habitat, BPAR, weather and other relevant data) and possible causes identified.

Where investigation indicates the low BPAR is likely due to dredging or reclamation activities, measures (including modifying or ceasing dredging) will be implemented to rectify the issue.

3.4. Groundwater

Desired Outcomes:

- No impacts on marine or terrestrial environments outside of the Project footprint as a result of groundwater drawdown or other changes that may result from the Project.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Dredging and removal of marine sediments facilitating direct	None proposed as only limited and localised changes to groundwater quality, which is currently already dominated by seawater.	Contractor	During dredging

Potential Impacts	Mitigation Measure	Responsibility	Timing
mixing of seawater and groundwater			
Dewatering: changing hydraulic gradients between aquifers/seawater to facilitate mixing	▪ Ongoing monitoring to characterise baseline groundwater level and quality within the Project footprint. ▪ Develop water level and quality 'trigger' levels to inform monitoring criteria and groundwater management during development.	Contractor	During dewatering
Dewatering: inducing contaminant mobilisation from buried landfill	▪ Ongoing monitoring to characterise baseline groundwater level and quality within the Project footprint. ▪ Develop water level and quality 'trigger' levels to inform monitoring criteria and groundwater management during development. ▪ If further investigation identifies significant risk of contamination, evaluate cost benefit of source removal prior to construction or post-construction groundwater treatment options.	Contractor	During dewatering
Reclaimed dredged sediments as potential source of contamination to groundwater	▪ Installation of (temporary) sheet piling wall to restrict groundwater flow to the west. ▪ Construction of new groundwater monitoring bores within reclaimed platform. ▪ Complete additional baseline monitoring prior to construction to characterise baseline groundwater level and quality within the Project footprint. ▪ Develop water level and quality 'trigger' levels to inform monitoring criteria and groundwater management during development. ▪ Dredged PASS will be treated onsite using lime prior to oxidation occurring.	Contractor	During dredging and reclamation
Disturbance of ASS – potentially acidifying groundwater and mobilising metals	▪ Monitoring groundwater quality for changes at TDMB02A, TDMB02B, TDMB05A, TDMB05B. ▪ Construct and monitor new monitoring bores in the reclaimed platform.	Contractor	During dredging and reclamation

Draft Groundwater Monitoring Plan

The EVs for the receiving environment have been described for the Toondah Harbour PDA based on the EPP(Water) for Redland Bay (Department of Environment and Resource Management, 2010). The Project WQOs will be defined, and trigger levels will be developed using the DSITI (2017) guidelines, following further baseline data collection and analysis prior to commencing construction. Ongoing baseline monitoring for water level and quality has been undertaken in the existing monitoring bore network over a bi-monthly period since April 2020. A further eight baseline monitoring rounds are expected to be undertaken.

The proposed strategy for monitoring impacts set out in the Table 3 below has been designed to assess changes that may occur as result of the key impacts summarised in the Groundwater Section of the Draft EIS. The potential for impacts from the activities will be monitored with the groundwater bore network currently constructed for the Project assessment. The following monitoring objectives have been identified based on the key impacts:

- Objective A: Baseline groundwater levels and water quality around the Project and the MBRS;
- Objective B: lowering the groundwater table for other users/GDEs
- Objective C: changes to hydraulic gradients between aquifers/seawater to facilitate mixing
- Objective D: point sources of contamination from the existing landfill
- Objective E: contamination from reclaimed platform material;
- Objective F: acidifying groundwater and contaminant mobilisation due to disturbed PASS; and
- Objective G: groundwater drawdown (mounding) behind containment wall.

Table 3: Analysis Strategy for Project Groundwater Monitoring.

Bore ID	Eastings (z56 m E)	Northings (z56 m S)	Screened geology and logged constituents (weathered products)	Monitoring objective
TDMB01A	528184	6955485	Basalt (weathered)	A, B, C, E, F, G
TDMB01B	528189	6955488	Basalt (fresh rock)	A, B, C, E, F, G
TDMB02A	527792	6955061	Basalt (weathered)	A, B, C, F, G
TDMB02B	527793	6955066	Basalt (weathered)	A, B, C, F, G
TDMB03	527974	6955291	Basalt (weathered)	A, B, C, F, G
TDMB04A	528181	6955359	Quaternary sediments (sand/clay)	A, C, D, F, G
TDMB04B	528178	6955354	Basalt (weathered)	A, C, D, F, G
TDMB05A	528053	6954905	Quaternary sediments (fine sand – sandy clay)	A, B, C, F
TDMB05B	528041	6954905	Basalt (weathered)	A, B, C, F

The parameters to be monitored are provided in Table 4. The suite of parameters has been selected primarily to monitor possible changes in metal concentrations from land disturbance and dredging activities, as well as organic and volatile compounds to assess against machinery or anthropogenic contaminants. Water levels and general parameters will also be monitored to assess general changes in the groundwater system, such as the changes in freshwater seawater interface and flow directions. Once sufficient monitoring data have been collected, a statistical analysis (minimum, maximum, median, mean 5^{th} to 95^{th} percentile, etc) of the baseline dataset will be conducted. The results will be used to understand the natural groundwater variations within the Toondah Harbour PDA to assist in development of trigger values using the DSITI (2017) guidelines. The derived trigger values will be adopted during the construction period as an allowable upper or lower concentration limit prior to triggering management actions or further groundwater investigations.

Existing water quality guideline values (ANZG 2018) and NEPM (2011) will be utilised for site assessment until such time as appropriate site-specific triggers are developed.

Table 4: Groundwater Analysis Suite Description.

Analysis	Description
GP (General parameters)	pH, DO, Temp, EC, TDS, major cations, and anions (Na^+, Ca^{2+}, K^+, Mg^{2+}, Cl^-, SO_4^{2-}, HCO_3^-, CO_3^{2-}) Alkalinity.
Br	Bromide (using HPLC method).
Organic and volatile compounds	BTEX, phenolic compounds, polynuclear aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and total recoverable hydrocarbons (TRH).
Metals	Arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, zinc, aluminium, antimony, barium, beryllium, boron, calcium, cobalt, iron, magnesium, molybdenum, potassium, selenium, silver, strontium, thallium, tin, vanadium.
Nutrients	Ammonia, nitrite, nitrate, total kjeldahl nitrogen, total phosphorus
Other parameters	Fluoride
SWLS	Standing water level data: Time-series groundwater levels. Corrected for barometric pressure effects.

3.5. Air Quality

Desired Outcomes:

- Minimal complaints from surrounding residents about air quality. If complaints occur, they are addressed efficiently.
- No impacts to the surrounding environment, including the MBRS, from dust or other air quality issues.

Potential Impact	Mitigation Measure	Responsibility	Timing
Dust generation from hauling material on and around the site during dredging and reclamation activities	▪ Set a maximum speed limit of 20 km/hr on site on unpaved/unsealed roads ▪ Install a wheel wash and rumble grid at entry points where trucks may pass on and off site. Ensure there is a sealed section of roadway between the wheel wash and exit point ▪ All trucks leaving and entering the site (whether loaded or unloaded) should be covered to ensure dust emissions from trucks are minimised ▪ Bulk materials including cement and/or lime should be delivered in enclosed tankers and stored in suitable containers or covered to prevent escape ▪ Where possible ensure haul roads have a hard surface or are regularly watered to minimise emissions. Frequency of watering to be increased if emissions observed or during dry periods ▪ Carry out regular inspections of haul routes and keep records on site of inspections	All contractors	During dredging and reclamation

Potential Impact	Mitigation Measure	Responsibility	Timing
Dust generation from earthworks within the project footprint during all stages of works	▪ Earthworks near the closest receptors are to be minimised as far as practicable. Controls for sources which may include haul roads and stockpiles will be maximised if located near to receptors ▪ Barriers and/or fencing installed near potential sources of dust (stockpiles) to reduce the risk of dust impacts. Inspect fencing and barriers weekly to ensure they do not build up with particulate matter or are damaged ▪ Cover, seed or fence stockpiles, and revegetate or stabilise exposed areas with environmentally safe dust suppression sprays. Reapply if surface is disturbed or if dust emissions are observed ▪ Use water collected through the sediment dewatering process for dust suppression on reclaimed areas ▪ For exposed areas which will not be actively worked, cover or stabilise the areas with dust suppression agents or hydroseeding	All contractors	During construction
Vehicle and equipment emissions during all stages of works	▪ Ensure any activities from fixed equipment (e.g. screening activities) which operate over an extended period use best practice dust control, which may include enclosing equipment ▪ Avoid the use of diesel generators and rely on mains power where possible ▪ If cutting, grinding or sawing equipment is to be used, ensure dust suppression techniques are used, such as local extraction systems or water sprays ▪ For hardstand or sealed roads, water assisted sweepers and/or dry sweepers should be used to avoid the risk of building of materials which could be re-entrained	All contractors	During construction
Safe material storage during all stages of works	▪ Bins and skips are covered where practicable ▪ Avoid storing materials on site that may lead to additional dust emissions, unless the materials are to be re used on site ▪ Position stockpile areas as far as possible from sensitive receivers ▪ For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust	All contractors	During construction

Draft Air Quality Monitoring Plan

A dust management plan (DMP) will be prepared for the Project including at a minimum:

- On- and off-site inspection methodology for assessing the potential for impact on receptors and roads and to record findings of observations.
- A process for regular inspections of site operations to ensure compliance with the DMP – results of inspections and any follow up actions for areas of concern will be recorded.
- Installation of a real time air quality monitoring station at or near the most likely affected receptor to monitor Total Suspended Particulates and PM_{10}.

The proposed air quality monitoring program for the Project is recommended to consist of:

- Real time measurement methods complying with Australian Standards for TSP and PM_{10}.
- Six impact dust deposition gauges and one background location in line with Australian Standards for measurement of dust fall out.

As the highest risk relates to the Stage 1 activities, it is recommended that the monitoring be performed for at least the duration of the Stage 1 dredging and reclamation works. The requirement for air quality monitoring for Stage 2 should be reviewed based on the monitoring results from Stage 1 which will enable the efficacy of the mitigation measures to be evaluated. The monitoring criteria applicable to the Project is described in Schedule 1 of the *Environmental Protection (Air) Policy 2019* (OQPC, 2019a).

The proposed locations of air quality monitoring equipment for the Project are presented in in Section 11.5.1 of the Draft EIS.

3.6. Terrestrial and Underwater Noise and Vibration

Desired Outcomes:

- No long-term disturbance to marine or terrestrial fauna as a result of high noise generating activities.
- Impacts to ecologically sensitive receptors to be managed by careful programming of noisy works.
- Minimise human disturbance during high noise generating activities.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Ambient and underwater noise generation from installation of sheet piling and rock revetments for reclamation perimeter walls	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. migratory bird breeding season). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours.	All contractors	During sheet piling and rock revetments

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.		
Ambient and underwater noise generation from installation of vertical piles within the harbour area	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. migratory bird breeding season when most of the birds are away from Moreton Bay). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During vertical piling
Ambient noise generation from dredging activities at night	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Ensure the crew is trained and suitably qualified. ▪ Acoustic screens to be deployed around unloading dock. ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During dredging
Ambient noise generation from	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers.	All contractors	During landforming and

Potential Impacts	Mitigation Measure	Responsibility	Timing
reclamation and construction of revetments for the marina and internal channels	▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. during migratory bird breeding season). ▪ Where the high noise level works are projected to occur for several hours provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.		revetment construction

3.7. Lighting

Desired Outcomes:

- No long-term disturbance to marine or terrestrial fauna as a result of lighting.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Short term increases in artificial lighting around the temporary unloading dock and other activities during construction.	▪ Lighting design to adhere to AS 4282 - Control of the obtrusive effects of outdoor lighting and the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds. ▪ Light downwards and not horizontally or vertically. ▪ Avoid excessively bright points of light being directed towards Moreton Bay. ▪ Temporary fencing to be placed around the work compounds where lighting may affect sensitive receptors.	Contractor	During construction
Increase in ambient light from urban areas (building, parkland, etc) and the upgraded ferry terminal including associated retail	▪ Lighting design to be adhere to AS 4282 - Control of the obtrusive effects of outdoor lighting and the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds. ▪ Luminaires selected for street and park lighting are to be dark sky compliant. ▪ Light downwards and not horizontally or vertically.	Contractor and operator	During construction and operation

Potential Impacts	Mitigation Measure	Responsibility	Timing
and commercial uses.	▪ Avoid excessively bright points of light being directed towards Moreton Bay. ▪ Avoid illumination of large vertical surfaces visible from Moreton Bay. ▪ Park and open space planting planning to assist with screening ground level visibility and avoid light spill onto surround areas.		

3.8. Waste Management

Desired Outcomes:

- Avoid impacts to the marine and terrestrial environments within and surrounding the Project footprint from waste during all periods of construction.
- Minimise waste escaping into the marine and terrestrial environments within and surrounding the Project footprint and avoid any spills outside of containment areas.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Generation of wastes from construction (building, civil and marine) works	▪ Develop waste management plans for each aspect of construction (dredging and reclamation, marine works, building works and civil works). ▪ Construction waste is not to be disposed to the marine environment at any time. ▪ Construction waste (with the exception of clean fill) is not to be disposed into the terrestrial environment of the port or the reclamation area. As outlined in the NAGD, dredge material is a natural resource that can be beneficially used for reclamation and not a waste. ▪ Specific waste management locations will be identified prior to the commencement of construction and designated collection bins or other appropriate containers will be supplied to facilitate waste segregation. ▪ Use of devices to prevent litter entering the water such as sediment fences and trash racks. ▪ Loose waste and bins will be kept covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through the Project footprint. ▪ The Project footprint will be maintained in a clean and tidy manner and waste will be progressively removed from site and not allowed to stockpile. ▪ The collection and transport of waste from the Project footprint will be by licensed contractors and disposed of at waste disposal facilities licensed for the various waste streams.	Contractor	At all times during construction

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Avoid stockpiling concrete during demolition and ensure isolation of concrete from other waste. Concrete to be re-used as fill where possible. ▪ Chemicals and fuels, including empty drums, are to be stored in appropriately bunded areas in accordance with relevant regulations. The volumes of these chemicals/fuels on site are to be kept below limits for notifiable activities or, if above these limits, appropriate permits and license are to be obtained. ▪ Any unknown or suspected contaminated material will be handled and disposed of in accordance with Project-specific contaminated land management plans and legislative requirements. ▪ The movement and quantities of wastes and recovered materials on/off site will be recorded in accordance with legislative requirements. ▪ Provide self-contained toilets (Portaloo or similar) on site for the duration of construction which will be transported and regularly serviced by a licensed contractor. ▪ Daily inspection and removal of litter from the site and adjacent areas. ▪ In the event of any of waste release into the environment (marine or terrestrial), the incident will be reported following the requirement of the EMP and the relevant incident response plan. Appropriate spill clean-up procedures will be followed.		
Generation of wastes from operations including residential, commercial and retail uses	▪ Develop waste management plans during detailed design for all open space and recreational areas including the foreshore park and boat ramp for non-motorised recreational vessels. ▪ Identify specific waste management locations in the Project footprint during detailed design. Supply designated collection bins or other appropriate containers to facilitate segregation and encourage waste recycling or re-use. ▪ Keep loose waste and bins covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through the Project footprint. ▪ Install educational signage in parks and other recreational areas, explicitly stating the risk to wildlife of disposing of rubbish in the water. ▪ Collect and dispose of wastes from residential, commercial and retail development in accordance with council requirements and by licensed contractors at licensed waste disposal facilities. ▪ Remove any trade or regulated waste by a licensed trade waste contractor to a licensed reception facility.	Contractor	During operations

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Comply with building standards and codes for urban sewer. Secondary containment of overflow devices to be incorporated in landscaping. ▪ Design commercial sites to incorporate storage bin areas that capture 'fugitive' waste. Lidded bins are appropriate for the waste stream to prevent vermin and wildlife impacts. ▪ Provide appropriate and sufficient containers for litter, including Tangler bins for the disposal of damaged fishing line and tackle at land-based recreational fishing locations within the Project footprint. ▪ Store chemicals and fuels, including empty drums, in appropriately bunded areas in accordance with relevant regulations. ▪ Handle chemical and fuels in accordance with the appropriate material safety data sheets and manufacturer specifications. Transport and store in containers that are fit for purpose. ▪ Handle and dispose of any contaminated material in accordance with legislative requirements.		
Generation of wastes from operations at the ferry terminal and marina	▪ Develop waste management plans for the marina and ferry terminal and include in lease and contract documentation. ▪ Provide a pump out facility for removal of sewage from recreational boats within the marina. ▪ Identify specific waste management locations in the Project footprint during detailed design. Supply designated collection bins or other appropriate containers to facilitate segregation of waste types and encourage waste recycling or re-use. ▪ Keep loose waste and bins covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through the Project footprint. ▪ Install educational signage in carparks and other communal areas, explicitly stating the risk to wildlife of disposing of rubbish in the water. ▪ Remove any trade or regulated waste by a licensed trade waste contractor to a licensed reception facility. ▪ Store chemicals and fuels, including empty drums, in appropriately bunded areas in accordance with relevant regulations. ▪ Handle chemical and fuels in accordance with the appropriate material safety data sheets and manufacturer specifications. Transport and store in containers that are fit for purpose. ▪ Handle and dispose of any contaminated material in accordance with legislative requirements.	Contractor	During operations at the ferry terminal and marina

3.9. Marine Ecology

Desired Outcomes:

- Minimise risk of injury or death of marine fauna as a result of construction activities.
- Avoid indirect impacts to marine habitats and fauna as a result of the Project.
- No marine pests introduced to the area.
- Avoid long term impacts to fauna within the Project footprint.

Potential impacts	Mitigation measure	Responsibility	Timing
Direct impact to marine fauna trapped within the reclamation areas	▪ Install sheet piles, silt curtains or other temporary barriers at low tide to minimise the number of marine vertebrates caught in the area. ▪ Capture fish and crabs within the area confined by the sheet piles, or other temporary barriers and release them outside the area. ▪ Carry out visual observations by trained marine megafauna spotters prior to reclamation bunds being closed, and removal of any marine megafauna by trained operators prior to closure. ▪ Temporarily cease nearby construction activities if a dolphin, dugong or turtle is observed within the area, until the animal moves on or can be removed. ▪ Use mechanical noise and boat activity to deter marine mammals and reptiles from entering an area prior to completion of the installation of sheet piles, silt curtains or other temporary barriers.	Reclamation Contractor	During Reclamation bund construction
Direct injury (i.e. boat strike) during reclamation, dredging and marine works	▪ Mitigation options to reduce the risk of physical contact with marine fauna during dredging and reclamation to follow recommendation in the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (Commonwealth of Australia 2017). ▪ Prior to dredging or reclamation activities that may impact marine fauna commencing after a break of more than two hours, appropriately trained marine fauna observers (MFOs) inspect the work area for 30 minutes. Report any sick or injured marine fauna immediately to appropriate authorities (currently RSPCA QLD on 1300 284625, the designated call centre for QPWS for marine mammal and turtles strandings). ▪ Train all vessel crew in the identification of marine mammals and turtles and instruct them to carry out observations during operations.	Dredging and Reclamation Contractor	All marine works

Potential impacts	Mitigation measure	Responsibility	Timing
	▪ Provide site inductions for all vessel crew, including procedures to minimise disturbance to marine fauna. ▪ If, prior to works, a marine mammal is identified within 150 m, or turtle within 50 m, work does not commence until the animal has passed. ▪ If after works have commenced (including a soft start phase), a marine mammal is observed within 150 m of the noise emitting source, work ceases until the animal has passed. ▪ Speed is limited to 4 km/hour in inshore areas around works sites. ▪ Implement movement restrictions in accordance with the National Guidelines for whale and dolphin watching (Commonwealth of Australia 2017b) ▪ Daily logbooks will be kept of all marine mammal and turtle sightings and interactions, and any management actions taken to avoid damage to them.		
Indirect impacts to marine habitats from turbidity and sedimentation during dredging and reclamation works	▪ Use temporary enclosures (e.g. silt curtains) to reduce the intensity and spatial distribution of dredge plumes. ▪ Monitor changes in seagrass and coral communities post-construction to determine any potential impacts. ▪ Avoid dredging during important periods of reproduction for coral and seagrass (e.g. late spring and summer).	Dredge Contractor	During Dredging
Indirect impacts to marine habitat from noise, dust, PASS and lighting during civil and marine works	▪ Activities that may cause noise damage to marine fauna, such as pile driving, have a 'soft-start', slowly increasing in intensity, to allow animals to move away from the area.	Marine Contractor	Pile driving works
Impacts from litter and waste and fuels and other spills during all construction works	▪ Potential flow or spillage will be prevented from reaching the waterways by use of the ground slope, or the provision of a diversion channel, kerb or bund. ▪ Dispensing pumps or self-closing metal taps will be used where possible to reduce the hazards of spillage. ▪ Any storage tanks and containers will be inspected and maintained regularly. ▪ All personnel handling flammable or combustible liquids will be appropriately trained in accordance with AS1940.	Civil Contractor	Construction
Introduction and spread of marine pest species during all construction works	▪ Ensure appropriate anti fouling used on all vessels. ▪ All vessel crew to be trained in the identification of potential pest species. ▪ All construction vessels to be regularly checked for fouling and cleaned where necessary.	All Contractors	All times

Potential impacts	Mitigation measure	Responsibility	Timing
	▪ Dispose of marine fouling found in an onshore bin.		
Disturbance of marine fauna during operations and ongoing uses	▪ Reducing risk of from boat activity by: o Installing educational signage in the marina, parks and other public areas, explicitly stating the risk to wildlife. o Encouraging recreational and commercial boat operators to install propeller guards to reduce impacts to marine fauna in the case of boat strike. o Supporting public education regarding the impact of vessel strike, and in particular speed on wildlife. o Supporting further go-slow areas in the MBMP to encompass the home ranges of marine turtles and mammals other than dugong (whose main habitat is already protected in go-slow areas).	Proponent	Pre Construction

Draft Marine Ecology Monitoring Plan

During dredging and reclamation works, a water quality and benthic habitat monitoring program will be implemented to ensure impacts to the surrounding environment are minimised. Details of the water quality monitoring program are outlined in Chapter 9, and include monitoring of water quality, litter, odours, excessive growth of algae, floating scums and slicks.

Benthic habitats comprise seagrass, coral and macroalgae communities, that may be impacted due to sedimentation, changes in water quality or altered hydrodynamics.

Benthic habitats will be monitored each month during active dredging at the following locations (**Error! Reference source not found.**):

- The closest coral communities near Jercuruba (Peel Island);
- The closest coral communities near Coochiemudlo Island;
- Coral communities on the north-east edge of the Cassim Island sandbar;
- Seagrass beds north of Oyster Point; and
- At two seagrass control sites, nominally north of Point Halloran and at Wellington Point.

Benthic communities will be assessed using 10 randomly placed 1x1 m quadrats along 100 m transects. Within each quadrat, the following parameters will be recorded:

- Date and time of sampling;
- Water depth;
- Turbidity, conductivity, Secchi depth, temperature and percent saturation of dissolved oxygen in surface waters;
- Presence/absence of benthic communities;
- Species present (including any seagrass, coral and macroalgae);
- Estimated percent cover by species;
- Epiphyte or filamentous algae cover; and
- Evidence of siltation or smothering.

If coral is present, coral health will be monitored using Coral Watch coral health charts. Notes on bleaching or other coral disease (e.g., black band, brown band and white-syndrome disease), if present, will also be recorded. All benthic transects will be fixed with start and end points recorded using a handheld GPS (accurate to ±4 m). A photograph of each quadrat will also be taken using an underwater camera for comparative purposes.

Civil Construction

Benthic habitat will be monitored each quarter during ongoing civil works, using the same methods and sites as the dredge monitoring program. Monitoring frequency could be reduced over time and eventually ceased if results show communities have stabilised.

Ongoing Use and Operations

Once the marine and reclamation works are completed, ongoing monitoring of benthic communities on a quarterly basis for two years is recommended. Benthic communities should use the same methods and sites as the dredge monitoring program.

4. Draft Ramsar Management Plan

4.1. Soils, Sediments, and Contaminated Land

Desired Outcomes:

- Dredging will be managed so that there are no long-term impacts to habitats or fauna outside of the dredge area.
- A site-specific adaptive water quality monitoring program will be developed and implemented in accordance with relevant guidelines such as the NAGD therefore effectiveness is considered high.
- Tailwater will be managed within the bunded reclamation area with minimal releases so that there are no long-term impacts to habitats or fauna outside of the Project footprint.
- ASS will be monitored and managed in accordance with industry guidelines so that there are no short or long-term impacts to habitats or fauna.
- Contaminated land will be managed in accordance with relevant guidelines so as to not impact on any sensitive environmental receptors including Moreton Bay.
- Chemicals and fuels will be stored in accordance with relevant safety data sheets and guidelines, and storage and use will be carried out in accordance with site-specific environmental authorities.

Potential impacts	Management and monitoring measures	Responsibility	Timing
Dredging resulting in the suspension of contaminated sediments into the water column	▪ Implement a water quality monitoring program to monitor dredge plumes and sensitive receptors. Additional management measures will be initiated in response to exceedances of impact criteria (refer to Chapter 9 for more detail on the proposed water quality monitoring program).	Contractor	During dredging
Release of contaminants from dredge material and soft upper sediments within the reclamation area into tailwater	▪ Carry out water quality testing of tailwater regularly to ensure no contaminants are present prior to re-use on site. ▪ If contaminants are present above human health trigger levels use appropriate treatments to remove from the water prior to re-use or transport water from site for disposal in an appropriate facility.	Contractor	During dredging and reclamation
Oxidation of PASS in reclamation and other parts of the Project footprint where excavations occur	▪ Implement an ASS management plan in accordance with relevant State and Federal guidelines including a monitoring program for the dredging and reclamation processes. ▪ Keep sediments saturated during the dredging process until they have been treated for potential acidity and placed within the reclamation area. ▪ Apply additional treatment as required to dredge material and soft upper sediments within the reclamation area.	Contractor	During dredging and reclamation

Potential impacts	Management and monitoring measures	Responsibility	Timing
	▪ Carry out daily inspections of the reclamation area to check for visual signs of oxidation. ▪ Carry out ASS and PASS sampling and analysis in accordance with relevant State and Federal guidelines prior to carrying out any on land works. Apply treatment as required to neutralise acid generating potential. ▪ Conduct an ASS weathering trial to determine rates of reaction and liming requirements for ASS containing sediment.		
Disturbance of existing contaminated land through construction activities adjacent to GJ Walter Park, existing ferry terminals, trade college and dredge sediment pond	▪ Carry out a DSI in accordance with relevant State and Federal guidelines prior to commencing works in areas identified as high or moderate risk by the PSI. ▪ Carry out groundwater monitoring during and post construction to check for changes in water chemistry (refer to Chapter 10 for more detail on the proposed groundwater monitoring program). ▪ Soil investigation to assess fill materials and underlying natural soil within GJ Walter Park, the ferry terminals and dredge sediment pond. Geotechnical assessment of soil in these areas to determine suitability of material to retain on site as part of site development.	Contractor	During disturbance / construction on land
Fuel or other chemicals spills to ground or water during the construction process and ongoing uses	▪ Store fuels and chemicals in appropriate areas away from sensitive receptors on site in accordance with relevant standards and guidelines. ▪ Retain appropriate spill response materials on site including booms and absorbent materials. Spill kits are to be kept nearby to any fuel or chemical storage area. ▪ Installation and sampling of additional groundwater bores targeting the southern landfill area and fuel storages.	Contractor	During construction and operations

4.2. Coastal Processes and Dredge Plumes

Desired Outcomes:

- Changes in coastal morphology will not impact on ecological values surrounding the Project footprint, such as shorebird use of the Cassim Island roost site.

Potential impacts	Management and monitoring measures	Responsibility	Timing
Changes to coastal erosion and accretion in	▪ Monitor changes in coastal morphology in areas adjacent to the Project. Key areas include potential for sediment build up at the sheltered beach area north of the reclamation and	Proponent during construction	During construction and operation

Potential impacts	Management and monitoring measures	Responsibility	Timing
areas outside of the Project footprint	erosion to the northwest of Cassim Island. If significant erosion around Cassim Island occurs, construction of the rockwall breakwater could be brought forward in the development cycle. Measures such as removal or placement of sand would be considered in the unlikely event of significant changes.	Operator/contractor during operation	

4.3. Surface Water Quality

Desired Outcomes:

- Dredging will be managed so that there are no long-term impacts to water quality.
- No water quality issues within the internal waterways and marina related to poor flushing, such as algae outbreaks.
- Tailwater will be managed within the bunded reclamation area with minimal releases so that there are no long-term impacts to water quality outside of the footprint.
- Stormwater will be managed onsite so that there are no long-term impacts to water quality outside of the footprint.
- Chemicals and fuels will be stored in accordance with relevant safety data sheets and Workplace Health and Safety Queensland's Managing risks of hazardous chemicals in the workplace.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Dredging resulting in the suspension of sediments into the water column	▪ Implement the water quality monitoring program to monitor dredge plumes and sensitive receptors. Where exceedances of monitoring criteria occur dredging activities will be modified. This may include: o Moving the position of the dredge away from the sensitive habitat; o Stopping dredging to allow turbidity levels to drop or currents to reverse; and o Use of or other management measures to reduce turbidity, such as modifying the dredge technique, should the investigation triggers be reached frequently. ▪ Silt curtains to be utilised around the dredge area wherever practicable.	Dredge Contractor	During Dredging
Water quality issues within the marina and internal channels due to poor flushing	▪ Include culverts within the design of the Project linking internal waterways to the marina and Moreton Bay increasing flushing times within the Project footprint. ▪ Implement the water quality monitoring program to monitor dredge plumes and sensitive receptors.	Proponent / Design Contractor	Detailed Design

Potential Impacts	Mitigation Measure	Responsibility	Timing
Suspension of sediments from dredge material and soft upper sediments within the reclamation area into tailwater	▪ Carry out water quality testing of tailwater regularly to ensure no contaminants are present prior to re-use on site. ▪ If contaminants are present above human health trigger levels use appropriate treatments to remove from the water prior to re-use or transport water from site for disposal in an appropriate facility. ▪ Use geofabric lining with sheet piling to ensure fine sediment does not move through rockwalls. ▪ Develop a construction erosion and sediment control plan and utilise control devices where appropriate.	Reclamation Contractor	During Reclamation Works
Stormwater runoff during construction and ongoing use reducing water quality in Moreton Bay through increased suspended solids and nutrients	▪ Develop a construction erosion and sediment control plan and utilise control devices where appropriate including regular monitoring of effectiveness. ▪ Implement stormwater management devices into the development in accordance with the conceptual stormwater management plan. ▪ Undertake a minimum of 2 years monitoring of stormwater treatment devices to ensure pollutant loads meet or exceed the predicted outputs.	Civil Contractor	Pre and during Construction
Fuel or other chemicals spills to ground or water during the construction process and ongoing uses	▪ Store fuels and chemicals in appropriate areas away from sensitive receptors on site in accordance with relevant standards and guidelines. ▪ Retain appropriate spill response materials on site including booms and absorbent materials. Spill kits are to be kept nearby to any fuel or chemical storage area.	Civil Contractor	During All Construction
Oxidation of PASS in reclamation and other parts of the Project footprint where excavations occur	▪ Implement an ASS management plan in accordance with relevant State and Federal guidelines including a monitoring program for the dredging and reclamation processes. ▪ Keep sediments saturated during the dredging process until they have been treated for potential acidity and placed within the reclamation area. ▪ Apply additional treatment as required to dredge material and soft upper sediments within the reclamation area. ▪ Carry out daily inspections of the reclamation area to check for visual signs of oxidation. ▪ Carry out ASS and PASS sampling and analysis in accordance with relevant State and Federal guidelines prior to carrying out any on land works. Apply treatment as required to neutralise acid generating potential.	Civil Contractor	During All Construction

Potential impacts to water quality and marine ecology will be managed through an overall trigger action response plan (TARP). In this plan key sensitive receptors will be protected by:

- Using baseline data and modelling to develop trigger levels for a suite of parameters that provide an early warning of potential damage;
- Monitoring these parameters; and
- Providing actions in response to these triggers being met.

All monitoring will be in accordance with methods prescribed in the latest edition of the Monitoring and Sampling Manual (Monitoring and Sampling Manual 2009 Environmental Water (Policy) DES 2018), and a project-specific standard operating procedure that addresses the management of data quality and integrity, including effective calibration and maintenance of water quality meters in accordance with their specifications and the Monitoring and Sampling Manual. Samples will be analysed by a NATA accredited laboratory so that data can be compared to the WQOs for Area C2. The results of water quality monitoring will be made publicly available, as close to real time as possible.

Where water quality parameters exceed predefined trigger levels, further investigation will be required. Where investigation indicates that there may be an adverse impact to key sensitive habitats, a management response will be implemented.

Overall impacts from the Project on sentinel key sensitive habitats in the surrounding area will also be monitored. This will include monitoring water quality, benthic photosynthetically active radiation (BPAR), and habitat condition.

Potential Plumes from Dredging and Reclamation

Water quality will be measured up and down current of any active dredging and of any activities from the reclamation works (e.g. construction of bund walls) that may negatively impact water quality[6]. The scope and extent of any plumes from activities will be assessed visually (including the use of drones) throughout the construction phase.

Monitoring sites will include sites up and down-current of dredging and other earthworks activities, as well as sites in nearby sensitive habitats that may be impacted by changes in water quality. As in previous dredge campaigns at Toondah Harbour, to assist in correctly attributing the cause of any changes in turbidity, an up-current control site will be monitored, in addition to down-current sites at set distances from the current dredging activities. As the dredge moves throughout the campaign, and the position on any one day cannot currently be predicted, and as the direction of up and down current changes with the tide, it is not possible to map all possible monitoring locations.

Water quality depth profiles of turbidity, percent saturation of dissolved oxygen and pH will be collected at sites:

- 50 -100 m up-current of activities that result in the disturbance of sediment or water quality;
- ≤350 m down-current of activities; and
- 500 m down-current of activities and continuing every 250 m to the maximum distance of any visible plume.

Water quality depth profiles will be collected:

- Every day for four days at the commencement of each dredge campaign;

[6] Noting that with the current design there are no discharges from the reclamation area, so ambient monitoring during standard reclamation activities would not be required.

- Every day for four days prior to any reclamation activity that would result in a discharge;
- Every day for four days following any exceedance; and
- Once a week throughout standard dredging activity, and any reclamation activity that would result in a discharge.

Further:

- Each time water quality data is collected, GPS coordinates will be recorded for the up-current control site(s), location(s) of the activity, and downstream monitoring point(s);
- Data will be collected in depth profiles, with measurements at 2 m depth intervals where overall depth is >10 m, or 1 m depth intervals where the overall depth is <10 m, with the deepest reading taken at least 1 m above the substrate;
- Water quality measurements will only be collected during tidal flows, and will be at least one hour either side of the slack tide; and
- All monitoring will be of samples that are representative of the effects of the dredging activity.

Background values (BV) will be calculated as the average of the readings collected from depth profiles at the up-current point.

Triggers for investigation will be based on the comparison of BV to the value ≤350 m down-current of activities. The following investigation triggers are nominally recommended:

- Where the BV for turbidity is less than 100 NTU, then the trigger for investigation is defined as 10 NTU or more above the BV; and
- Where the BV is more than 100 NTU, then the trigger for investigation is defined as 10% or more above the BV.

These triggers have been used previously to monitor dredge activities in Toondah Harbour and no apparent impacts to the surrounding marine environment have been identified.

The pH at the monitoring point/s 350 m downstream of activities will also be compared to the prescribed minimum and maximum WQO for Area C2, and to the BV.

When an investigation trigger is reached or exceeded, the likely cause will be investigated and determined. The length of the plume will be recorded, and data will be collected and analysed from the nearby sensitive habitats (refer to Figure 16-11) to determine whether pH complies with the WQO, and whether there is a corresponding peak in turbidity or decrease in BPAR that may be due to the dredge or reclamation activities. Where other current data is available (e.g. data from the EHMP) it will also be used in this assessment.

Where the activities result in a plume that may negatively impact nearby sensitive habitats, management measures (including modifying or ceasing dredging) will be implemented to rectify the issue. Specific measures may include:

- Moving the position of the dredge away from the sensitive habitat;
- Stopping dredging to allow turbidity levels to drop or currents to reverse; and
- Use of or other management measures to reduce turbidity, such as using additional silt curtains or modifying the dredge technique, should the investigation triggers be reached frequently.

Water Quality within the Marina

On connection of the interior waterways to the bay, the site will be inspected daily for visual and olfactory signs of poor water quality, including:

- Floating scums of algae;

- Slicks (oil, chemical);
- Litter;
- Excessive growth of algae; and
- Unpleasant odours.

Water quality will also be monitored monthly for the first twelve months in the areas of the marina with the longest flushing times (i.e. the north-western section of the internal waterway, the central marina, the middle entrance channel and at two background (control) points to the north and south of the Project). Turbidity, pH, conductivity and the percent saturation of dissolved oxygen will be measured in situ in surface water, and 1 m from the bottom. In addition, surface samples will be collected and analysed for the concentration of total nitrogen, oxides of nitrogen, ammonia, oxidised nitrogen, total phosphorus, filterable reactive phosphorus, chlorophyll *a*, and enterococci.

These water quality parameters will also be measured at these sites following two rainfall events each year (nominally > 20 mm within a 24 hour period), and where visual assessment indicates a deterioration in water quality.

Management Trigger: Dissolved Oxygen

After each monitoring event, the percent saturation of dissolved oxygen at each site within the marina will be compared to data from the control sites and to the water quality objectives (WQO).

Where the percent saturation of dissolved oxygen is within WQO (95% to 105%[7]) at the control sites, but is not within the WQO at a site within the marina:

- Monitoring of dissolved oxygen will be increased to daily until levels return to an acceptable level;
- The cause will be investigated by a suitably qualified water quality scientist or engineer; and
- The waterway will be managed to prevent the percent saturation of dissolved oxygen decreasing to less than 85%. Management measures may include aeration, and re-evaluation of stormwater management.

Management Trigger: Nutrients, Chlorophyll a, and Enterococci

The annual median of the monthly concentration of nutrients, chlorophyll *a*, and enterococci from each site within the marina will be compared to the median from the control sites.

Where the median from each site within the marina is higher than the control sites, the medians from the marina will be compared to the WQO.

Indicative triggers for investigation based on this approach, and using background concentrations in Area C2 as a guide for likely median concentrations for the control sites, are presented in *Table 1*.

Table 1: Indicative Triggers for Investigation within the Marina.

Parameter (µg/L)	Modelled Increase*	Median in Area C21	WQO	Trigger for Investigation
Total nitrogen	<7	150	<160	160

[7] Noting that in Area C2, the median of water quality parameters should comply with the WQO, not individual readings. Thus this will be an early alert.

Parameter (µg/L)	Modelled Increase*	Median in Area C21	WQO	Trigger for Investigation
Total phosphorous	<1.3	15	<20	20

[1] 50th percentile of Sites E0309, E0500 and E0501 in Area C2

* indicates differences with respect to existing concentrations

Where a median from within the marina is higher than the median from the control sites and exceeds the WQO, the cause and impacts will be investigated, and where necessary management actions implemented to rectify this (e.g. aeration, re-evaluation of stormwater management) implemented to improve it.

If after 12 months water quality does not comply with the expectations of the models, is significantly poorer than historical water quality, and/ or is poorer than at the control sites, water quality data will continue to be collected each month, until such time as these expectations are met.

If, after twelve months, water quality in the channels and marina complies with the expectation of the models, or is not significantly different to historical data or to water quality at the control sites, water quality data will only be collected after significant rainfall events (i.e. > 20 mm within a 24 hour period) for three years.

If, after twelve months, water quality in the channels and marina complies with the expectation of the models, or is not significantly different to historical data or to water quality at the control sites, water quality data will only be collected after significant rainfall events (i.e. > 20 mm within a 24 hour period) for three years.

Ongoing Use and Operations

After the completion of works comprising the establishment of the development footprint and the completion of dredging, monitoring of the marina will be required to assess any changes in water quality due to runoff and altered hydrodynamics. Water quality will be measured in the marina and ferry port harbour, Fison Channel and two background (control) locations, quarterly over two years for:

- Physico-chemical parameters measured in situ (i.e. dissolved oxygen, pH, salinity and turbidity);
- Nutrients (e.g. total nitrogen, total phosphorous, oxides of nitrogen, organic nitrogen, filtered reactive phosphorous, ammonia);
- Total suspended solids; and
- Chlorophyll *a*.

Where the median concentration of nutrients, chlorophyll *a*, or enterococci is higher than the background (control) conditions and exceeds the WQO, the cause and impacts will be investigated, and where necessary management actions implemented to rectify this.

Monitoring Water Quality and BPAR at Key Habitats

In addition, to determine and manage any adverse impacts to nearby sensitive habitats, turbidity, pH, and benthic photosynthetically active radiation (BPAR) will be monitored at the sites where the ecological condition of key habitat is monitored (Chapter 16 – Marine Ecology; **Error! Reference source not found.**):

- The closest coral communities near Jercuruba (Peel Island)
- The closest coral communities near Coochiemudlo Island
- Coral communities on the north-east edge of the Cassim Island sandbar
- A coral control site east of Wellington Point
- Seagrass bed north of Oyster Point

- Seagrass bed north of the proposed development
- Seagrass control site north of Point Halloran, and a
- Seagrass control site at Wellington Point.

These sites will be surveyed prior to monitoring commencing to ensure they still support these habitats and varied as appropriate if habitat distribution has changed.

Water Quality

Turbidity, conductivity, Secchi depth, temperature and percent saturation of dissolved oxygen in surface waters will be monitored at each site. Each site will be monitored:

- Immediately prior to, and each month during dredging and reclamation activities
- Each quarter for two years once the final development footprint is established.

This data will be assessed together with the results of the marine ecological assessments at each site (Chapter 16 – Marine Ecology). Where there are significant changes to habitats at potentially impacted coral or seagrass habitats but not at the control sites, the reasons for these changes, including changes to water quality, will be investigated, and appropriate management actions applied.

BPAR

A variety of factors, including genetics, temperature, nutrient and sediment conditions may influence light thresholds (Collier *et al*. 2016). Light thresholds for the management of acute impacts have been developed for all the seagrasses species that occur in the MIA, including the dominant species *Zostera muelleri* and *Halophila ovalis* (Collier *et al*. 2016, Pearson *et al*. 2020, *Table 2*). These thresholds are conservative as they are higher than the maximum biological thresholds (Collier *et al*. 2016). Therefore, they provide an early warning of potential impact and an opportunity to investigate and instigate appropriate management actions to prevent impacts.

Table 2: Seagrass Light Thresholds for Species in the MIA.

Species	Classification	Suggested Management Threshold (Mol m^{-2} d^{-1})	Integration Time (days)*	Time to Impact (days)**	Confidence Score+	Application Area
Cymodocea serrulata	opportunistic	5	14	50	4	GBRWHA
Halophila decipiens	colonising	2	1	14	3	GBRWHA
Halophila ovalis^	colonising	2	7	14	3	GBRWHA
Halophila ovalis^	colonising	6	7	28	3	GBRWHA
Halodule uninervis	colonising / opportunistic	5	14	40	3	GBRWHA
Zostera muelleri	colonising / opportunistic	6	14	28	2	GBRWHA

Species	Classification	Suggested Management Threshold (Mol m^{-2} d^{-1})	Integration Time (days)*	Time to Impact (days)**	Confidence Score+	Application Area
Zostera muelleri	colonising / opportunistic	4.5	14	-	-	Gold Coast

*Averaging time used to describe light history and as first signal to trigger management plan

**Time to impact expected and a management plan should be implemented before this time

^Two thresholds are recommended for this species as it occupies diverse habitats (with a broad range in light levels) and is highly sensitive to disturbance. Both levels should be complied with.

+ A confidence score of 2 indicates a relatively high level of confidence, but based on studies from limited locations, 3 indicates somewhat confident, 4 indicates low confidence.

BPAR will be logged at deepest end of the *Z. muelleri* meadow at each of the four seagrass sites for 14 months prior to works commencing, and throughout the dredging and reclamation campaigns. Two autonomous loggers (OdysseyTM or similar) with wiper units to keep sensors clean will be used to measure BPAR at each site. Light will be recorded as instantaneous light (µmol m^{-2} s^{-1}) every 15 – 30 minutes and will be summed to daily light (mol m^{-2} d^{-1}), which integrates daily light exposure (Bryant *et al.* 2014, McKenzie *et al*. 2016). Daily light will then be reported as a rolling average of the previous 14 days.

Seagrass biomass, average leaf length and density will also be measured in five replicate quadrates each month at each site at the deepest edge of the *Z. muelleri* meadow, for 14 months prior to works commencing.

This data will be compared to data from existing studies to determine a conservative threshold to be used in combination with the water quality monitoring to manage dredging and reclamation activities.

The light threshold will be used to supplement the triggers and dredge management. Where BPAR is below the threshold at the potentially impacted sites for 14 days, an investigation of data will be triggered (including water quality, habitat, BPAR, weather and other relevant data) and possible causes identified.

Where investigation indicates the low BPAR is likely due to dredging or reclamation activities, measures (including modifying or ceasing dredging) will be implemented to rectify the issue.

4.4. Groundwater

Desired Outcomes:

- No impacts on marine or terrestrial environments outside of the Project footprint as a result of groundwater drawdown or other changes that may result from the Project.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Dredging and removal of marine sediments facilitating direct	None proposed as only limited and localised changes to groundwater quality, which is currently already dominated by seawater.	Contractor	During dredging

Potential Impacts	Mitigation Measure	Responsibility	Timing
mixing of seawater and groundwater			
Dewatering: changing hydraulic gradients between aquifers/seawater to facilitate mixing	▪ Ongoing monitoring to characterise baseline groundwater level and quality within the Project footprint. ▪ Develop water level and quality 'trigger' levels to inform monitoring criteria and groundwater management during development.	Contractor	During dewatering
Dewatering: inducing contaminant mobilisation from buried landfill	▪ Ongoing monitoring to characterise baseline groundwater level and quality within the Project footprint. ▪ Develop water level and quality 'trigger' levels to inform monitoring criteria and groundwater management during development. ▪ If further investigation identifies significant risk of contamination, evaluate cost benefit of source removal prior to construction or post-construction groundwater treatment options.	Contractor	During dewatering
Reclaimed dredged sediments as potential source of contamination to groundwater	▪ Installation of (temporary) sheet piling wall to restrict groundwater flow to the west. ▪ Construction of new groundwater monitoring bores within reclaimed platform. ▪ Complete additional baseline monitoring prior to construction to characterise baseline groundwater level and quality within the Project footprint. ▪ Develop water level and quality 'trigger' levels to inform monitoring criteria and groundwater management during development. ▪ Dredged PASS will be treated onsite using lime prior to oxidation occurring.	Contractor	During dredging and reclamation
Disturbance of ASS – potentially acidifying groundwater and mobilising metals	▪ Monitoring groundwater quality for changes at TDMB02A, TDMB02B, TDMB05A, TDMB05B. ▪ Construct and monitor new monitoring bores in the reclaimed platform.	Contractor	During dredging and reclamation

Draft Groundwater Monitoring Plan

The EVs for the receiving environment have been described for the Toondah Harbour PDA based on the EPP(Water) for Redland Bay (Department of Environment and Resource Management, 2010). The Project WQOs will be defined, and trigger levels will be developed using the DSITI (2017) guidelines, following further baseline data collection and analysis prior to commencing construction. Ongoing baseline monitoring for water level and quality has been undertaken in the existing monitoring bore network over a bi-monthly period since April 2020. A further eight baseline monitoring rounds are expected to be undertaken.

The proposed strategy for monitoring impacts set out in the Table 3 below has been designed to assess changes that may occur as result of the key impacts summarised in the Groundwater Section of the Draft EIS. The potential for impacts from the activities will be monitored with the groundwater bore network currently constructed for the Project assessment. The following monitoring objectives have been identified based on the key impacts:

- Objective A: Baseline groundwater levels and water quality around the Project and the MBRS;
- Objective B: lowering the groundwater table for other users/GDEs
- Objective C: changes to hydraulic gradients between aquifers/seawater to facilitate mixing
- Objective D: point sources of contamination from the existing landfill
- Objective E: contamination from reclaimed platform material;
- Objective F: acidifying groundwater and contaminant mobilisation due to disturbed PASS; and
- Objective G: groundwater drawdown (mounding) behind containment wall.

Table 3: Analysis Strategy for Project Groundwater Monitoring.

Bore ID	Eastings (z56 m E)	Northings (z56 m S)	Screened geology and logged constituents (weathered products)	Monitoring objective
TDMB01A	528184	6955485	Basalt (weathered)	A, B, C, E, F, G
TDMB01B	528189	6955488	Basalt (fresh rock)	A, B, C, E, F, G
TDMB02A	527792	6955061	Basalt (weathered)	A, B, C, F, G
TDMB02B	527793	6955066	Basalt (weathered)	A, B, C, F, G
TDMB03	527974	6955291	Basalt (weathered)	A, B, C, F, G
TDMB04A	528181	6955359	Quaternary sediments (sand/clay)	A, C, D, F, G
TDMB04B	528178	6955354	Basalt (weathered)	A, C, D, F, G
TDMB05A	528053	6954905	Quaternary sediments (fine sand – sandy clay)	A, B, C, F
TDMB05B	528041	6954905	Basalt (weathered)	A, B, C, F

The parameters to be monitored are provided in Table 4. The suite of parameters has been selected primarily to monitor possible changes in metal concentrations from land disturbance and dredging activities, as well as organic and volatile compounds to assess against machinery or anthropogenic contaminants. Water levels and general parameters will also be monitored to assess general changes in the groundwater system, such as the changes in freshwater seawater interface and flow directions. Once sufficient monitoring data have been collected, a statistical analysis (minimum, maximum, median, mean 5^{th} to 95^{th} percentile, etc) of the baseline dataset will be conducted. The results will be used to understand the natural groundwater variations within the Toondah Harbour PDA to assist in development of trigger values using the DSITI (2017) guidelines. The derived trigger values will be adopted during the construction period as an allowable upper or lower concentration limit prior to triggering management actions or further groundwater investigations.

Existing water quality guideline values (ANZG 2018) and NEPM (2011) will be utilised for site assessment until such time as appropriate site-specific triggers are developed.

Table 4: Groundwater Analysis Suite Description.

Analysis	Description
GP (General parameters)	pH, DO, Temp, EC, TDS, major cations, and anions (Na^+, Ca^{2+}, K^+, Mg^{2+}, Cl^-, SO_4^{2-}, HCO_3^-, CO_3^{2-}) Alkalinity.
Br	Bromide (using HPLC method).
Organic and volatile compounds	BTEX, phenolic compounds, polynuclear aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and total recoverable hydrocarbons (TRH).
Metals	Arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, zinc, aluminium, antimony, barium, beryllium, boron, calcium, cobalt, iron, magnesium, molybdenum, potassium, selenium, silver, strontium, thallium, tin, vanadium.
Nutrients	Ammonia, nitrite, nitrate, total kjeldahl nitrogen, total phosphorus
Other parameters	Fluoride
SWLS	Standing water level data: Time-series groundwater levels. Corrected for barometric pressure effects.

4.5. Air Quality

Desired Outcomes:

- Minimal complaints from surrounding residents about air quality. If complaints occur, they are addressed efficiently.
- No impacts to the surrounding environment, including the MBRS, from dust or other air quality issues.

Potential Impact	Mitigation Measure	Responsibility	Timing
Dust generation from hauling material on and around the site during dredging and reclamation activities	▪ Set a maximum speed limit of 20 km/hr on site on unpaved/unsealed roads ▪ Install a wheel wash and rumble grid at entry points where trucks may pass on and off site. Ensure there is a sealed section of roadway between the wheel wash and exit point ▪ All trucks leaving and entering the site (whether loaded or unloaded) should be covered to ensure dust emissions from trucks are minimised ▪ Bulk materials including cement and/or lime should be delivered in enclosed tankers and stored in suitable containers or covered to prevent escape ▪ Where possible ensure haul roads have a hard surface or are regularly watered to minimise emissions. Frequency of watering to be increased if emissions observed or during dry periods ▪ Carry out regular inspections of haul routes and keep records on site of inspections	All contractors	During dredging and reclamation

Potential Impact	Mitigation Measure	Responsibility	Timing
Dust generation from earthworks within the project footprint during all stages of works	▪ Earthworks near the closest receptors are to be minimised as far as practicable. Controls for sources which may include haul roads and stockpiles will be maximised if located near to receptors ▪ Barriers and/or fencing installed near potential sources of dust (stockpiles) to reduce the risk of dust impacts. Inspect fencing and barriers weekly to ensure they do not build up with particulate matter or are damaged ▪ Cover, seed or fence stockpiles, and revegetate or stabilise exposed areas with environmentally safe dust suppression sprays. Reapply if surface is disturbed or if dust emissions are observed ▪ Use water collected through the sediment dewatering process for dust suppression on reclaimed areas ▪ For exposed areas which will not be actively worked, cover or stabilise the areas with dust suppression agents or hydroseeding	All contractors	During construction
Vehicle and equipment emissions during all stages of works	▪ Ensure any activities from fixed equipment (e.g. screening activities) which operate over an extended period use best practice dust control, which may include enclosing equipment ▪ Avoid the use of diesel generators and rely on mains power where possible ▪ If cutting, grinding or sawing equipment is to be used, ensure dust suppression techniques are used, such as local extraction systems or water sprays ▪ For hardstand or sealed roads, water assisted sweepers and/or dry sweepers should be used to avoid the risk of building of materials which could be re-entrained	All contractors	During construction
Safe material storage during all stages of works	▪ Bins and skips are covered where practicable ▪ Avoid storing materials on site that may lead to additional dust emissions, unless the materials are to be re used on site ▪ Position stockpile areas as far as possible from sensitive receivers ▪ For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust	All contractors	During construction

Draft Air Quality Monitoring Plan

A dust management plan (DMP) will be prepared for the Project including at a minimum:

- On- and off-site inspection methodology for assessing the potential for impact on receptors and roads and to record findings of observations.
- A process for regular inspections of site operations to ensure compliance with the DMP – results of inspections and any follow up actions for areas of concern will be recorded.
- Installation of a real time air quality monitoring station at or near the most likely affected receptor to monitor Total Suspended Particulates and PM_{10}.

The proposed air quality monitoring program for the Project is recommended to consist of:

- Real time measurement methods complying with Australian Standards for TSP and PM_{10}.
- Six impact dust deposition gauges and one background location in line with Australian Standards for measurement of dust fall out.

As the highest risk relates to Stage 1 activities, it is recommended that the monitoring be performed for at least the duration of the Stage 1 dredging and reclamation works. The requirement for air quality monitoring for Stage 2 should be reviewed and based on the monitoring results from Stage 1 which will enable the efficacy of the mitigation measures to be evaluated. The monitoring criteria applicable to the Project is described in Schedule 1 of the *Environmental Protection (Air) Policy 2019* (OQPC, 2019a).

The proposed locations of air quality monitoring equipment for the Project are presented in in Section 11.5.1 of the Draft EIS.

4.6. Terrestrial and Underwater Noise and Vibration

Desired Outcomes:

- No long-term disturbance to marine or terrestrial fauna as a result of high noise generating activities.
- Impacts to ecologically sensitive receptors to be managed by careful programming of noisy works.
- Minimise human disturbance during high noise generating activities.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Ambient and underwater noise generation from installation of sheet piling and rock revetments for reclamation perimeter walls	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. migratory bird breeding season). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works.	All contractors	During sheetpiling and rock revetments

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.		
Ambient and underwater noise generation from installation of vertical piles within the harbour area	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. migratory bird breeding season when most of the birds are away from Moreton Bay). ▪ Where the high noise level works are projected to occur for several hours, provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During vertical piling
Ambient noise generation from dredging activities at night	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers. ▪ Ensure the crew is trained and suitably qualified. ▪ Acoustic screens to be deployed around unloading dock. ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.	All contractors	During dredging
Ambient noise generation from reclamation and construction of	▪ Ensure all equipment used is maintained in good working condition and fitted with high performance mufflers.	All contractors	During landforming and revetment construction

Potential Impacts	Mitigation Measure	Responsibility	Timing
revetments for the marina and internal channels	▪ Increase intensity of high noise activities (i.e. multiple piling units) when low risk to environmental receptors (i.e. during migratory bird breeding season). ▪ Where the high noise level works are projected to occur for several hours provide a two-hour respite period every four hours. ▪ Ensure the crew is trained and suitably qualified to carry out piling works. ▪ Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. ▪ Acoustic screens to be deployed close to any high noise activity or sensitive receptor as required ▪ Carry out monitoring and management measures for marine fauna (Chapter 16) and migratory shorebirds (Chapter 17). This will include ongoing monitoring for fauna and ecologically sensitive locations and modifying works in real time to minimise disturbance.		

4.7. Lighting

Desired Outcomes:

- No long-term disturbance to marine or terrestrial fauna as a result of lighting.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Short term increases in artificial lighting around the temporary unloading dock and other activities during construction.	▪ Lighting design to adhere to AS 4282 - Control of the obtrusive effects of outdoor lighting and the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds. ▪ Light downwards and not horizontally or vertically. ▪ Avoid excessively bright points of light being directed towards Moreton Bay. ▪ Temporary fencing to be placed around the work compounds where lighting may affect sensitive receptors.	Contractor	During construction
Increase in ambient light from urban areas (building, parkland, etc) and the upgraded ferry terminal including associated retail	▪ Lighting design to be adhere to AS 4282 - Control of the obtrusive effects of outdoor lighting and the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds. ▪ Luminaires selected for street and park lighting are to be dark sky compliant. ▪ Light downwards and not horizontally or vertically.	Contractor and operator	During construction and operation

Potential Impacts	Mitigation Measure	Responsibility	Timing
and commercial uses.	▪ Avoid excessively bright points of light being directed towards Moreton Bay. ▪ Avoid illumination of large vertical surfaces visible from Moreton Bay. ▪ Park and open space planting planning to assist with screening ground level visibility and avoid light spill onto surround areas.		

4.8. Waste Management

Desired Outcomes:

- Avoid impacts to the marine and terrestrial environments within and surrounding the Project footprint from waste during all periods of construction.
- Minimise waste escaping into the marine and terrestrial environments within and surrounding the Project footprint and avoid any spills outside of containment areas.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Generation of wastes from construction (building, civil and marine) works	▪ Develop waste management plans for each aspect of construction (dredging and reclamation, marine works, building works and civil works). ▪ Construction waste is not to be disposed to the marine environment at any time. ▪ Construction waste (with the exception of clean fill) is not to be disposed into the terrestrial environment of the port or the reclamation area. As outlined in the NAGD, dredge material is a natural resource that can be beneficially used for reclamation and not a waste. ▪ Specific waste management locations will be identified prior to the commencement of construction and designated collection bins or other appropriate containers will be supplied to facilitate waste segregation. ▪ Use of devices to prevent litter entering the water such as sediment fences and trash racks. ▪ Materials recycling or re-use on site will be encouraged. ▪ Loose waste and bins will be kept covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through the Project footprint. ▪ The Project footprint will be maintained in a clean and tidy manner and waste will be progressively removed from site and not allowed to stockpile.	Contractor	At all times during construction

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ The collection and transport of waste from the Project footprint will be by licensed contractors and disposed of at waste disposal facilities licensed for the various waste streams. ▪ Avoid stockpiling concrete during demolition and ensure isolation of concrete from other waste. Concrete to be re-used as fill where possible. ▪ Demolition timber to be separated on site and recycled where possible. ▪ A complete inventory, including material safety data sheets, of chemicals to be used on site will be developed and maintained. ▪ Store chemicals and fuels, including empty drums, in appropriately bunded areas in accordance with relevant regulations. The volumes of these chemicals/fuels on site are to be kept below limits for notifiable activities or if above these limits, appropriate permits and license are to be obtained. ▪ Any unknown or suspected contaminated material will be handled and disposed of in accordance with Project-specific contaminated land management plans and legislative requirements. ▪ The movement and quantities of wastes and recovered materials on/off site will be recorded in accordance with legislative requirements. ▪ Provide self-contained toilets (Portaloo or similar) on site for the duration of construction which will be transported and regularly serviced by a licensed contractor. ▪ Daily inspection and removal of litter from the site and adjacent areas. ▪ In the event of any of waste release into the environment (marine or terrestrial), the incident will be reported following the requirement of the EMP and the relevant incident response plan. Appropriate spill clean-up procedures will be followed.		
Generation of wastes from operations including residential, commercial and retail uses	▪ Develop waste management plans during detailed design for all open space and recreational areas including the foreshore park and boat ramp for non-motorised recreational vessels. ▪ Identify specific waste management locations in the Project footprint during detailed design. Supply designated collection bins or other appropriate containers to facilitate segregation and encourage waste recycling or re-use. ▪ Keep loose waste and bins covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through Project footprint.	Contractor	During operations

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Install educational signage in parks and other recreational areas, explicitly stating the risk to wildlife of disposing of rubbish in the water. ▪ Collect and dispose of wastes from residential, commercial and retail development in accordance with council requirements and by licensed contractors at licensed waste disposal facilities. ▪ Remove any trade or regulated waste by a licensed trade waste contractor to a licensed reception facility. ▪ Comply with building standards and codes for urban sewer. Secondary containment of overflow devices to be incorporated in landscaping. ▪ Design commercial sites to incorporate storage bin areas that capture 'fugitive' waste. Lidded bins are appropriate for the waste stream to prevent vermin and wildlife impacts. ▪ Provide appropriate and sufficient containers for litter, including Tangler bins for the disposal of damaged fishing line and tackle at land-based recreational fishing locations within the Project footprint. ▪ Store chemicals and fuels, including empty drums, in appropriately bunded areas in accordance with relevant regulations. ▪ Handle chemical and fuels in accordance with the appropriate material safety data sheets and manufacturer specifications. Transport and store in containers that are fit for purpose. ▪ Handle and dispose of any contaminated material in accordance with legislative requirements.		
Generation of wastes from operations at the ferry terminal and marina	▪ Develop waste management plans for the marina and ferry terminal and include in lease and contract documentation. ▪ Provide a pump out facility for removal of sewage from recreational boats within the marina. ▪ Identify specific waste management locations in the Project footprint during detailed design. Supply designated collection bins or other appropriate containers to facilitate segregation of waste types and encourage waste recycling or re-use. ▪ Keep loose waste and bins covered to secure waste to prevent wind, rain or animals spreading litter or contaminants through the Project footprint. ▪ Install educational signage in carparks and other communal areas, explicitly stating the risk to wildlife of disposing of rubbish in the water. ▪ Remove any trade or regulated waste by a licensed trade waste contractor to a licensed reception facility.	Contractor	During operations at the ferry terminal and marina

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ Store chemicals and fuels, including empty drums, in appropriately bunded areas in accordance with relevant regulations. ▪ Handle chemical and fuels in accordance with the appropriate material safety data sheets and manufacturer specifications. Transport and store in containers that are fit for purpose. ▪ Handle and dispose of any contaminated material in accordance with legislative requirements.		

4.9. Migratory Shorebirds

Desired Outcomes:

- Minimise disturbance of shorebirds outside the project area, in particular at the adjacent roost sites.

Potential Impacts	Mitigation Measure	Responsibility	Timing
Disturbance and loss of habitat as a result of dredging and reclamation	▪ Carry out water quality monitoring in accordance with Chapter 9 of the EIS. ▪ Implement lighting strategy during construction periods as outlined in Chapter 13 of the EIS. ▪ Clearly identify and delineate Project spatial boundaries to minimise physical disturbance of intertidal areas outside the Project footprint. ▪ No access allowed beyond the Project boundary. Use appropriate physical barriers if necessary. ▪ Implement educational programs for all construction workers highlighting the importance of roosting sites and ways shorebirds can be impacted. ▪ Carry out noise monitoring at sensitive areas including high tide roost sites during high noise generating activities such as pile driving. ▪ Activities that have a higher risk of disturbance (noise levels greater than 60 dBA) will be restricted to mid-April to August when fewer migratory shorebirds are present in Moreton Bay unless monitoring shows no birds are present or noise levels are lower than expected. ▪ Use vibration piling to install sheet piling where possible and minimise pile driving.	Contractor	During construction and operations

Potential Impacts	Mitigation Measure	Responsibility	Timing
	▪ All construction equipment will be maintained in good working condition and fitted with high performance mufflers in good condition.		
Disturbance to roost sites and adjacent habitat from civil, marine and building works	▪ Appropriate barriers will be used and clearly communicated to ensure no access by workers or machinery to intertidal areas outside the Project footprint. ▪ Implement lighting strategy during construction periods as outlined in Chapter 13 of the EIS. ▪ Activities that have a higher risk of disturbance (noise levels greater than 60 dBA) will be restricted to mid-April to August when fewer migratory shorebirds are present in Moreton Bay unless monitoring shows no birds are present or noise levels are lower than expected. ▪ All construction equipment will be maintained in good working condition and fitted with high performance mufflers in good condition. ▪ Implement stormwater management and treatment in accordance with Chapter 9 of the EIS.	Contractor	During all construction works
Disturbance to roost sites during ongoing operations	▪ Implement lighting strategy into detailed design of open space and public areas as outlined in Chapter 13 of the EIS. ▪ Cassim Island will be designated as a sensitive shorebird habitat area with educational signage erected at the boat ramp for non-motorised vessels. Entry of watercraft within the Cassim Island sensitive shorebird habitat area during high tide will be discouraged. ▪ Put in place a barrier fence to prevent access to the rockwall to allow undisturbed use by shorebirds. ▪ Implement stormwater management and treatment in accordance with Chapter 9 of the EIS.	Operator / Contractor	During operations

Draft Shorebird Monitoring Plan

Dredging and Reclamation

The monitoring program for dredging and reclamation activities will be undertaken for at least 5 years after commencement of works and must be carried out in years when any dredging operations or sheet piling occurs. Monitoring will include:

- Monthly monitoring of potential disturbance and migratory shorebird use of the Cassim Island and Nandeebie Claypan roost sites during high tide during the period September to April inclusive to determine if changes in migratory shorebird use of the roost sites occurs by comparison with the baseline
- Monthly monitoring of migratory shorebird responses to disturbance (from dredging and reclamation activities) at the Cassim Island and Nandeebie Claypan roost sites at high tide and tidal flat feeding habitat adjacent to the Project footprint at low tide during the period September to April inclusive

- Seasonal monitoring of benthic invertebrate community structure and abundance in tidal flat shorebird feeding areas that are adjacent to the Project footprint and within the potential zone of impact of the dredging and reclamation activities, and at comparable control sites outside the zone of influence of dredging and reclamation activities to determine if changes to benthic invertebrate community structure and abundance occurs by comparison with the baseline in a before-after-control-impact (BACI) design
- Monthly monitoring of migratory shorebird use of tidal flats adjacent to the Project footprint within the potential zone of impact of the dredging and reclamation activities and at comparable control sites outside the zone of influence of dredging and reclamation activities to determine if changes to migratory shorebird feeding densities occur by comparison with the baseline in a before-after-control-impact (BACI) design.

Civil, Tidal and Building Works

On completion of the dredging and reclamation program monitoring will continue for another 5-year period to identify any changes in migratory shorebird use as a result of construction activities. Monitoring will include:

- Monthly monitoring of potential disturbance and migratory shorebird use of the Cassim Island and Nandeebie Claypan roost sites during high tide during the period September to April inclusive to determine if changes in migratory shorebird use of the roost sites occurs by comparison with the baseline
- Monthly monitoring of migratory shorebird responses to disturbance (from civil construction activities) at the Cassim Island and Nandeebie Claypan roost sites at high tide and tidal flat feeding habitat adjacent to the Project footprint at low tide during the period September to April inclusive
- Monthly monitoring of migratory shorebird use of tidal flats that are adjacent to the Project footprint and within the potential zone of impact of the civil construction activities, and at comparable control sites outside the zone of influence of civil construction activities to determine if changes to migratory shorebird feeding densities occur by comparison with the baseline in a before-after-control-impact (BACI) design.

Monitoring will cease if results show that works are having no impact on shorebird usage of the roost sites and adjacent mudflats for a period of at least three years.

Ongoing Use and Operations

The monitoring plan during the ongoing use and operations phase should include the following components to monitor the impacts of the Project on migratory shorebirds for two years after the completion of the Project:

- Monthly monitoring of potential disturbance and migratory shorebird use of the Cassim Island, Nandeebie Claypan and Oyster Point roost sites during high tide during the period September to April inclusive to determine if changes in migratory shorebird use of the roost sites occurs by comparison with the baseline
- Monthly monitoring of migratory shorebird responses to disturbance (from ongoing use and operational activities) at the Cassim Island and Nandeebie Claypan roost sites at high tide and tidal flat feeding habitat adjacent to the Project footprint at low tide during the period September to April inclusive, bearing in mind that Nandeebie Claypan is currently abandoned as a roost site

Monthly monitoring of migratory shorebird use of tidal flats that are adjacent to the Project footprint and within the potential zone of impact of the ongoing use and operational activities, and at comparable control sites outside the zone of impact of ongoing use and operational activities during the period September to April inclusive to determine if changes to migratory shorebird feeding densities occur by comparison with the baseline in a before-after-control-impact (BACI) design. Monitoring frequency will be reviewed each year and will cease once it is demonstrated shorebird use has not deviated from baseline conditions.

4.10. Marine Ecology

Desired Outcomes:

- Minimise risk of injury or death of marine fauna as a result of construction activities.
- Avoid indirect impacts to marine habitats and fauna as a result of the Project.
- No marine pests introduced to the area.
- Avoid long term impacts to fauna within the Project footprint.

Potential impacts	Mitigation measure	Responsibility	Timing
Direct impact to marine fauna trapped within the reclamation areas	▪ Install sheet piles, silt curtains or other temporary barriers at low tide to minimise the number of marine vertebrates caught in the area. ▪ Capture fish and crabs within the area confined by the sheet piles, or other temporary barriers and release them outside the area. ▪ Carry out visual observations by trained marine megafauna spotters prior to reclamation bunds being closed, and removal of any marine megafauna by trained operators prior to closure. ▪ Temporarily cease nearby construction activities if a dolphin, dugong or turtle is observed within the area, until the animal moves on or can be removed. ▪ Use mechanical noise and boat activity to deter marine mammals and reptiles from entering an area prior to completion of the installation of sheet piles, silt curtains or other temporary barriers.	Reclamation Contractor	During Reclamation bund construction
Direct injury (i.e. boat strike) during reclamation, dredging and marine works	▪ Mitigation options to reduce the risk of physical contact with marine fauna during dredging and reclamation to follow recommendation in the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (Commonwealth of Australia 2017). ▪ Prior to dredging or reclamation activities that may impact marine fauna commencing after a break of more than two hours, appropriately trained marine fauna observers (MFOs) inspect the work area for 30 minutes. Report any sick or injured marine fauna immediately to appropriate authorities (currently RSPCA QLD on 1300 284625, the designated call centre for QPWS for marine mammal and turtles strandings). ▪ Train all vessel crew in the identification of marine mammals and turtles and instruct them to carry out observations during operations.	Dredging and Reclamation Contractor	All marine works

Potential impacts	Mitigation measure	Responsibility	Timing
	▪ Provide site inductions for all vessel crew, including procedures to minimise disturbance to marine fauna. ▪ If, prior to works, a marine mammal is identified within 150 m, or turtle within 50 m, work does not commence until the animal has passed. ▪ If after works have commenced (including a soft start phase), a marine mammal is observed within 150 m of the noise emitting source, work ceases until the animal has passed. ▪ Speed is limited to 4 km/hour in inshore areas around works sites. ▪ Implement movement restrictions in accordance with the National Guidelines for whale and dolphin watching (Commonwealth of Australia 2017b) ▪ Daily logbooks will be kept of all marine mammal and turtle sightings and interactions, and any management actions taken to avoid damage to them.		
Indirect impacts to marine habitats from turbidity and sedimentation during dredging and reclamation works	▪ Use temporary enclosures (e.g. silt curtains) to reduce the intensity and spatial distribution of dredge plumes. ▪ Monitor changes in seagrass and coral communities post-construction to determine any potential impacts. ▪ Avoid dredging during important periods of reproduction for coral and seagrass (e.g. late spring and summer).	Dredge Contractor	During Dredging
Indirect impacts to marine habitat from noise, dust, PASS and lighting during civil and marine works	▪ Activities that may cause noise damage to marine fauna, such as pile driving, have a 'soft-start', slowly increasing in intensity, to allow animals to move away from the area.	Marine Contractor	Pile driving works
Impacts from litter and waste and fuels and other spills during all construction works	▪ Potential flow or spillage will be prevented from reaching the waterways by use of the ground slope, or the provision of a diversion channel, kerb or bund. ▪ Dispensing pumps or self-closing metal taps will be used where possible to reduce the hazards of spillage. ▪ Any storage tanks and containers will be inspected and maintained regularly. ▪ All personnel handling flammable or combustible liquids will be appropriately trained in accordance with AS1940.	Civil Contractor	Construction
Introduction and spread of marine pest species during all construction works	▪ Ensure appropriate anti fouling used on all vessels. ▪ All vessel crew to be trained in the identification of potential pest species. ▪ All construction vessels to be regularly checked for fouling and cleaned where necessary.	All Contractors	All times

Potential impacts	Mitigation measure	Responsibility	Timing
	▪ Dispose of marine fouling found in an onshore bin.		
Disturbance of marine fauna during operations and ongoing uses	▪ Reducing risk of from boat activity by: o Installing educational signage in the marina, parks and other public areas, explicitly stating the risk to wildlife. o Encouraging recreational and commercial boat operators to install propeller guards to reduce impacts to marine fauna in the case of boat strike. o Supporting public education regarding the impact of vessel strike, and in particular speed on wildlife. o Supporting further go-slow areas in the MBMP to encompass the home ranges of marine turtles and mammals other than dugong (whose main habitat is already protected in go-slow areas).	Proponent	Pre Construction

Draft Marine Ecology Monitoring Plan

During dredging and reclamation works, a water quality and benthic habitat monitoring program will be implemented to ensure impacts to the surrounding environment are minimised. Details of the water quality monitoring program are outlined in Chapter 9, and include monitoring of water quality, litter, odours, excessive growth of algae, floating scums and slicks.

Benthic habitats comprise seagrass, coral and macroalgae communities, that may be impacted due to sedimentation, changes in water quality or altered hydrodynamics.

Benthic habitats will be monitored each month during active dredging at the following locations (Figure 16-11):

- The closest coral communities near Jercuruba (Peel Island);
- The closest coral communities near Coochiemudlo Island;
- Coral communities on the north-east edge of the Cassim Island sandbar;
- Seagrass beds north of Oyster Point; and
- At two seagrass control sites, nominally north of Point Halloran and at Wellington Point.

Benthic communities will be assessed using 10 randomly placed 1x1 m quadrats along 100 m transects. Within each quadrat, the following parameters will be recorded:

- Date and time of sampling;
- Water depth;
- Turbidity, conductivity, Secchi depth, temperature and percent saturation of dissolved oxygen in surface waters;
- Presence/absence of benthic communities;
- Species present (including any seagrass, coral and macroalgae);
- Estimated percent cover by species;
- Epiphyte or filamentous algae cover; and
- Evidence of siltation or smothering.

If coral is present, coral health will be monitored using Coral Watch coral health charts. Notes on bleaching or other coral disease (e.g., black band, brown band and white-syndrome disease), if present, will also be recorded. All benthic transects will be fixed with start and end points recorded using a handheld GPS (accurate to ±4 m). A photograph of each quadrat will also be taken using an underwater camera for comparative purposes.

Civil Construction

Benthic habitat will be monitored each quarter during ongoing civil works, using the same methods and sites as the dredge monitoring program. Monitoring frequency could be reduced over time and eventually ceased if results show communities have stabilised.

Ongoing Use and Operations

Once the marine and reclamation works are completed, ongoing monitoring of benthic communities on a quarterly basis for two years is recommended. Benthic communities should use the same methods and sites as the dredge monitoring program.