walker

TOONDAH HARBOUR

EPBC ACT DRAFT ENVIRONMENTAL IMPACT STATEMENT

EXECUTIVE SUMMARY

saunders havill group

Executive Summary

Project Details

Location and Background

Toondah Harbour is an existing marine facility located in the suburb of Cleveland in the Redland City Local Government Area (LGA), approximately 30 kilometres (km) south of Brisbane. It serves as the base for water taxi, passenger and vehicle ferry services between the mainland and North Stradbroke Island, known as Minjerribah by its Traditional Custodians, the Quandamooka People. Current terrestrial land uses within the harbour area include multiple ferry terminals, a public boat ramp, extensive areas of surface car parking for ferry customers, an office complex temporarily leased by a trade college, and a disused dredge material disposal pond. GJ Walter Park is located immediate north of the harbour area and includes a dog park and cricket oval. The overwater areas of the harbour are made up of a mix of tidal and intertidal habitats, and include existing wet berths, the turning basin and the harbour approach channel, known as Fison Channel. Site locality and existing features are shown on Figure ES-1 and Figure ES-2.

The harbour was constructed on reclaimed land and has been operational since 1972 when it was used as an industrial barge terminal to support sand mining operations on Minjerribah (North Stradbroke Island). Vehicle ferry services commenced in 1974. The most recent landside upgrades occurred in the early 2000s when additional hardstand car parking and the public boat ramp were added. The harbour is not located in naturally deep water therefore periodic maintenance dredging is required to maintain navigable depths in the turning basin and Fison Channel.

In June 2013, at the request of Redland City Council (RCC), the Queensland Government declared Toondah Harbour a priority development area (PDA) under the *Economic Development Act 2012* (Qld) (ED Act). PDAs are parcels of land within Queensland identified for accelerated development to deliver significant benefits to the community. The intent of the PDA is to revitalise the harbour, improve the transport function by better integrating ferry and bus services and managing car parking, and establish Toondah Harbour as a high-quality urban environment.

The Toondah Harbour PDA has a total area of 67.4 hectares (ha), encompassing 17.9 ha of existing land and 49.5 ha of marine and tidal environments. Approximately 42 ha of the marine and tidal environments within the PDA are also included in the boundaries of the Moreton Bay Ramsar Site (MBRS). A Ramsar site is a wetland designated to be of international importance under the Ramsar Convention. In designating a wetland as a Ramsar site, countries agree to establish and oversee a management framework aimed at conserving the wetland and ensuring its wise use.

The proposed redevelopment of Toondah Harbour is not a market led proposal – it did not originate from the private sector or from the Proponent specifically.

In June 2014, Economic Development Queensland (EDQ) and RCC called for expressions of interest (EOI) from the private sector to redevelop public lands in the Toondah Harbour PDA. In September 2015, Walker Group Holdings Pty Ltd (the Proponent) was announced as the preferred development partner. In 2015/16, the Minister for Economic Development Queensland (MEDQ), RCC, Redland Investment Corporation and the Proponent entered into binding commercial agreements for the Project, including a development agreement and an infrastructure agreement. Under the development agreement, the Proponent is responsible for designing, financing and delivering the Project, including obtaining environmental and development approvals.

The Project is a standalone project – not linked to any other action and tied to specific public landholdings – that provides for the delivery of the specified infrastructure and public realm requirements as part of a single integrated proposal.

Figure ES-1: Project Location

Legend

Project location

Moreton Bay Ramsar site

Toondah Harbour EIS

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N

0 10 20 30 km

GDA 1994 MGA zone 56

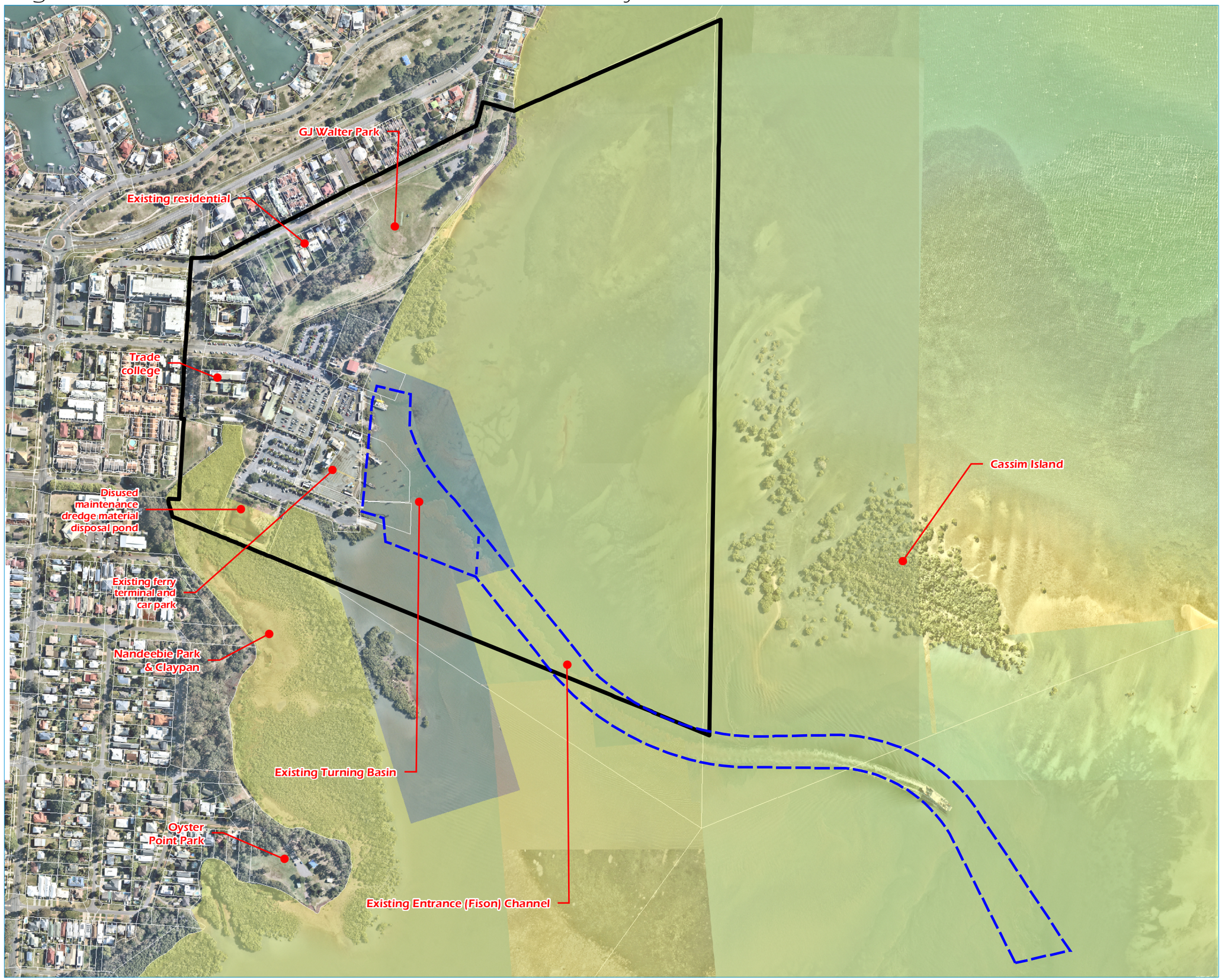
Scale (A4):1:650,000

Layer Source: © State of Queensland Datasets (Department of Resources 2022)

DATE 11/07/2022

FILE REF. 9858 E Figure 1_1 Project Location D

Figure ES-2: Toondah Harbour PDA and Key Features



Legend

- Toondah Harbour PDA
- Moreton Bay Ramsar site
- Existing Fison Channel & Turning Basin
- Old DCDB

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0 50 100 150 200 250 m

GDA 1994 MGA zone 56

Scale (A3): 1:5,900

N

DATE: 11/07/2022

FILE REF. 9858 E Figure 1_2 Toondah Harbour Feature

Layer Source: © State of Queensland Datasets (Department of Resources 2022), Aerial Imagery (Nearmap.com 2020)

Project Description

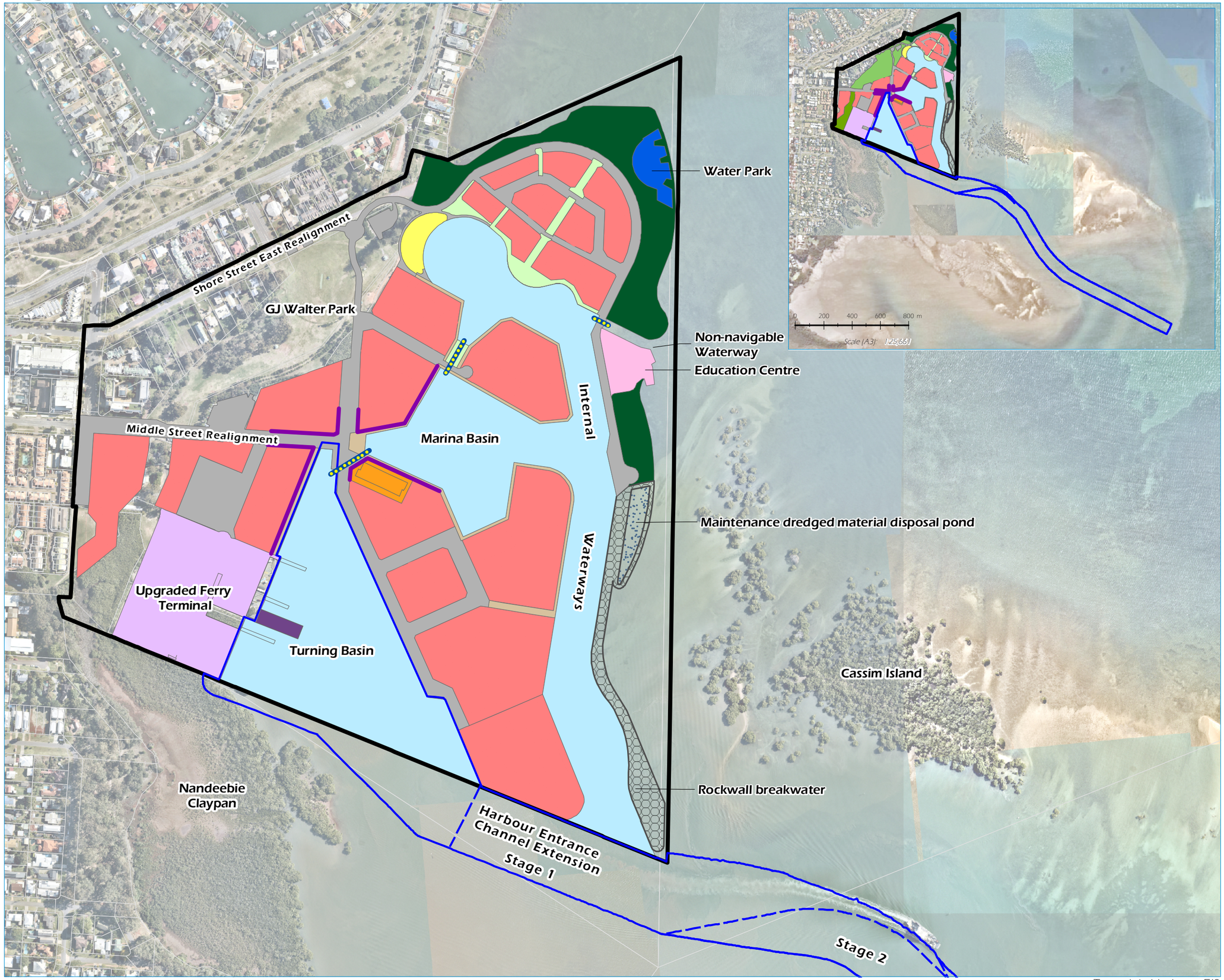
The Project includes the following key components:

- Capital dredging of up to 530,000 m^3 to widen and deepen the Fison Channel and extend the turning basin to meet minimum requirements for safe navigation (PIANC 2014, AS3962 – 2001) will be undertaken in two separate campaigns. Currently, the channel is approximately 45 m wide (excluding batters) with a target depth of -2.5 m below Lowest Astronomical Tide (LAT). The Project proposes to widen the channel to 75 m (excluding batters), with a target depth of -3 m LAT.
- All dredged and excavated sediments generated by capital dredging will be beneficially reused to reclaim a 37.6 ha sub-tidal area north of the harbour to create new landforms for proposed public open space and urban uses as well as internal waterways including a central marina basin. The reclamation will be formed in two discrete stages. For each stage, a perimeter bund will be established to contain the dredged material, which will limit indirect impacts outside of the project footprint. The reclamation has been designed to balance dredge material volumes with fill requirements, minimising the need to import materials from offsite.
- The internal waterways and marina, which will include up to 200 berths with floating pontoons, are located within the reclamation area and will be excavated 'in the dry'.
- New harbour and public transport infrastructure, facilities and amenities for ferry customers and visitors will be constructed south of the existing vehicle ferry loading area. These works will be undertaken concurrently with the first reclamation stage and overlap the existing ferry terminal and boat ramp aside from a 1.5 ha section to the south of the current car park made up of a disused dredged material disposal pond and a 0.7 ha patch of mangroves.
- A network of open space and recreation areas will include a 3.5 ha foreshore park with water play/lagoon pool, an education centre, boardwalks, plazas, walking paths, neighbourhood parks and a ramp for non-motorised vessels such as kayaks and dinghies.
- A mixed-use village precinct that will comprise of residential areas on the northern and southern reclamation areas and a hotel, residential apartments, retail and commercial development focused around a new marina plaza. A further residential precinct will be located in the western part of the PDA replacing the existing trade college building. Including the hotel, the Project will deliver up to 3,600 dwellings.
- Installation of civil infrastructure and services – such as electrical, gas, telecommunications, water supply, sewerage infrastructure and roads will keep pace with development.

The only component of the development outside of the PDA boundary is the extension of Fison Channel and the turning basin. This is unavoidable as dredging must achieve target channel depths until naturally deeper areas of Moreton Bay are reached to provide safe navigation. The existing Fison Channel already extends outside of the PDA boundary and regularly requires dredging to maintain its target depths.

Importantly, the Toondah Harbour PDA contains privately and publicly owned land that is not part of the Project. This includes existing residential lots to the north and GJ Walter Park. The proposed master plan is shown on Figure ES-3.

Figure ES-3: Toondah Harbour Project Master Plan



Legend

- Toondah Harbour PDA Boundary
- Qld DCDB
- Wetland centre & recreational facitilities
- Residential
- Ferry terminal and car park
- Hotel & convention
- Marine services
- Water Park
- Foreshore park
- Pocket Parks
- Artificial beach
- Boardwalks
- Activated edges - retail & commercial
- Harbour swing basin & fison channel extension
- Culverts

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0 50 100 150 200 250 m

GDA 1994 MGA zone 56 Scale (A3): 1:5,250

DATE: 21/07/2022

FILE REF. 9858 E Figure 1_3 Toondah Harbour Master Plan H

Layer Source: © State of Queensland Datasets (Department of Resources 2022), Aerial Imagery (Nearmap.com 2020)

EPBC Act Approvals History

The Project was referred under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 5 June 2018 (EPBC Reference number 2018/8225) and was made a controlled action on 23 July 2018, to be assessed by environmental impact statement (EIS). The relevant controlling provisions of the EPBC Act for the controlled action decision were:

- Wetlands of international importance (sections 16 & 17B);
- Listed threatened species and communities (sections 18 & 18A); and
- Listed migratory species (sections 20 & 20A).

Draft tailored guidelines for the EIS were released for public comment by DCCEEW on 6 February 2019 with the comment period closing on 6 March 2019. The final guidelines were released to the public on 3 April 2019.

The objectives of this Draft EIS are to meet the legislative requirements under the EPBC Act by way of:

- Responding to the Guidelines for the Preparation of a Draft Environmental Impact Statement (DAWE, 2019);
- Assessing the potential for the Project to impact on any matters of national environmental significance (MNES), including the ecological character of the Moreton Bay Ramsar Site (MBRS);
- Providing public information on the need for the Project, alternatives to it and optioneering undertaken through the design process to balance engineering, environmental, social and economic considerations;
- Identifying and assessing potential direct and indirect environmental, social and economic impacts upon the surrounding physical and human environments during the construction and operational phases of the Project;
- Recommending mitigation measures to avoid or minimise any significant impacts identified to acceptable levels;
- Identifying potential significant residual impacts and designing an appropriate management and monitoring program for the construction and operational phases of the Project; and
- Where significant impacts to MNES cannot be avoided, proposing an offset strategy that will provide an overall benefit and positive conservation outcome for the matter(s) impacted.

Refinements have occurred to the Project master plan since submission of the referral documentation, primarily in response to feedback from technical consultants and stakeholders. These minor changes have not altered the key Project components or uses outlined in the referral and do not result in impacts upon MNES additional to those described in the referral. Most changes are aimed at minimising direct and indirect impacts upon MNES from the Project. Table ES-1 summarises the minor changes that have been made to the master plan since the Project was referred in 2018.

Table ES-1: Master Plan Minor Changes from Referral.

Change	Referral Master Plan	Draft EIS Master Plan	Outcome
Reclamation landforms	The reclamation landforms encompassed 32 ha of tidal land	The reclamation landforms encompass 27.1 ha of tidal land	Reduction in tidal land disturbed by reclamation landforms by 4.9 ha
Marina and internal waterways	Marina and internal waterways encompassed 17.7 ha of tidal land	Marina and internal waterways encompass 10.5 ha of tidal land	Reduction in tidal land disturbed by excavation of marina and internal waterways by 7.2 ha
Breakwater design	The breakwater protecting the marina and internal waterways incorporated a mangrove conservation area that would be accessible for nature-based tourism	The breakwater has been redesigned as a rock wall with no public access once constructed	Reduced footprint and increased distance between the project footprint and Cassim Island. Proposed mangrove habitat within the conservation buffer

Change	Referral Master Plan	Draft EIS Master Plan	Outcome
			was considered undesirable as shorebirds roosting at Cassim Island prefer an open landscape. The rock wall will provide roosting habitat for some shorebird species
Fison Channel and turning basin	The project footprint included the turning basin and inner Fison Channel. The referral included written material and plans indicating that capital dredging of the channel would be extended as far as necessary to ensure safe navigation depth, but the actual distance could not be accurately determined at referral stage. The minimum predicted dredge volume was 500,000 m^3	Once detailed bathymetry was obtained and channel design basis confirmed with Maritime Safety Queensland (MSQ), the full extent of the channel dredging could be identified and dredge volumes calculated. Up to 530,000 m^3 of dredging is required to upgrade the channel, including allowance for overdredging	Channel design was optimised to provide a balance between safe navigation outcomes and minimising dredge volumes

Project Proponent

Walker Group Holdings Pty Ltd is the Proponent for the Project. Lang Walker AO is the majority shareholder of both Walker Group Holdings and Walker Corporation Pty Ltd, which was established in the 1960s and is one of Australia's largest private, diversified development companies. Walker Group has delivered over 1,000 projects and are experienced across all areas of the property spectrum, from residential through to master planned communities, retail, commercial, industrial and resort living. Walker Group's future development and construction pipeline is valued at $32 billion and includes 30,000 lots of land, 10,000 apartments, 11 commercial towers and 300 ha of industrial land in Australia, and 46,000 dwellings in Malaysia, with other major projects in New South Wales, South Australia, Victoria, Queensland, and Fiji.

Project Need

Fison Channel (the harbour entrance channel) is a critical artery for the transport of residents, businesses, commuters, school children and visitors between the mainland and Minjerribah (North Stradbroke Island). Similar to road and rail networks, the artificially deepened channel and turning basin at Toondah Harbour needs to be continuously maintained through maintenance dredging and, at times, developed further through capital dredging.

Capital and maintenance dredging are essentially the same process with the only difference the areas being dredged. Capital dredging is carried out to enlarge or deepen existing channel and port areas or to create new ones while, as the name implies, maintenance dredging is required to remove sediment build up in existing channels and port areas to maintain current operational capacity. Maintenance dredging to remove sediments that accumulate in the Fison Channel and turning basin already occurs at approximately five-year intervals and will continue to be required to ensure all tide access for ferries and recreational vessels.

The capacity of Toondah Harbour to operate efficiently directly impacts on the Redlands' ability to grow and develop a sustainable nature and culture-based tourism sector. Widening and deepening of the Fison Channel and turning basin through capital dredging have been identified as necessary to enable vessels to pass each other and manoeuvre safely in the turning basin, and to future-proof the harbour by enabling it to accommodate larger ferries. Consequently,

beneficial reuse of the dredge material by placing it within another part of the PDA has been proposed in accordance with national best practice for disposal of dredge material.

RCC's *Tourism Strategy and Action Plan 2015-2020* provides a region-specific strategy for improving local tourism and amenity. The strategy highlights several issues that restrict tourism growth in the region including:

- Lack of higher end and large-scale accommodation to support groups, conferences and functions;
- Lack of jetty/boating infrastructure;
- Parking issues, particularly around ferry access points;
- Lack of a clear identity for the Redlands and its past – no destination identity;
- Lack of quality visitor information services;
- Lack of public boat moorings/berthing;
- Limited bay access; and
- Limited quality dining.

The delivery of a dedicated tourism precinct is a key action in the tourism strategy. The Project will directly address and improve on a number of these issues by delivering a broad range of infrastructure including visitor accommodation and various activities that will heighten visitors' and residents' experience of Toondah Harbour and southern Moreton Bay and create a new destination and set of attractions for the Redlands. RCC's *Economic Development Framework 2014-2021* acknowledges that Toondah Harbour is a catalytic project for the construction and tourism sectors in the Redlands, with the potential to drive employment and tourism development in the region.

Project Alternatives

Alternatives to projects can take several forms including achieving similar development outcomes in a different location, altering some aspects of project design to minimise environmental impacts or doing nothing and maintaining the current situation. For Toondah Harbour, another alternative also applies which is the 'dredge and disposal offsite' option. This option looks at issues associated with carrying out capital dredging of the Fison Channel and turning basin and disposing of the material somewhere offsite. It would also require upgrades to the port area to provide increase ferry loading and unloading capacity, improve car parking and access and provide a new ferry terminal building. Multiple options for placement of the material have been investigated as part of the assessment of alternatives.

Short, medium- and long-term advantages and disadvantages for each of the project alternatives are summarised in Table ES-2. All alternative options are either unfeasible or have major environmental, economic or engineering challenges that exceed the challenges of redeveloping Toondah Harbour.

Table ES-2: Summary of Short, Medium, and Long-Term Advantages and Disadvantages of Project Alternatives.

Option	Advantages	Disadvantages
Alternative location	▪ No feasible alternative location was identified as existing infrastructure renewal is at the core of the Project. In addition, the Proponent's proposal is tied to specific land in the Toondah Harbour PDA under binding commercial agreements with the Queensland Government and RCC.	▪ If passenger and vehicle ferry services were implemented in any other location in southern Moreton Bay, significant engineering challenges and similar or greater environmental impacts as would occur at Toondah Harbour would result.
Alternative designs	Not applicable as the structure plan is not able to be implemented. The Project master plan has been designed in accordance with the statutory planning instrument for the Toondah Harbour PDA and has already been optimised to balance functionality and amenity with environmental and engineering constraints	

Option	Advantages	Disadvantages
Alternative option: Port upgrade only (dredging without reclamation)	▪ Direct impacts to mudflats avoided in the short term and medium terms. However, sea level rise is likely to reduce the same habitat in the long term.	▪ Direct and indirect impacts associated with dredging and ocean disposal would occur in the short term. ▪ Decreased capacity at the Mud Island material disposal area in the long term. ▪ Disposal at the Mud Island material disposal area is not supported by key stakeholders – MSQ and Port of Brisbane. ▪ Increased ongoing maintenance dredging requirements in the medium and long term. ▪ No private capital sourced investment in community and transport infrastructure. ▪ Not likely to be supported by State Government funding in the short, medium or long term. ▪ Significant capital costs to carry out the works in the short term (~$90M). ▪ Minimal new landside facilities means no cost benefit in the longer term. ▪ No urban renewal of the Toondah Harbour area or new amenity associated with the foreshore parks, etc in the short, medium and long term.
Do nothing	▪ No environmental impacts associated with the dredging or reclamation would occur in the short or medium term.	▪ Poor amenity, safety and operational issues, limited foreshore access, and dilapidated facilities that cannot cater for existing peak demand would persist in the short, medium and long term. ▪ No catalytic urban renewal project would occur, which will discourage investment in the Redlands and see a range of economic opportunities and benefits foregone.

Toondah Harbour is unique in SEQ based on its location, PDA status, tenure, history and existing land uses. It is a marine transport hub built on reclaimed land that has provided access to Minjerribah (North Stradbroke Island) for business, residents, and visitors for decades.

The Project is tied to the declared PDA and the identified parcels of land in public ownership. The proposed development outcomes have been endorsed by the Queensland Government and RCC through the making of a statutory development scheme for the Toondah Harbour PDA which was subject to public notification.

The Proponent has entered into binding commercial agreements that are tied to specific landholdings in the PDA and is therefore not in a position to consider alternative locations in this EIS process.

Land Uses

Project land uses are consistent with the vision for the Toondah Harbour PDA as outlined in the development scheme and the precinct plan. When completed, the Project will deliver an improved ferry precinct and a new waterfront destination that will transform the Redlands Coast and revitalise nature and culture-based tourism in SEQ and Moreton Bay.

New land uses within the Project footprint will include up to 3,600 dwellings (including 150 – 180 hotel rooms) and retail and commercial development capped at 5,000 m^2 GFA and 2,500 m^2 GFA respectively. This will equate to an indicative future residential population of up to 5,800 people. The entire Project will be delivered over 15 to 20 years, staged according to market demand.

Precinct 1 – Mixed Use Village

The mixed-use village precinct includes GJ Walter Park, the new foreshore parklands, and residential and mixed-use development in the northern and southern reclamation areas. It will form the heart of the PDA and will provide for:

- A vibrant mixed-use node around the marina plaza, including a hotel, residential apartments and ground floor retail and commercial uses;
- A northern residential area with townhouses, residential apartments and a few small ground floor retail tenancies to cater for park users and residents (e.g. coffee shop, fish and chip shop);
- A southern residential area incorporating predominantly residential apartment uses;
- Public realm features including:
  - The marina plaza, which will be the location for community events and celebrations;
  - 3.5 ha of new foreshore parklands, which will incorporate:
    - Areas for active and passive recreation, which progressively become quieter towards the interface with Cassim Island;
    - Water park/lagoon pool;
    - Beach;
    - Opportunities for land-based recreational fishing and informal interaction with the foreshore and bay (sited to minimise risk of disturbance to migratory shorebirds);
    - An education centre, which will operate as a focal point for promoting public education, community awareness and nature and culture-based tourism experiences;
    - Art and cultural heritage trail and interpretative signage;
  - Boardwalks, plazas, nature trails and neighbourhood parks integrated throughout the development;
- Car parking provision for each development relevant to its land use category; and
- Minor embellishments to GJ Walter Park.

The design of residential and mixed-use development will allow public access along the waterfront, including access to the marina and foreshore.

Precinct 2 – Residential

Precinct 2 is located in the west of the PDA and includes existing low and medium rise residential development that is in private ownership and not part of the Project. Development of the Project land in Precinct 2 will feature predominately medium rise residential apartments that are compatible with existing residential development to the north and west.

Precinct 3 - Ferries

The proposed new ferry precinct will consolidate marine and passenger infrastructure, replacing the existing dilapidated facilities with contemporary infrastructure. The master plan allows for an expanded and revitalised port precinct that will provide an enhanced regional gateway to Minjerribah (North Stradbroke Island) and southern Moreton Bay and become a destination in its own right. The precinct includes:

- Three roll on/roll off (Ro-Ro) vessel berths;
- Two passenger ferry berths;
- Opportunity for charter boat berthing to facilitate new nature and culture-based tourism offerings;
- An airport-style multi-operator ferry terminal with passenger amenities;
- Ticket and tourist information centre;
- An over-water building for marine related uses such as a seafood co-op;
- Vehicle ferry queuing areas;
- Public plaza;
- Bus-ferry interchange; and
- 1,010 public car parks for ferry users, with capacity for RCC to provide a further 500 car parks in a multi deck structure if demand warrants it
- Residential apartments with ground floor food and beverage or retail tenancies opening onto the port promenade.

Residential and mixed-use buildings will have screening and acoustic treatments to mitigate noise from ferry operations.

Precinct 4 – Marina and Water Based Development

The marina and water-based development precinct will provide:

- Up to 200 new wet berths for recreational and commercial vessels located within the marina coves and internal waterways;
- A public pontoon close to the marina plaza;
- A dredge spoil pond located in the eastern arm of the southern reclamation area for the treatment and disposal of dredge material associated with ongoing maintenance dredging of the marina coves and internal waterways; and
- A new public boat ramp with trailer parking for non-motorised vessels (e.g. kayaks and dinghies), located in the new foreshore park and sited and designed to minimise potential indirect disturbance to the Cassim Island roost site.

Recreational vessels will access Moreton Bay via the internal waterways, which will be protected by a rock wall breakwater to allow safe navigation and mooring during most weather conditions. The internal waterways will connect to the Fison Channel seaward of the turning basin and landward of Cassim Island. Navigation aids, lights and signage will be provided in compliance with MSQ requirements to ensure safe navigation for all within internal waterways, as well as within the Fison Channel.

The existing public boat ramp at Emmett Drive, which is used by motorised and non-motorised recreational vessels, will be decommissioned. TMR, RCC and the Proponent have agreed that the Proponent will offset the closure of the boat ramp by making a financial contribution to the upgrade of the existing public boat ramp at William Street, Cleveland as well as providing recreational boating infrastructure within the Project, such as the boat ramp for non-motorised recreational vessels and the public pontoon.

Project Sequencing

The Project will be delivered over a period of up to 20 years with timing dependent on a range of factors including weather conditions, approval conditions and market forces. Most development and community infrastructure will be delivered within the first 10 years, with staged delivery of the southern residential area occurring over the last five to 10 years. Construction will incorporate a range of work types which can be broadly categorised into:

- Dredging and reclamation works;
- Civil infrastructure and servicing works;
- Marine infrastructure works; and
- Building works.

General project sequencing is with construction and operational activities summarised in Table ES-3. Sequencing plans encompass the first 10 years of works with the last five to 10 years consisting of staged development of the southern reclamation area.

Table ES-3: Summary of Indicative Project Sequencing.

Period from Commencement	Construction Activities	Operations / Uses
Year 1	1. Establish construction site, including access 2. Enclose northern reclamation area with sheet piles and rock bunding 3. Commence stabilisation and dewatering of in situ material	Existing ferry services continue to operate out of existing ferry facilities
Year 2 - 4	4. Complete Stage 1 dredging (inner Fison Channel and turning basin) and place in northern landform 5. Complete northern reclamation landform and sub tidal areas including the marina basin and internal waterways 6. Commence and complete marine infrastructure and ferry car parking upgrade. Existing ferry access and no net loss of ferry car parking maintained at all times during construction 7. Commence and complete Middle Street and Shore Street East road upgrades. Vehicle access maintained at all times 8. Commence staged civil and building works in northern residential area 9. Commence staged civil and building works in mixed use node and ferry precinct	A. Existing ferry services continue to operate out of existing ferry facilities B. Foreshore park completed and open to public C. Recreational beach completed and open to public D. Education centre completed and open to public E. Boat ramp for non-motorised vessels operational F. Up to 400 dwellings completed and occupied in northern residential area and mixed-use node G. 500 m^2 of retail GFA in mixed-use node (cafes, etc) H. Up to 30 wet berths completed in marina (no bay access yet)
Year 5 - 7	10. Complete staged civil and building works in the northern residential area and mixed-use node 11. Complete staged civil and building works in the ferry precinct 12. Enclose southern reclamation area with sheet piles and rock bunding 13. Commence stabilisation and dewatering of in situ material in southern reclamation area	I. New ferry precinct completed and operational J. Up to 800 additional dwellings completed and occupied in the northern residential area and mixed-use node K. 1,000 m^2 of additional retail GFA in mixed use node is operational L. 500 m^2 of commercial GFA in mixed-use node is operational M. Hotel completed and operational

Period from Commencement	Construction Activities	Operations / Uses
	14. Complete Stage 2 dredging (outer Fison Channel) and place material in southern reclamation area	
Year 8 - 10	15. Complete southern reclamation landform and sub tidal areas including internal waterways 16. Commence and complete 'in the dry' marine infrastructure works for marina and internal waterways 17. Connect internal waterways to Moreton Bay 18. Commence staged civil and building works in southern residential area	N. Up to 120 additional wet berths completed in marina and internal waterways O. Marina operational P. Up to 750 additional dwellings completed and occupied in the northern reclamation area and mixed-use node Q. 3,500 m^2 of additional retail operational in the mixed-use node R. 2,000 m^2 of additional commercial GFA operational in the mixed-use node
Years 10 - 20	19. Staged civil and building works in southern residential area to completion 20. Complete marine infrastructure works for remaining marina wet berths	S. Up to 1,470 additional dwellings completed in the southern residential area T. Up to 50 wet berths completed in the marina and internal waterways

Dredging and Reclamation Works

The reclamation philosophy for the Project comprises three core elements:

1. The full containment of the reclamation areas by sheet-piling and rock bund to create a 'dry' work area and minimise risk of adverse environmental impacts external to the site;
2. Dewatering and stabilising sediments within the bunded reclamation area so that it is suitable to be used as engineering fill; and
3. The full beneficial reuse within the reclamation area of the dredged material from the widening and deepening of the Fison Channel and turning basin.

Dredging will be carried out in two stages with stage 1 incorporating the turning basin and the inner Fison Channel and stage 2 the outer Fison Channel. Dredge volumes for stage 1 and stage 2 are approximately 350,000 m^3 and 180,000 m^3 respectively. Expanding the turning basin and inner channel early in the development cycle will alleviate key navigational safety issues by allowing multiple ferries to safety manoeuvre into and out of Ro-Ro berths and for vessels to pass each other when entering and departing the harbour.

All dredging will be carried out mechanically using a barge-mounted backhoe dredge (BHD) or similar. BHDs are mechanical dredgers consisting of an excavator mounted on a pontoon. The process of dredging using a BHD introduces limited additional water content beyond that contained within the *in-situ* material to be dredged. The method used for capital dredging would be very similar to the method used for maintenance dredging operations at Toondah Harbour that were undertaken in 2019. A floating silt curtain will be placed around the dredge area to minimise plumes of suspended sediment resulting from the dredging process. It may not be possible to use a silt curtain in all of the dredge area, in particular the shallow mudflat areas where the turning basin and inner channel will be extended.

Once barges are full, they will be transported to the reclamation area via hopper or flat top barges and unloaded using an excavator at a temporary dock constructed by the Proponent specifically for that purpose.

Dredging operations will be carried out for 144 hours/week (24 hrs 6 days a week). The narrower sections in the Fison Channel and central parts of the turning basin will be dredged at night while there is no ferry traffic. Areas which allow more room for ferries to pass will be dredged during daylight hours.

The formation of land through reclamation works will be split into two stages aligned with the dredging stages:

- Stage 1 (referred to as the northern reclamation) will incorporate the northern residential area, foreshore park and marina precinct; and
- Stage 2 (referred to as the southern reclamation) incorporates the southern residential area and its completion will allow the commencement of marina operations.

The finished landform for the reclamation areas will be 3 m AHD. Revetment walls will be constructed to 2.5 m AHD with the landform battered up over several metres to reach 3 m AHD prior to reaching any buildings or habitable areas. The proposed edge treatments around the concept landform comprise a mix of vertical wall, internal waterway wall (hybrid of vertical wall and rock revetment), and rock armour pitched wall. The design level of 3 m AHD was calculated in accordance with the requirements of the Queensland Government's *Coastal Hazards Technical Guide – Determining Coastal Hazard Areas*.

The Project has been designed to balance cut and fill with all dredged and excavated sediments dried on-site and used within the reclamation, minimising the requirement for imported material. The only materials expected to be sourced externally for construction of the landform are:

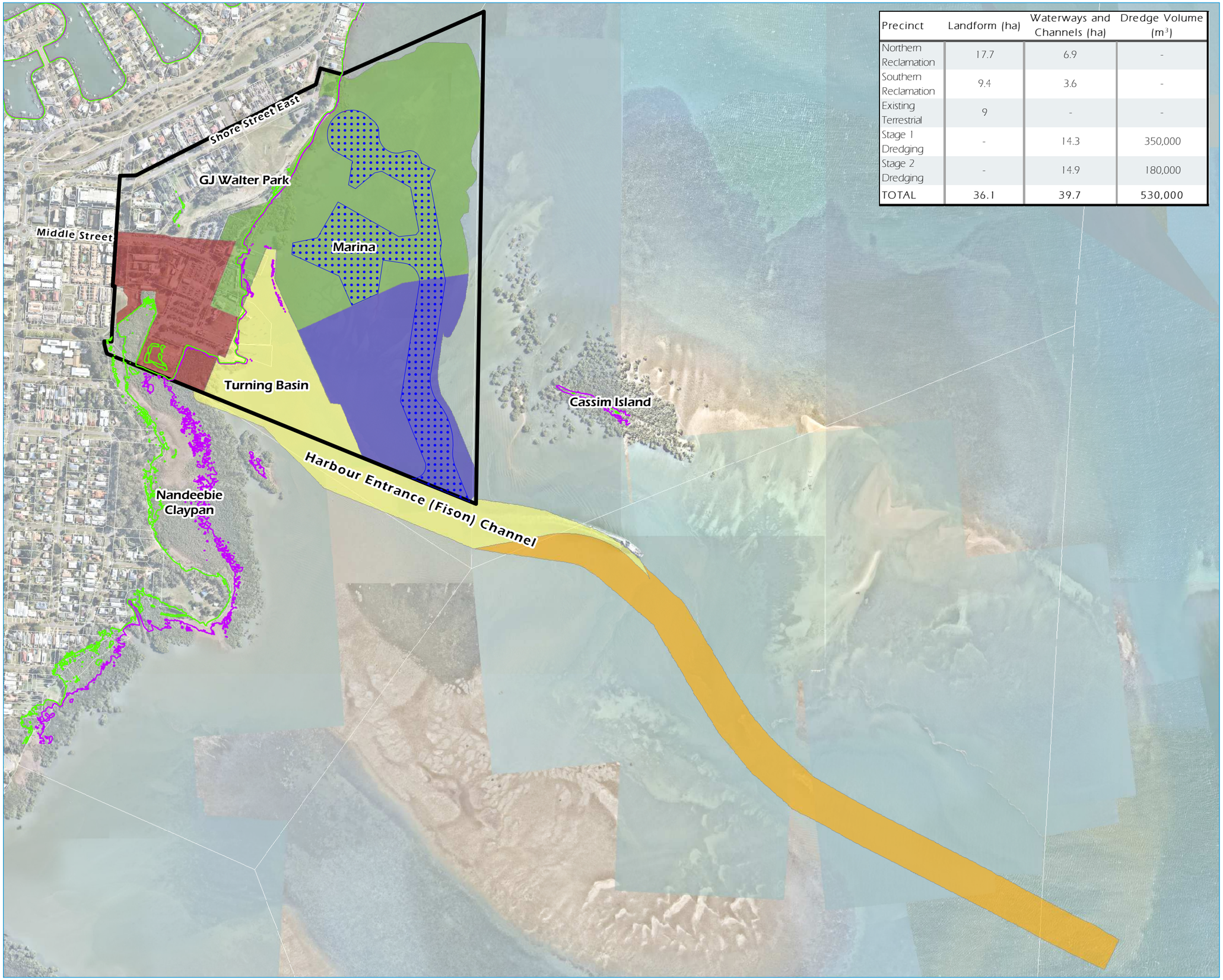
- Rock armouring for the creation of the external bunds;
- Agricultural lime to treat potential acid sulfate soils (PASS); and
- A small amount of quarry material to assist in stabilising the dredge material.

Initial works for creating the reclamation entails the establishment of a perimeter bund around the northern and southern reclamation areas respectively to create a 'dry' area for the works and limit indirect impacts outside of the Project footprint. The bund will comprise an inter-locking sheet pile cut-off wall, vibrated into place. A small amount of hammer pile driving may be required to ensure the sheet piles are firmly within the underlying stiff clays. Sheet piling will be reinforced by rock armouring, which would be imported to site and placed by excavator.

A significant component of the reclamation process will be dewatering and stabilising the very weak upper sediments. The stabilisation works associated with the reclamation area is a material drying exercise with the material spread, treated and allowed to dry in a designated area. A dewatering system will be established with a collection and treatment node located at the south eastern corners of the staged construction works. Water collected through this process will be captured and re-used on site for dust suppression. Discharging of water from the reclamation area into Moreton Bay is only likely to be required during significant rain events. If release is required, water would be treated and tested to ensure it meets relevant environmental guidelines before being released.

Dredging and reclamation staging is shown on Figure ES-4.

Figure ES-4: Project Footprint and Dredging and Reclamation Staging



Precinct	Landform (ha)	Waterways and Channels (ha)	Dredge Volume (m^3)
Northern Reclamation	17.7	6.9	-
Southern Reclamation	9.4	3.6	-
Existing Terrestrial	9	-	-
Stage 1 Dredging	-	14.3	350,000
Stage 2 Dredging	-	14.9	180,000
TOTAL	36.1	39.7	530,000

Legend

- Toondah Harbour PDA
- Qld DCDB
- Harbour Precinct
- Stage 1 (northern) Reclamation
- Stage 2 (southern) Reclamation
- Stage 1 dredging
- Stage 2 Dredging
- Marina & internal navigation waterways
- MHWS (0.96m)
- HAT (1.53m)

TOONDAH HARBOUR

walker

0 100 200 300 400 m

GDA 1994 MGA zone 56

Scale (A3): 1:8,600

N

DATE: 22/07/2022

FILE REF. 9858 E Figure 2_11 Dredge Reclamation Areas G

Layer Source: © State of Queensland Datasets (Department of Resources 2022), Aerial Imagery (Nearmap.com 2020)

Ongoing Operations and Use

Marine Vessel Traffic

Toondah Harbour is located in SEQ, the most densely populated region in Queensland, which is adjacent to Moreton Bay. Moreton Bay is heavily used for recreational boating and accommodates the Port of Brisbane and several ferry routes between the mainland and the bay islands. The marine vessel traffic assessment addresses existing boat use in Moreton Bay, Redland City LGA and Toondah Harbour as well as predicted future boat use in Moreton Bay and the Project footprint.

Review of the existing marine vessel use in Moreton Bay and Toondah Harbour specifically can be summarised as follows:

- More than 120,000 recreational vessels are currently registered in LGAs adjacent to Moreton Bay including Brisbane, Gold Coast, Moreton Bay Region and Redland City.
- A TMR Recreational Boating Facilities Demand Forecasting Study (Economics Associates 2017) estimates up to 7,500 recreational vessels are active in these LGAs on an average weekend day, many of which would be utilising Moreton Bay and its estuaries.
- Various passenger and vehicle ferry services travelling from Brisbane and Redland City mainlands to the bay islands result in over 100 vessel movements on an average weekend day.
- In addition to the recreational fleet and ferry operations, more than 2,300 large cargo vessels visit the Port of Brisbane annually.
- The Redland City LGA accounts for more than 23,000 registered recreational vessels with more than 1,400 estimated to be using Moreton Bay on an average weekend day and more than 100 daily ferry movements between the mainland, Minjerribah and the four inhabited Southern Moreton Bay Islands.
- Combined, ferries and recreational vessels using Toondah Harbour account for 146 vessel movements on an average weekend day.
- Recreational vessels using Toondah Harbour would generally be travelling to other destinations in Moreton Bay and would not remain in the vicinity of the harbour due to navigational constraints.

An assessment of predicted boat use in the Redlands Coast area and at Toondah Harbour as a result of the Project found:

- Recreational boating use of Moreton Bay and the Redland City LGA is expected to grow regardless of the Toondah Harbour Project. Registered vessels in the LGA are expected to increase from 23,559 to approximately 28,000 by 2031. Average weekend daily use is expected to increase from 1,410 to 1,668 vessels.
- The existing public boat ramp at Toondah Harbour will be decommissioned by the Project. Motorised recreational boat traffic generated by the new 200-berth marina is expected to be the same or less than traffic generated by the existing boat ramp. The Proponent and TMR have agreed to an offset in the form of a financial contribution to upgrades to the nearby William Street boat ramp at Cleveland, to provide improved access for recreational vessels.
- The existing boat ramp will be replaced with a boat ramp for non-motorised vessels, such as kayaks and dinghies, and will provide water access over most, but not all, tidal phases.
- No data is available to make an informed prediction of the use of the boat ramp by non-motorised vessels, however the beach at GJ Walter Park is already a high tide kayak launch point. It is expected that the improved facilities and access provided by the Project could result in a moderate increase in non-motorised vessel use of the northern part of the PDA. A combination of natural morphology and educational signage will discourage traffic from non-motorised vessels travelling south towards Cassim Island.
- Additional demand for vehicle and passenger ferries is expected to be met through the use of larger vessels that cannot currently be used as the Fison Channel and turning basin are too narrow and shallow. To provide a conservative estimate, a small increase of six trips (12 vessel movements) per day is predicted.

Maintenance Dredging

Ongoing maintenance dredging will be required in both the upgraded Fison Channel, turning basin, marina basin and internal waterways. In Queensland, most ports and boat harbours are artificially deepened and require maintenance dredging. Siltation occurs through the process of sediments being mobilised by waves and currents and then transported to and settling out in areas which are more quiescent (i.e. have lower currents and/or waves). Dredged areas are typically subject to siltation, as deeper and wider channels typically having greater trapping potential, resulting in higher siltation rates. Siltation rates can also be affected by changes in current patterns and wave exposure, which can alter the volume of sediment mobilised and carried into those dredged areas.

An assessment has been made of the likely percentage increase in siltation volume for the completed Project using a 3D hydrodynamic model created to assess impacts to coastal processes. The outcomes of this assessment were then compared to historical siltation volumes from previous maintenance dredging of the Fison Channel to ground truth ongoing requirements. The two most recent maintenance dredging events in 2014 and 2019 required the removal of approximately 85,000 m^3 and 43,000 m^3 of sediment respectively. Both events included small areas of capital dredging to provide a slightly larger swing basin.

While siltation is a gradual process, the annual volume will vary with prevailing conditions from year to year. The magnitude and frequency of maintenance dredging will depend on prevailing conditions, the overdredging allowance and navigational constraints. Historical records show dredging being carried out at Toondah Harbour in 1997, 2005, 2008, 2014 and 2019. As such, intervals between dredging have ranged from three to eight years (average 5.5 years).

An increase in annual siltation rates from approximately 10,000 m^3 to 16,000 m^3 is expected based on the channel extensions. Dredging frequency is not expected to change from the existing requirement of approximately five-year intervals. Volumes for each dredge event will be similar to the 2014 maintenance dredging event. It is anticipated that all uncontaminated material will be disposed of at Mud Island material disposal area in accordance with environmental authorities.

For the internal waterways and marina basin, annual siltation rates are expected to range between 1,200 m^3 and 2,240m^3. Siltation will be highest at the entrances where suspended sediment enters on the incoming tide and begins to settle out in areas of low flow velocity and low wave energy. Material will be disposed of within a pond created within the Project footprint Capacity of this pond will be 10,000 m^3 – 15,000 m^3, providing sufficient room for up to 10 years of maintenance dredged material. Once the pond is full, material will be removed via truck or barge for disposal offsite. The pond can then be re-used. Future maintenance dredging campaigns and removal of dredged material from the pond will be subject to a range of local and state approvals.

Vehicle Traffic

Traffic counts were undertaken to obtain a baseline understanding of existing traffic volumes on roads within and surrounding the study area. Table ES-44 identifies the roads within and surrounding the study area, the existing volumes of traffic on these roads, their RCC hierarchy classification and the expected maximum traffic volumes associated with the classification. Existing traffic volumes on both North Street and Middle Street currently exceed the maximum traffic flow associated with the road hierarchy designation for these roads.

Table ES-4: Existing Traffic Volumes.

Road Name	Existing Daily Traffic Volume (VPD)	Max. Traffic Volumes (RCC desired standard)	RCC Classification
Shore Street West	7,680	15,000 – 20,000	Sub Arterial
North Street	4,013	1,000	Local Street
Shore Street East	315	1,000	Local Street
Middle Street	3,370	1,000	Local Street
Passage Street	3,465	10,000	Trunk Collector
Wharf Street	580	1,000	Local Street

Toondah Harbour presents an opportunity to bring forward sustainable transport for the Redlands Coast including pedestrian and cycle infrastructure to fulfil strategic movements between Cleveland Point, Eddie Santagiuliana Way and Cleveland CBD via Middle Street. To achieve sustainable outcomes, the Project proposes to reduce private vehicle travel and promote public and active transport travel to the site. Use of an autonomous shuttle bus between Cleveland CBD, Cleveland Rail Station and the proposed ferry terminal will be explored. RCC and the RACQ trialled Stage 1 of an autonomous shuttle bus service on Karragarra Island in 2019, and have brought the vehicle to Cleveland for the next stage of the trial, which will run until June 2021. During Stage 2, the shuttle will travel between Raby Bay Harbour and Raby Bay Foreshore Park during off peak periods.

Traffic generation has been calculated in accordance with TMR's Guide to Traffic Impact Assessments. The Project will be implemented in stages with the final development yield not expected to be delivered until 15 – 20 years after the commencement of works. To reflect this, traffic generation has been calculated for year 5 and 10 of the development as well as the final development.

Middle Street is expected to see an increase in daily traffic movements of 2,561 trips after five years of development and a further 8,308 trips after 10 years with an ultimate increase of up to 15,827 trips. Shore Street East is expected to see an ultimate increase of up to 3,625 trips per day.

It is noted that the trip generation provided is conservative as the nature of the proposed development will likely see a greater uptake of active travel and public transport use than what has been included within the generation rates. It is expected that the outlined trips, especially the residential trips, would be considerably lower as Toondah Harbour is a destination in itself.

Legislation and Planning Framework

Legislation relating to planning and the environment is typically the responsibility of the State or Territory government. However, where certain plants, animals, places and environments are considered or deemed to be of national or international significance, Australian Government legislation triggers assessment and careful consideration of certain works and potential impacts on matters of national environmental significance (MNES). Beyond assessment of identified projects at a federal level, projects are further assessed for their potential impacts on the environment and biodiversity values, land use considerations, infrastructure, economic and community considerations by State and local governments. The applicable legislation and policy framework and multi-tiered assessment processes for the Project have been reviewed.

The Project triggers a number of permits and approvals under the Queensland legislative framework, in addition to the overarching federal environment assessment process (specifically this EIS) being undertaken in accordance with the EPBC Act. The main State approvals and permits processes include:

- Declaration of a 'works area' under the Marine Parks (Moreton Bay) Zoning Plan 2008, OR revocation of the area from the Moreton Bay Marine Park;
- Application for various development permits (approvals) under the Toondah Harbour PDA, Development Scheme pursuant to the *Economic Development Act 2012* (ED Act);
- Application for an Environmentally Relevant Activity under the *Planning Act 2016* (PA 2016); and
- Various other environmental and works permits and management procedures and frameworks required under Queensland legislation.

The Ramsar Convention

Wetlands of international importance are those wetlands nominated and listed under the *Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971*. This convention is also known as the 'Ramsar Convention on Wetlands' using the protocol of naming international agreements after the city in which it was first formulated. The convention was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975. In line with this nomenclature, wetlands listed under the Convention are referred to as Ramsar wetlands. The Convention uses a broad definition of wetlands which includes all lakes and rivers, underground aquifers, swamps and marshes, wet grasslands, peatlands, oases, estuaries, deltas and tidal flats, mangroves and other coastal areas, coral reefs, and human-made sites such as fishponds, rice paddies, reservoirs and salt pans.

Under the Convention signatory countries commit to:

- Work towards the wise use of all their wetlands;
- Designate suitable wetlands for the list of Wetlands of International Importance (the "Ramsar List") and maintain their ecological character through effective management; and
- Cooperate internationally on transboundary wetlands, shared wetland systems and shared species.

The Ramsar convention defines ecological character as the combination of the ecosystem components, processes, benefits and services that characterise the wetland at a given point in time.

The Toondah Harbour Project occurs partly within the Moreton Bay Ramsar Site (MBRS). The MBRS covers an area of 120,654 ha which includes a semi-enclosed bay bounded by Mulgumpin (Moreton Island), Minjerribah (North Stradbroke Island) and Garadgi (South Stradbroke Island): three of the largest natural sand islands in the world. The proposed reclamation areas overlap the MBRS by approximately 36.4 ha and the dredge area within Fison Channel overlaps the MBRS by a further 22.3 ha. Combined this represents 0.048% of the MBRS.

In accordance with the mission of the Ramsar Convention, projects and developments may occur in Ramsar wetlands, but they must maintain or enhance the ecological character of the site, and be in accordance with 'wise use'. The wise use concept refers to maintaining wetland values and functions, while at the same time delivering services and benefits now and into the future, for human well-being. Wise use, in promoting maintenance of environmental, economic and social sustainability, encourages compromise (or trade-offs) between individual and collective interests. The Project must ultimately meet the test of compatibility of the wise use and conservation purposes.

The Project incorporates a number of land uses that are typically considered 'wise use' in the context of sustainable development in a Ramsar setting, including the turning basin, Fison Channel, ferry terminals, marina, public open space, boat ramp and recreational facilities.

Like any coastal port, Toondah Harbour and the Fison Channel must be dredged to create the required depth for safe navigation of vessels. The Project responds to the fundamental challenge of disposal of dredge material associated with necessary capital dredging by proposing to beneficially reuse dredged material to reclaim land. This land will be used for public open space and urban purposes. With a net balance achieved between dredging and reclamation on preliminary estimates, the impact of dredging and material disposal is confined to the Project footprint.

Residential, recreational and commercial land uses are necessary to fund the port upgrade and other community infrastructure, provide a vibrant and financially sustainable destination and ensure that the intended benefits in terms of employment, education and conservation accrue from the Project.

By virtue of the PDA location, which has been established by regulation and is based on the position of the existing ferry terminal, the Project cannot progress without interacting with the MBRS. Effort has been invested in the planning and design of the Project to minimise impacts and integrate the development with the aesthetic and environmental values of the wetland. This is achieved through the adoption of wise use principles and modelling itself on successful wetland developments globally, and by incorporating best practice conservation, education and cultural and nature-based tourism into the Project.

Notably, a range of developments have been approved or are located within Ramsar sites both in Australia and internationally.

For example, the Riverwalk development (EPBC 2006/3176) in Victoria was approved to deliver 2,200 residential lots and other urban uses over a 197 ha area within the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site. While the development is within the boundaries of the Ramsar site the area was considered degraded and approval conditions required a range of measures to be implemented to protect the ecological character of the site including improving habitat values for the Growling Grass Frog.

Riviera Harbour (EPBC 2002/732) in the Gippsland Lakes Ramsar site in Victoria was also approved to carry out works within the boundaries of the Ramsar site. The works included dredging, dredge material disposal and a canal estate with urban lots covering 0.042% of the Gippsland Lake Ramsar site.

Internationally, Ramsar sites include a range of tourism and urban infrastructure within their boundaries. Examples include several marinas, apartments and hotels located within the Etang de Salses-Leucates Ramsar site in France, and a resort and mixed-use residential development within the Sungai Pulai Ramsar site in Malaysia.

Stakeholder and Community Engagement

A significant community and stakeholder engagement process that has been delivered as part of the development of the Draft EIS for the Project. Engagement activities took place at various milestones, including prior to the release of the draft EIS Guidelines by the Australian Government, during the public notice of the draft EIS Guidelines, and during the development of the draft EIS by the project team. Activities undertaken for the Project between January 2016 and December 2020, included:

- 34 unadvertised pop-up listening posts across Redland City;
- Two face-to-face community drop-in sessions in the local area;
- Six online community drop-in sessions (promoted as Talk Toondah sessions);
- Formation of three technical focus groups and facilitation of two meetings with each group;
- Key stakeholder meetings;
- Establishment of a staffed project information centre in the Cleveland CBD;

- Statistically valid telephone survey with 300 randomly selected Redland City residents;
- Project telephone hotline and email address;
- Community updates; and
- Project website.

These activities were undertaken to provide community members and stakeholders with opportunities to receive information, provide feedback, and engage in conversation to learn more about the Project.

Common themes that emerged in relation to the perceived benefits of the Project and potential opportunities related to:

- Improved public facilities, including the ferry terminal facilities and public parkland;
- Improved housing options;
- Revitalisation and activation of Cleveland's coastline;
- Improved recreation opportunities for families and children;
- Potential for an upturn in the Cleveland economy; and
- Potential for more job opportunities in Cleveland.

Common themes that emerged in relation to the perceived impacts of the proposed development related to:

- Scale of the Project;
- Perceived environmental impacts;
- Perceived traffic impacts;
- Perceived geotechnical challenges Raby Bay is currently facing;
- The need for community infrastructure;
- Potential construction impacts; and
- Potential impacts to Cleveland CBD businesses.

In addition, the project team observed that as the Project has progressed, the broader community has become more aware of the Project and more informed about it. This increased awareness has resulted in an increased number of detailed questions in relation to the EIS process, the elements that are considered in the assessment, and the specific activities associated with the environmental assessment. Some community members and stakeholders have also indicated their interest in being informed about the results of the environmental assessment process.

Existing Environment and Potential Impacts

Sediment Quality, ASS and Contaminated Land

Sediments from the proposed dredge and reclamation areas were sampled and analysed at 18 sites for contaminants with the potential to cause environmental harm if released into the water column. Of the 18 sites, 14 were in the proposed navigational channel and four in the reclamation area. Sampling and analysis were carried out in accordance with a sediment sampling and analysis plan (SSAP) prepared in compliance with the National Assessment Guidelines for Dredging (NADG). Historical sediment sampling studies carried out for maintenance dredging events at Toondah Harbour were also reviewed to provide an understanding of any contaminants identified in the past.

All samples were analysed for a targeted suite of parameters (including PASS) and contaminants that had been identified at Toondah Harbour and in Western Moreton Bay by previous sampling programs. A smaller cross section of samples was analysed for a comprehensive suite of parameters that included all potential marine contaminants listed in the NADG.

Clay and silt dominated the sediments in the proposed dredge area, with varying amounts of sand and gravel. In the reclamation area, particle size distribution was more varied in surface and middle subsamples at sites furthest from the shoreline, with clay dominating the bottom layers.

Analysis found the sediments in the proposed dredge and reclamation areas are not considered to be contaminated. Further, as all dredged material will be placed in the bunded the reclamation area, there is minimal risk that the sediment will mix with the surrounding water.

Sediment throughout the proposed dredge and reclamation areas contains PASS and will be treated with lime or similar while the material is still saturated to neutralise acid generating potential before it occurs. Ongoing monitoring will also be put in place to ensure if acidification occurs it will be treated promptly.

Management and monitoring of the dredging and reclamation will be documented in the Environmental Management Framework for the Project, and will include treatment of PASS, and monitoring of tail water and water quality in the surrounding area during dredging.

A contaminated land Preliminary Site Investigation (PSI) was carried out of the Toondah Harbour Project footprint and surrounding area. The PSI encompassed GJ Walter Park on Shore Street East and the ferry facilities and marine facilities. The investigation assessed the potential for contamination associated with current and former land uses at the site, and determined what management actions may be required. The assessment identified the following areas of potential concern:

- **GJ Walter Park** - Historical landfilling identified in southern and central parts of the site. Investigations to date have identified waste, but not evidence of gross chemical contamination. Two large ponds located in the area of current southern carpark, with use unknown.
- **Workshop area** - Site not Environmental Management Register (EMR) listed, however landfilling may have taken place in this area. Further soil and groundwater investigation recommended. Possible chemical storage in this area.
- **Passenger ferry terminal** - EMR listed for petroleum industries: site has diesel and waste oil above-ground fuel storage tanks (ASTs).
- **Vehicle ferry terminal** - EMR listed for petroleum storage: site has diesel and waste oil ASTs.
- **Vehicle ferry ramp, carpark and public boat ramp** - Fill materials used to raise level of site not known.
- **Former dredge pond** – Potential contaminated material from sediment disposal.
- **Trade College** - EMR listed for petroleum storage. Current status of fuel storage not known.

This PSI identified a number of potential sources of contamination which require further investigation as part of site management to determine whether any impact is present, and/or whether a risk to human health or the environment exists. Investigation works to be carried out prior to the commencement of construction include:

- Additional investigation into site activities, focused on the ferry terminals and Trade College.
- Soil investigation to assess fill materials and underlying natural soil within GJ Walter Park, the ferry terminals, other filled areas and dredge sediment pond.
- Installation and sampling of additional groundwater bores targeting the southern landfill area and fuel storages.
- Conduct an ASS weathering trial to determine rates of reaction and liming requirements for ASS containing sediment.
- Conduct a feasibility or cost/ benefit analysis of EMR removal 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 relevant permits for removal are obtained.

While a range of potential contaminated land issues were identified by the PSI none are considered to pose any risk to human health or the environment once the above recommendations and resulting management actions are put in place.

Coastal Processes and Dredge Plumes

The Project includes significant coastal works including dredging, excavation and reclamation works along the foreshore and across adjacent intertidal and subtidal areas at Toondah Harbour. These works have the potential to impact the prevailing hydrodynamic and coastal processes which in turn also influence the design of the works. Numerical modelling was carried out to assess any changes to coastal processes resulting from the Project. Components addressed by the assessment include:

- Tidal hydraulics (water levels and currents);
- Wave climate;
- Marine sediment dynamics (erosion and siltation);
- Shoreline processes;
- Extreme events and storm tides;
- Dredge plume dispersion;
- Coastal hazards and risks; and
- Climate change considerations.

The model was calibrated using a substantial quantity of site and Project specific data covering waves, current wind speed and direction, and suspended sediments.

Key outcomes of the study include:

- Current patterns in the vicinity of the Project will be modified, with the diversion of tidal flows generating higher velocity magnitudes to the east of the Project footprint, most notably on spring ebb tides. While localised areas of higher ebb tide velocities are predicted between the Project footprint and Cassim Island and extending to the northeast following construction of the Stage 1 bund, these velocities are reduced following construction of the Stage 2 bund (and in particular the rock wall breakwater). There is a general reduction in ebb tide velocities immediately to the north of the Project. Importantly, these localised velocity changes are not expected to be severe enough to have any significant effect on Cassim Island.
- The significant wave height magnitude is generally reduced in most areas surrounding the Project due to sheltering provided by the new reclamation. Wave energy in the Toondah Harbour area is already dissipated significantly by the shallow areas to the north and east of the Project footprint, so the additional sheltering effect of the new landform is not considered to be a major change to existing conditions.
- Some areas of net erosion or sedimentation are expected to result from these changes to currents and wave patterns. However, these will be minor and, in particular, the modelled impact to Cassim Island is negligible. Where additional areas of erosion have been identified it is expected that the seabed morphology will adjust and the erosion rate will reduce over time as a new equilibrium is established.
- No major changes to shoreline alignment or position are expected as a result of the Project, however, there may be some accumulation of sediment on the protected beach immediately to the north of the Project. Sediment already accumulates in this area and the Project is not expected to significantly add to sediment accumulation.

- The model indicates that the Project will not increase the water level or wave impacts associated with extreme events at the site. Rather, it shows that the Project is likely to provide some benefits to adjacent areas during extreme storm events due to reduced wave height in the lee of the Project footprint.
- The dredge plume modelling indicates that dredging-related turbidity and deposition rate impacts are relatively small compared to the natural variation in the ambient turbidity and impacts are limited to areas in close proximity to the Project. A combination of regional and local tidal dynamics results in the net northward transport of the dredge sediment plume, particularly over the ebb tide phase. Plumes reach as far north as Cleveland Point however turbidity levels are very low, generally less than 10 NTU outside of the immediate Project area. Ambient turbidity levels often exceed 100 NTU in nearshore areas during ebb tides therefore the short term and minor increases resulting from the dredging would likely be imperceptible from background levels outside of the Project area.

It should be noted that the modelling of dredge plumes and sedimentation rates do not take into account the use of silt curtains, which will be utilised wherever possible during the dredging process. When in place the silt curtains will significantly reduce turbidity plumes therefore modelling results would be considered worst case.

Water Quality

Available literature and data for water quality in the vicinity of the proposed development was collated and reviewed, including data collected as part of the Ecological Health Monitoring Program (EHMP) Queensland, and data collected during the maintenance dredging of Toondah Harbour and the Fison Channel in 2019. In addition, water quality loggers were installed at five sites for periods ranging from 18 months to four years.

Receiving water quality modelling was carried out including existing and future stormwater treatment to assess potential impacts to water quality. The outcomes of the modelling indicate that:

- The marina and internal waterways created by the Project are likely to be well flushed, and it is unlikely there will be phytoplankton blooms or eutrophication within these waterways;
- While there may be slight increases in the concentration of total nitrogen and phosphorous in the marina and internal waterways, these increases are very small compared to current concentrations;
- In wet weather conditions there is likely to be a reduction in the concentration of total suspended solids, total nitrogen and total nutrients in the intertidal area southwest of the ferry terminal due to an increase in the proportion of treated stormwater flows;
- Stormwater from the Project will not significantly negatively impact the management intent of High Ecological Value waters in surrounding the Project area;
- During the dredge campaigns most of the increases to turbidity are confined to the Fison Channel. There are likely to be some minor increases in turbidity to the north of the channel, over seagrass and bare sand/mud, and in mangroves to the south of the ferry terminal;
- Increases in sediment deposition are largely confined to the Fison Channel. In the first dredging campaign a small build up (2 – 3 mm) of sediment is also likely to be deposited in areas to the north east of the Project footprint unvegetated bare sand/mud, seagrass, macro-algae and some hard corals;
- Increases in deposition rates are lower in the second dredging campaign than in the first dredge campaign. In the second dredge campaign there were some brief increases in deposition rates over the seagrass close to the channel area being dredged; and
- In the context of existing regularly high turbidity in the vicinity of the proposed works, changes to the concentration of turbidity and sedimentation due to dredging are likely to be brief (in the order of days), short term (in that they are predicted to only increase during the dredging activity), and will not result in increases significantly greater than existing conditions.

Water quality will be monitored throughout the dredging and reclamation works, and during ongoing use and operation. During dredging, water quality and ecological condition will be assessed up and down current of the dredge activity, and at nearby sensitive habitats including:

- 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.

Stormwater management, dredging activities and reclamation works have been designed to minimise impacts to water quality. The proposed works will also be subject to management measures to ensure detrimental impacts to water quality are minimised by using appropriate erosion and sediment controls, management of potential acid sulfate sediments, and chemical (including fuel) management and containment.

Based on the modelling of potential impacts, and where monitoring and management measures are effectively implemented, long-term impacts to water quality as a result of the Project are unlikely.

Groundwater Quality and Quantity

A hydrogeological conceptual model was developed to describe the potential groundwater interaction by Project activities with the groundwater receptors within the existing environment.

Freshwater recharge into the regional aquifer occurs mostly inland through a combination of rainfall and urban seepage into the water table within the weathered Petrie Formation. Downward leakage of groundwater flow is constrained by deeper, unweathered low permeability basalt of Petrie Formation. As a result, groundwater flow is predominantly lateral from areas of higher elevation towards the coast, where it eventually discharges into the overlying Quaternary sediments and marine environments of Moreton Bay.

Groundwater levels in the Quaternary sediments (upper soil profile) are slightly lower than mean sea level, except when further inland and so predominantly receive seawater recharge. In contrast, groundwater levels in the Petrie Formation (lower base rock formations) recorded from monitoring bores near the coast are generally higher than the base of the Quaternary sediments and mean sea levels. This suggests that the Petrie Formation discharges into the overlying Quaternary sediments and the marine environment.

Groundwater quality baseline sampling found concentrations of arsenic, aluminium, copper, boron, iron, manganese, nickel and zinc. Comparison of the current water quality results with the previous study by Golder in 2013 suggests that some of these elevated concentrations are related to the rehabilitated landfill underneath GJ Walter Park. Sediments in the Moreton Bay marine environment also exhibit concentration levels naturally elevated in Ni, Hg, Pb, Zn and occasionally Cd, As and Cr. Future monitoring will consider the baseline groundwater chemistry concentrations and will to seek at a minimum to maintain existing water quality.

Modelling of potential drawdown of the groundwater table was carried out to identify potential for any impacts outside of the Project footprint. Drawdown of water levels on the landward side of the sheet piling wall during construction is

not significant and will only occur for a short time. Levels will recover following reclamation activities and removal of the sheet piling located at the interface of the existing shoreline and reclamation area. The drawdown is not predicted to be greater than 1.5 m in close proximity to the sheet piling wall and reduces in magnitude landward to the west in vicinity of GJ Walter Park.

The risk assessment determined the potential for significant impact was low after application of management measures.

Air Quality

Air quality impacts resulting from the Project in isolation, and with the inclusion of background concentrations of relevant pollutants, were determined at identified sensitive receptors using numerical modelling. The results were then compared to the identified air quality criteria considering both human health agriculture, forest, natural vegetation and ecosystem standards within the Air EPP as required by the EPBC Act EIS guidelines.

Compliance with relevant guidelines was generally predicted for all parameters at all locations. The model identified a potential exceedance in particulate matter in GJ Walter Park however this occurred due to a high background concentration and not Project activities.

Management measures will be based on the high-risk requirements as outlined in Guidance on the assessment of dust from demolition and construction. This includes the use of real-time particulate measurements to optimise site mitigation and ensure that actions on the site are performed in a way to minimise the risk of adverse impacts on the site and surrounds.

Considering the above the risk of significant residual impact to any environmental values is unlikely.

Terrestrial and Underwater Noise and Vibration

Background noise levels were obtained by attended measurements at three locations within the Toondah Harbour PDA during the cooler months when ambient noise levels are typically low.

The Project will include some night time activity however this will be limited to dredging and unloading of barges, which is unlikely to create significant noise levels. Daytime works will create audible noise, therefore noise goals were developed based on background data to adequately protect surrounding sensitive receivers' amenity. Modelling was carried out for work periods when the highest noise volumes were likely, such as pile driving and construction of the rock bund walls.
Maximum noise levels predicted by modelling range between 40 and 60 dB(A) at sensitive receptors such as Cassim Island. By way of comparison, noise levels for common noise sources reported by Safe Work Australia (2015) include:

- 30 dB – Whispering;
- 40 dB – Quiet radio music; and
- 60 dB – Normal conversation.

Noise modelling indicated that the construction works are likely to cause periods when noise levels are in excess of the residential goals as well as predicted levels of disturbance for shorebirds roosting at Cassim Island. These exceedances will be short lived and most of the construction period is expected to readily comply with the acoustic quality objectives. High noise works, such as construction of perimeter bunding, will be scheduled for winter months when less shorebirds will be present at the roost site minimising the potential for disturbance.

Underwater noise and vibration will only occur when vibratory sheet piling and circular pile driving is carried out within water. For the sheet pile bunds enclosing the reclamations this will only occur for approximately 3.25 hours either side of high tide. Underwater noise and vibration levels are not expected to exceed limits that would impact of marine mega fauna behaviour in areas outside of the Project footprint and immediate surrounds.

Management measures will be implemented to keep periods of high noise levels as short as possible (i.e. if an exceedance is likely to occur then complete the works as quickly as possible). Periods of respite will also be provided during high noise activities.

Lighting Strategy

The *National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds* and Australian Standard AS/NZS4282:2019: Control of the obtrusive effects of outdoor lighting, have been considered in the lighting design for the Project.

The philosophy adopted for the lighting plan is low, long and shielded. Specifically fixtures will be mounted as low as possible. Low mounted fixtures provide more light directly on the ground where it is needed for human safety. This also reduces the potential of a light source or lamp from being directly visible at distance. The Project will use long wavelength (greater than 560 nm AND absent wavelengths below 560 nm) light sources such as amber, orange, or red LEDs, without the use of filters, gels, or lenses. Using long wavelength light sources is less disruptive to marine turtles than white or multi-colored lights. The luminaire should meet or exceed full cutoff. This is defined as no light emitting above a 90-degree plane. The fixture must be shielded so that the lamp or glowing lens is not directly visible when looking towards the fixture at a large distance, i.e. 100^{+} m.

The proposed lighting during construction and operational phases will have luminaire design which directs light downwards and not horizontally or vertically. It is considered important to avoid light spill onto Moreton Bay. Luminaires that are elevated (such as streetlamps) may be visible from Moreton Bay. These luminaires will have inherent screens to minimise or avoid visibility of the luminaire at water level at distances of 500 m from the shoreline. The future residential towers will not feature large prominent illuminated areas on vertical surfaces.

Illumination levels (Lx) at ground level for the Project were modelled as part of the lighting strategy. The contours show that directly under a streetlamp the illumination level is approximately 20 Lx to 30 Lx, while under the park lights the illumination level is greater than 50 Lux (but of a much smaller area). Since the model has adopted "Dark Sky Compliant" luminaires, the illumination level quicky reduces to 1 Lux within the boundaries of the site. Apart from minor illumination of the marina water, there is no light spill onto adjacent mudflats, nor into the water, that could affect flora and fauna.

Waste Management

A large part of the waste profile will closely resemble that of any similar sized master planned community, with waste generation arising from domestic residential construction and uses along with significant retail and hospitality floor space.

Key outcomes from the waste assessment include:

- There is potential for impacts to wildlife from fugitive release of some waste streams, in particular plastic and packaging wastes and food wastes. However, the design of waste storage and transport modalities is well regulated under State law, including the W*aste Reduction and Recycling Act 2011* and the subordinate regulation and polices under the Queensland Government and local governments. A risk assessment based on minimum regulated management and controls has concluded a low risk of impact to MNES;

- Wastewater will not be treated on site. Wastewater will leave the site via a connection with the municipal reticulated system;
- Currently RCC operates recycling and processing facilities, although landfill is exported to sites in other municipalities. South East Queensland currently has an extensive private sector resource and recycling industry along with commercial landfill operations. These are subject to the current incentives and regulatory direction from all levels of government to improve resource recovery;
- All wastes, including trade wastes, liquid wastes, and solid wastes, will be transported off-site by road, other than wastewater sewer which will connect to municipal sewer mains. The State landfill levy along with other market based commercial incentives will ensure the maximum possible resource recovery occurs. The remainder will be transported to landfill within South East Queensland, within the requirements to ensure facilities will manage applicable regulated wastes;
- Wastes will not be discharged on or near the site. Disposal criteria will comply with the *Waste Reduction and Recycling Act 2011* and subordinate regulation and policy, as well as RCC policy which is aligned with State regulation; and
- Water quality of wastewater discharge will be managed by RCC under existing regulatory controls through of the State at the existing municipal waste facilities. Trunk line and treatment infrastructure capacity upgrades will be supported where necessary. There will be no direct releases from any part of Toondah Harbour to Moreton Bay, therefore the water quality objectives for Moreton Bay are not expected to be impacted by any discharge.

Terrestrial Ecology

The key assessment outcomes of the terrestrial ecology assessment include:

- No EPBC Act threatened terrestrial ecological communities are present within the Project area.
- No EPBC Act threatened terrestrial flora species are present within the Project area.
- The Project area supports 134 primary Koala food trees (predominantly *Eucalyptus tereticornis*), 82 secondary food trees and over 98 trees of other species which may provide shelter and roosting/sheltering locations for Koala.
- The findings of previous and current assessments of the site and surrounds indicate that the Project area contributes significantly to supporting the Cleveland urban Koala population, with at least seven Koalas relying entirely or almost entirely on its resources.
- Existing habitat connections between the Project area and surrounding bushland habitat are highly fragmented.
- While there are some food resources present for EPBC Act vulnerable Grey-headed Flying-fox, the Project area does not represent important habitat for the species.
- The Project area does not represent important habitat for EPBC Act vulnerable and migratory White-throated Needletail, a predominantly aerial species for which there are no roosting resources present.
- While components of the habitats within the intertidal ecosystems of Project area may be suitable for the EPBC Act vulnerable Water Mouse, the species has not previously been recorded on the western shores of Moreton Bay between Pumicestone Passage 54 km to the north and Behm Creek 22 km to the south of the Project area and no signs of the species were recorded during field surveys. The species is widely considered to be absent from this section of coastline.
- The diverse range of native terrestrial fauna species recorded from the Project has biodiversity and cultural significance at the local scale.

Potential direct and indirect impacts from the Project on the terrestrial environment include:

- Temporary noise, dust and vibration associated with construction of containment bunds, excavation, treatment and compaction of marine sediments potentially impacting wildlife within and outside the Project footprint.
- Temporary generation of road traffic for the delivery of machinery and materials, as well as for workers attending the site daily, impacting on Koala safety when crossing roads within and outside of the Project footprint, noting that most of the infill material would result from the channel dredging, which would minimise truck movements.
- Direct impact of removal of a small number of Koala habitat trees within the Project footprint.
- Temporary noise, dust and human presence associated with civil works potentially impacting wildlife in the terrestrial and marine environments within and outside of the Project footprint.
- Temporary generation of traffic for the delivery of machinery and materials, as well as for workers attending the site, impacting on Koala safety when crossing roads within and outside of the Project footprint.
- Erection of temporary fencing or other potential barriers to Koala movement for terrestrial works, including temporary road traffic barriers, potentially affecting the movements of resident and transitory Koalas.
- Traffic generated by the various residential, commercial and retail elements of the Project impacting on the safety of Koalas crossing roads within and outside of the Project footprint.
- Recreational use of the Project footprint by new residents, a proportion of whom would be dog owners, as well as an increase in visitors from outside the Project footprint attracted by ferry terminal upgrades and improved amenity, causing disturbance to native species within the Project footprint.

With the implementation of the proposed mitigation and management measures, no significant residual impacts are expected on terrestrial ecological values.

Of the 215 Koala food trees recorded within GJ Walter Park and other areas within the PDA, only one primary food tree and 18 secondary food trees are within the Project footprint and will be removed as a result of construction works. Fifteen of these trees are within existing carpark plantings and are not considered to represent critical habitat for Koalas due to the existing threats present in these locations. To mitigate this impact and enhance the value of the Project footprint as Koala habitat, it is proposed to plant approximately 1,000 Koala food trees with occasional shelter trees over an area of 1 ha within GJ Walter Park. The planting will be comprised primarily of the primary food tree *Eucalyptus tereticornis*.

The same habitat areas within GJ Walter Park and the trade school grounds also support feeding resources for Grey-headed Flying-fox, primarily the winter-spring flowering *Eucalyptus tereticornis* that provides food for the species at a time when available resources are scarce. The proposed supplemental planting for Koala will likewise benefit Grey-headed Flying-fox.

The Project will increase the potential for indirect impacts to Koala through increased traffic generation internal and external to the Project footprint. The proposed Koala underpass beneath Middle Street will ensure the increased traffic at this location is not a barrier to Koala movement. Further measures will be identified and enacted by contributing to the establishment of a 'Safe Koala Neighbourhood' that incorporates the Project footprint and surrounds. The program will provide community education and participation, monitoring and management opportunities beyond those that could be achieved by the Proponent alone and will allow a broader and coordinated approach to the identification and management of threats to Koalas in the local area.

Migratory and Threatened Shore Birds

Based on the results of desktop assessment and extensive field surveys, 19 migratory shorebird species including seven species listed as threatened under the EPBC Act and NC Act are known to occur within the Toondah Harbour PDA.

Important habitats used by migratory shorebirds within or adjacent to the Toondah Harbour PDA include tidal flat feeding habitat and three roost sites:

- Cassim Island mangroves located east of the Project footprint;
- Nandeebie Claypan located south-west of the Project footprint; and
- Oyster Point located 400 m south-west of the Project footprint.

The Toondah Harbour Project footprint incorporates approximately 28.9 ha of tidal flat that is used as feeding habitat by migratory and resident shorebirds. Five migratory shorebird species regularly used the tidal flats for feeding at low tide during the summer months (October-February) over the five years from 2018 to 2022:

- Grey-tailed Tattler (present on 75% of surveys; average of 12);
- Vulnerable Bar-tailed Godwit (present on all surveys; average of 13);
- Whimbrel (present on all surveys; average of 8);
- Critically endangered Eastern Curlew (present on 97% of surveys; average of 3); and
- Terek Sandpiper (present on 36% of surveys; average of 5).

A further four species were rarely recorded in small numbers: the critically endangered Great Knot, the endangered Lesser Sand Plover, Red-necked Stint and Common Greenshank.

The Cassim Island roost site was used by an average of 890 and maximum of 1,300 migratory shorebirds during the summer months over the past five years. Species observed were mostly Grey-tailed Tattler but also Whimbrel, Terek Sandpiper, Ruddy Turnstone and occasionally several Bar-tailed Godwit and Common Greenshank. Within the past five years, the roost site supported six migratory shorebird species, including up to 1.6% of the estimated flyway population of Grey-tailed Tattler (internationally significant), up to 0.3% of the estimated flyway population of Whimbrel (nationally significant) and up to 0.1% of the estimated flyway population of Terek Sandpiper (nationally significant).

The Nandeebie Claypan roost site has historically been used by 11 migratory shorebird species, the most abundant being the vulnerable Bar-tailed Godwit, with the critically endangered Eastern Curlew and Whimbrel also frequently present in lower numbers. The frequency of use of the roost site has steadily declined since the mid 1990s and no migratory shorebirds have been recorded over 45 surveys since the last recorded use of the roost in January 2020, therefore the site is considered to be abandoned. The declining use of the roost site by migratory shorebirds is attributed to mangrove encroachment.

The Oyster Point roost site has been used by a total of 15 migratory shorebird species, the most frequent and abundant species being Bar-tailed Godwit, with Eastern Curlew and Whimbrel also frequently present in lower numbers. Within the past five years, the roost site supported nine migratory shorebird species, including up to 0.1% of the estimated flyway population of Eastern Curlew (nationally significant) and up to 0.5% of the estimated flyway population of Bar-tailed Godwit (nationally significant).

Dredging and reclamation to accommodate the Project footprint will result in a permanent direct impact on 28.9 ha of tidal flat habitat that provides feeding habitat for migratory shorebird species. This area coincides with the seagrass and unvegetated mud/sand habitats. Tidal flat feeding habitat within the Project footprint is characterised as important habitat for migratory shorebirds under the EPBC Act since it occurs within the MBRS.

The loss of a relatively small area of feeding habitat in south-western Moreton Bay as a result of the Project is unlikely to result in a proportionate reduction in the population sizes in Moreton Bay of threatened migratory shorebird species such as Eastern Curlew, Great Knot, Lesser Sand Plover and Bar-tailed Godwit as Moreton Bay is considered to have significant remaining habitat capacity for these species. Non-threatened migratory shorebird species such as Grey-tailed

Tattler, Whimbrel, Terek Sandpiper, Red-necked Stint and Common Greenshank are found in large numbers throughout Moreton Bay however the loss of a small amount of feeding habitat would not be expected to result in a significant reduction of these species in the bay.

The implementation of a range of management measures to reduce indirect disturbance, such as fauna friendly lighting strategies and avoiding high noise generating activities during periods when shorebirds are most active, minimises potential impacts on areas outside of the immediate footprint. The Project is not expected to have significant residual impacts on migratory shorebirds using the roost sites adjacent to the Project footprint.

Marine Ecology

Moreton Bay supports a diverse range of habitats with high ecological connectivity including saltmarsh, mangrove, tidal mudflats and sandbars, coral reefs, rocky reefs, seagrass beds and unvegetated sediment. Prior to European settlement, shellfish reefs were also extremely abundant.

Contemporary literature and databases were carried out and key researchers were contacted to determine the distribution and ecological sensitivities of marine fauna, flora and habitats that may be impacted by the Project. From this information, a preliminary map of the distribution of habitats in the proposed Project footprint and surrounding Marine Investigation Area (MIA) was prepared, and then ground-truthed and updated with field surveys.

Habitats

Unvegetated mud and sand flats and banks are the dominant habitat in Moreton Bay, and within the MIA. Other habitats recorded in the MIA included seagrass, rubble, coral and macroalgae. Seagrass dominated the Project footprint, extending seaward from the mangroves to Cassim Island and into the proposed channel.

There are approximately 15,231 ha of mangroves, 3,080 ha of saltmarsh and 1,591 ha of claypan habitat in Moreton Bay. The area of mangroves is increasing over time, primarily due to sea level rise, and resulting in a landward encroachment of mangroves into saltmarsh areas. In contrast, the distribution of saltmarsh is decreasing, as landward colonisation of saltmarsh is largely constrained by landform, infrastructure, or urban and agricultural development.

The dominant mangrove community within both the Project footprint and MIA is the grey mangrove (*Avicennia marina*). Saltmarsh within salt-tolerant shrub communities is dominated by samphire (*Sarcocornia sp*.) and seablite (*Suaeda spp*.), while grassland communities are dominated by marine couch (*Sporobolus virginicus*), saltwater couch (*Paspalum vaginatum*) and rush *(Juncus kraussii*).

There are approximately 17,900 ha of seagrass in Moreton Bay, with the largest areas on the Eastern Banks. Seagrass is predominantly in intertidal and subtidal areas, down to -5 m LAT. *Zostera muelleri* is the dominant species in Moreton Bay, as well as within the Project footprint. Seagrasses can be classified according to their response to disturbance, with three groups that form a continuum: colonising, opportunistic and persistent species. The dominant species in the Project footprint and MIA are colonising and opportunistic species.

Coral communities within Moreton Bay are in marginal environmental conditions, and tend to consist of widely distributed, generalist, stress tolerant and opportunistic coral species, with massive and horizontally spreading morphologies. Coral reefs in the inner bay are mainly in shallow (>-3 m LAT), inshore areas and are characterised by a mixture of soft and hard corals, and algae. No significant areas of live corals were recorded in the Project footprint or MIA; however, scattered and isolated hard and soft corals are found around Cleveland Point, north and east of Cassim Island, the northern end of the Project footprint, and at the tip of a sandbar in the south of the MIA.

Marine Megafauna

Moreton Bay provides food and habitat for a number of marine megafauna species including marine turtles, dugongs, dolphins, sharks, and rays. Of these, Australian Humpback Dolphins, Dugong, Loggerhead Turtles, Green Turtles and Hawksbill Turtles are species listed as MNES and known to occur in the vicinity of the Project footprint.

Within the bay, the Eastern Banks have the highest density of marine turtles and Dugong, while the central-western side has core areas of usage for Australian Humpback Dolphins. There are also 30 species of ray and 44 species of shark found throughout the bay.

Soft Sediment Invertebrates

Dominant invertebrate species varied between habitats; mangrove epifauna was dominated by prawns/shrimps and crabs, with a high abundance of gobies (benthic fish). Soft sediment infauna was dominated by polychaete worms, rubble epifauna by mussels, seagrass epifauna by marine snails and hermit crabs, and bare mud and sand epifauna by whelks.

Potential Impacts, Management and Monitoring

The Project will result in the direct loss of marine and wetland habitat within the reclamation and dredging footprint including:

- 3.4 ha of mangroves;
- 37 ha of seagrass, including 11.8 ha in the Fison channel extension; and
- 8.8 ha of unvegetated sand/mud.

Some seagrass is likely to regrow in the proposed channel, as it did after the previous maintenance dredging of the existing channel in 2019.

Five threatened marine species have the potential to utilise habitats within or adjacent to the Project footprint: Loggerhead Turtle, Green Turtle, Hawksbill Turtle, Dugong and Australian Humpback Dolphin. While Dugong and marine turtles feed on seagrass, the Project footprint does not provide significant habitat for them, with population densities far higher on the Eastern Banks of Moreton Bay (the landward side of the bay islands). Australian Humpback Dolphin is found throughout the bay; however, the Project footprint is not part of their core habitat.

Changes to stormwater runoff due to the Project are unlikely to negatively impact water quality, aquatic habitats or fauna and flora outside of the Project footprint. Inside the Project footprint there may be some slight increases in suspended solids and nutrients within the marina and internal waterways, however modelling indicates these areas will be well flushed by tidal forces therefore eutrophication (high nutrient levels resulting in algal blooms) is unlikely.

While there may be some short-term localised changes to turbidity during dredging, and some localised minor changes to erosion and sedimentation rates, this is unlikely to significantly impact aquatic marine species, or the habitats that support them.

Existing turbidity in the vicinity of the proposed works is already high, chronically exceeding water quality objectives. Predicted increases in turbidity in the dredge campaigns are short lived, and usually less than the current ambient maximums. Consequently, the changes to turbidity are unlikely to negatively impact the seagrass, rubble, coral and mangrove areas in the vicinity of the proposed works. These communities are already adapted to high and variable turbidity. It is also noted that silt curtains will be used where possible to reduce the extent of turbidity plumes, which would result in much smaller impacts than those shown by dredge plume modelling.

Fish, turtles, dugong and dolphin may be trapped within the reclamation areas as they are bunded off. However, this risk will be mitigated through a range of standard management practices including installing barriers at low tide, using trained marine megafauna spotters during works to ensure no megafauna are trapped within the bunded areas and using mechanical noise and boat activity to deter marine mammals from entering bunded areas.

Underwater noise and vibration will be generated from activities such as dredging and pile driving. Assessment of underwater noise sources found levels will not exceed thresholds for changes in fauna behaviour outside the areas immediately surrounding Toondah Harbour. This area does not provide significant habitat for any listed marine mega fauna species therefore potential for impacts are minimal.

Increased boating activity in the area has the potential to result in more collisions with marine megafauna. During dredging operations this will be mitigated by a comprehensive management plan that includes fauna spotters, restrictions on vessel movement when marine megafauna are sighted, vessel exclusion zones around megafauna, and adherence to speed limits.

The Project will not result in a significant increase in marine vessel usage in Moreton Bay but may result in some changes to usage patterns via decommissioning the existing boat ramp, providing wet berths, providing funds for the upgrading the William Street boat ramp, and providing access for non-motorised vessels. It will also facilitate an increase in ferry trips and allow larger vessels to use the channel. As the predicted increase in vessel traffic directly attributable to the proposed development is small in comparison to broader recreational boating usage in the region, the increased risk resulting from the proposed development to marine fauna is expected to be minor.

Other potential risks, such as disturbance of acid sulfate soils, spills of hydrocarbon and other contaminants, introduction and spread of pest species, and increased litter, are low, and can be reduced through appropriate site management.

Water quality and the condition of key habitats will be monitored throughout the dredging and reclamation works and initial use of the site post development. Where detrimental impacts to either water quality or habitat are detected, management responses will be implemented.

Aboriginal Cultural Heritage

Background research was undertaken using historic information, oral history and local knowledge, aerial photographs and field observations to identify sites and areas of archaeological potential. Following this, pedestrian survey was conducted to assess surface manifestations of Aboriginal cultural heritage within the study area and advise on the potential for sub-surface deposits. Key outcomes included:

- There were no recorded Aboriginal Cultural Heritage sites listed on the DATSIP database within 1000 m of the study area. There is one previously recorded DATSIP site within 3 km of the study area.
- Four sites of Aboriginal Cultural Heritage were identified within the study area including two artefact scatters, being (a) four red chert flakes and (b) one silcrete core, one whelk and other shell fragments and two isolated artefacts, being (a) two basalt flakes and (b) one silcrete core.
- The review of historic aerial photography suggests that much of the south-eastern portion of the study area had been subject to significant ground disturbance. 'Disturbance', in this instance primarily involved the dumping of sediment, burying the original land surface;
- Following the pedestrian survey, six areas were identified as being of risk to Aboriginal cultural heritage (i.e. having the potential to contain sub-surface cultural heritage);
- Pedestrian survey concluded that there was potential for the proposed works to interact with Aboriginal cultural heritage, as demonstrated by the identification of cultural heritage material, and a sub-surface testing investigation was proposed and subsequently undertaken; and

- Initial areas of risk to Aboriginal cultural heritage and management recommendations were revised as part of the testing exercise in 2020, which facilitated a greater understanding of the study area's potential to hold archaeology.

QYAC is the body responsible for determining ongoing risks to cultural heritage. Indigenous cultural heritage will be managed under a cultural heritage management plan (CHMP) specific to the Project.

Commercial and Recreational Fisheries

Recreational fishing is the dominant activity within Moreton Bay, which is the most important commercial fishing region in the state by volume and value of fish per unit area. Indigenous fisheries are also important for the traditional owners – the Quandamooka people. There are a variety of limited entry commercial fisheries which are licenced to operate within Moreton Bay. The potential impacts of any coastal development on fisheries includes two main considerations: potential impacts to access by fishers and loss or modification of habitats that may alter populations of fished species.

Compulsory commercial fishing logbook data represents the best available data on commercial fishing activity. The data identified that the northern part of Moreton Bay represented a more important area for commercial fishing than the southern part. This was particularly the case for the otter trawl fishery. It was identified through consultation and available information that individual commercial tunnel netters did access part of the Project area at times, but it did not represent a key location for the activity of this fishery. This was also the case for the commercial blue swimmer crab fishery. It was concluded that the Project represented no risk to access for the commercial otter trawl, ocean beach or line fisheries as these fisheries did not occur at the Project area. It was concluded that the project represented a medium risk to the net fishery with an emphasis on the tunnel net fishery, and the blue swimmer crab fishery.

Through discussion with commercial fishing representatives, it was identified that the eastern and northern side of Cassim Island is utilised by commercial tunnel net fishers and there is some utilisation by commercial blue swimmer crab fishers of the area. The area is not utilised by commercial otter trawl fishers. While there is some boat-based access by recreational fishers around Cassim Island and some land-based access at GJ Walter Park, neither of these locations are identified as important locations for recreational fishing activities.

The Project will result in the removal of up to 37 ha of seagrass and 3.4 hectares of mangroves, some coral rubble and shallow unvegetated habitats. Partly in place of this habitat will be artificial habitats including rock walls and marine infrastructure such as pontoons and deeper unvegetated habitat. Impacts during construction on areas adjacent to the Project area will be minimised or eliminated through standard procedures. There is scope to engineer rock walls to enhance them as fisheries habitat while still remaining fit for purpose, as well as incorporating small patches of oyster reef which was one of the dominant habitats in western Moreton Bay at the time of European arrival. The loss of seagrass habitat is expected to have local impacts on the abundance of some fished species that utilise this habitat in preference to other types, including garfishes and tiger prawns. It is highly unlikely that these local impacts will have impacts on these species at the population level or their overall spatial distribution within Moreton Bay. Other fished species such as yellowfin bream adapt readily to artificial habitats and can become abundant in them.

The Project will result in the closure of the current public boat ramp at Emmett Drive which is little used. Within the Project footprint. a new launching point for non-powered vessels (e.g. kayaks) will be constructed with associated parking. The Proponent will make a financial contribution to support upgrade of facilities at the William Street Boat Haven, Cleveland, to compensate for the reduced public access for motorboats at Toondah Harbour. This outcome was based on feedback from the recreational fishing sector. Compared to current arrangements, the Project will improve opportunity and amenity for land-based recreational fishers along the eastern foreshore of the Project.

Social Matters

Key social impacts and benefits resulting from the Project include:

- **Increased local employment opportunities**: The Project is expected to have a high positive impact by increasing employment opportunities for the local community. The selection of Toondah Harbour as an Indigenous Project under the Queensland Government's Building and Construction Training Policy is likely to have a particularly positive impact, due to requirements relating to matters such as employment of apprentices, trainees and local First Nation peoples. The jobs created during the construction and operations phases of the Project will also contribute to reducing Cleveland's unemployment rate, which is higher than the LGA average.
- **Increased housing diversity**: Detailed design of housing is to be undertaken as part of the next stages of the planning process. With the incorporation of recommendations made in the Social Impact Assessment (SIA) associated with the EIS, the Project has the potential to have a high positive impact on housing diversity in Cleveland and the Redlands. This includes the provision of dwellings of diverse sizes and configurations, as well as the incorporation of accessible and affordable housing.
- **Improved safety and activation**: The Project is expected to have a positive impact on the local area by significantly improving and upgrading the safety of Toondah Harbour's port and ferry route in line with maritime standards for two-way channels. The Project will provide opportunities for additional operators to access the site, for example, charter operations, or new routes within southern Moreton Bay. The Project will also broaden opportunities for increased activation and natural surveillance across the site through a mix of uses and new access routes.
- **Access to open space**: The Project is expected to have a high positive impact on the provision of accessible and embellished open space to the community. GJ Walter Park is proposed to be retained and improved, with no loss of access to this space other than during temporary periods associated with minor improvement works. The Project will also result in 3.5 ha of new foreshore parks, plazas and boardwalk connections, providing a range of recreation and leisure opportunities. A lagoon pool and water play area have been incorporated into the design as a result of community engagement. These facilities will increase the positive impact of the Project.
- **Pressure on health and education facilities**: The incoming residential population is unlikely to create excessive demand on the surrounding health and education facilities and will have a low impact on the community. The approved upgrades to Redland Hospital, as well the Queensland Schools Planning Reference Committee assessment that no new schools are needed in Cleveland over the next 20 years, suggests the needs of the incoming and existing residential population can be accommodated adequately.
- **Change to local character**: It is expected the Project will have a very high overall impact on the community's understanding of the local character of Toondah Harbour and surrounding areas. The nature of this impact (positive to negative) is likely to vary considerably between community members, based in part on their perceptions of the Project overall. Ongoing implementation of the management measures and SIA recommendations will be important to reflect local character, encourage a sense of community ownership and support the community to adapt to change over time. Delivery of an ongoing Communications and Engagement Plan, with community participation, will assist in managing this impact.

Based on this assessment and the implementation of recommendations, it is likely the Project will generate a positive social impact. Best practice communications, engagement and, where possible, participatory processes, will be critical in achieving this outcome. Engagement will be particularly important in reflecting local character, encouraging a sense of community ownership and supporting the community to adapt to change over time.

Economic Matters

The cost-benefit analysis of the Toondah Harbour Project demonstrates that the Project is economically feasible. At a real social discount rate of 7 per cent (the discount rate accounts for the social opportunity cost of capital), the development

has a Net Present Value of $412.6 million, with a Benefit Cost Ratio of 1.48. This means that for every dollar invested in the project, an economic return of $1.48 is derived.

The vast majority of the economic benefits derived from the Project are accounted for by the economic value of the land created by the development to be used for residential, commercial and retail purposes. Likewise, the capital costs account for the majority of the economic cost under the Project case.

The regional economic impact analysis demonstrates the development will make a significant contribution to regional economic activity, both through construction activity, and through the increased tourism expenditure at both Toondah Harbour and on Minjerribah (North Stradbroke Island). In terms of the construction impacts, the analysis shows the project will contribute up to $1,560 million to regional output and support peak annual employment (construction and operations) of over 1,000 FTEs.

In terms of the ongoing impacts on Minjerribah and the rest of the Redlands regional economy, the additional tourism expenditure to be facilitated by the development is estimated to result in the following beneficial impacts:

- For Minjerribah, the following increases by 2030:
    - $152 million in additional gross output;
    - $83 million in added Gross Regional Product; and
    - Additional employment of 357 FTEs.
- For the rest of the Redland LGA (i.e. Toondah Harbour and other locations), the following total impacts, based on projected increased in tourist visitations and expenditure from 2026 to 2041:
    - $440 million in additional gross output;
    - $140 million in added Gross Regional Product; and
    - Additional employment of up to 135 FTEs.

These beneficial impacts are particularly significant given the importance of facilitating the growth of a sustainable Minjerribah tourism industry following the cessation of sand mining in 2019, and subsequent loss of economic activity and employment and the limited alternative drivers of employment growth throughout the Redland LGA.

MNES Significant Impact Assessment

Threatened Species

Assessment against the relevant criteria for the threatened species MNES found the following species are likely to be significantly impacted by the Project:

- Eastern Curlew – Critically endangered
- Great Knot – Critically endangered
- Lesser Sand Plover – Endangered
- Bar-tailed Godwit – Vulnerable

All four threatened species likely to be impacted are migratory shorebird species that use the mudflats where reclamation and dredging will occur as foraging habitat. It is of note that two of the species, Great Knot and Lesser Sand Plover, have very rarely been observed using the mudflats. A single Great Knot was observed during one survey of the 49 carried out at the mudflats. That was in 2014 and the species has not been observed on the mudflats since that time. Two Lesser Sand Plovers were observed during a single survey of the 49 carried out, which was in 2019. Eastern Curlew is observed regularly at the site but in low numbers (average of 3.5 when present). They do not utilise the adjacent Cassim Island roost site and, while they were observed regularly at Nandeebie Claypan, this roost site is considered abandoned as no migratory shorebirds have been observed since 2019. The Bar-tailed Godwit is observed regularly in small number (average of 13 when present) as well as Cassim Island which they occasionally use as a mid tide roost site (i.e. they must find another site for roosting during high tides).

Importantly significant impacts are only considered likely for all four species due to a loss of critical habitat or 'area of occupancy' for that species. Tidal flats in Toondah Harbour are only considered critical habitat for these species as it is located within the Moreton Bay Ramsar Site (MBRS). If the site was not in the MBRS it would not meet any other criteria to be considered critical habitat for these species.

Dredging and reclamation will reduce the area of occupancy of the species in tidal flat feeding habitat by 0.29% within Moreton Bay. Moreton Bay likely retains significant carrying capacity in available foraging habitat for these species therefore it can be reasonably expected that these migratory bird species will utilise other foraging habitat nearby. Consequently, the loss of a relatively small area of feeding habitat as a result of the Project is unlikely to result in a proportionate reduction in the population sizes of these species.

Migratory Species

Assessment against the relevant criteria for the migratory species MNES found the following species are likely to be significantly impacted by the Project:

- Grey-tailed Tattler
- Whimbrel
- Terek Sandpiper
- Red-necked Stint
- Common Greenshank

Similar to the threatened species all five migratory species considered likely to be significantly impacted are migratory shorebirds. Both species were observed consistently feeding on the mudflats within the Project footprint in low numbers (average of 12.5 and 7.6 when present for the Grey-tailed Tattler and Whimbrel respectively) and both used Cassim Island as roosting habitat. Cassim Island is a significant roosting site for Grey-tailed Tattler in particular with an average of 655

birds observed whenever they were present. An average of 159 Whimbrels and 32 Terek Sandpipers were also observed when present at Cassim Island. Based on these observations the roost site is considered internationally significant for Grey-tailed Tattler, and nationally significant for Whimbrel and Terek Sandpiper.

While short-term disruption of roosting behaviour from noise and activity is possible at Cassim Island during during construction, particularly revetment wall construction, the risk of disruption will be minimised by scheduling activities generating noise levels exceeding 60 dB(A) in the receiving environment of the high-density roost areas to the winter months when fewer migratory shorebirds are present. Disruption from long-term operational activities is unlikely once mitigation measures are successfully implemented, particularly the exclusion of non-motorised watercraft from entering the Cassim Island roost site.

The Project will result in the loss of 28.9 ha of feeding habitat for these species, which corresponds to 0.29% of the approximately 10,000 ha of important tidal flat habitat within Moreton Bay (Fuller *et al*. 2021). The loss of this habitat and potential for significant impacts on these species will be offset through a range of projects delivered through the Environmental Offsets Strategy. These projects will be required to demonstrate a conservation benefit to the matter being impacted.

Cumulative and Consequential Impacts

A Cumulative Impact Assessment (CIA) was carried out addressing likely cumulative and consequential impacts associated with the Toondah Harbour Project. Where EIS studies found impacts to an environmental value are unlikely to occur or will be localised to the Project area, those values have not been considered further in the CIA. Environmental values with the potential to be impacted include:

- Water Quality – modelling indicates dredge plumes will extend from Cleveland Point in the north to Goleby Esplanade Foreshore Park in the south;
- Terrestrial threatened species and communities – potential cumulative and consequential impacts include increased traffic and barrier to movement for urban Koala populations in the Cleveland area;
- Migratory and threatened shorebirds – While impacts are not expected outside of the Project area, migratory birds are highly mobile and have the potential to utilise habitats throughout Moreton Bay; and
- Marine threatened species and habitats – the Project is considered unlikely to impact on any threatened marine species therefore the CIA addresses potential impacts to marine habitats including mangroves, saltmarsh and seagrass.

Water Quality

The risk of potential cumulative impacts to water quality is considered to be very low for the following reasons:

- As a result of the high level of treatment, ongoing regulation requirements and large distance between the sites, the risk of cumulative impacts from the release of nutrients from the WWTPs and the incremental increases associated with Toondah Harbour Project is expected to be minimal;
- Impacts from sediment suspension (plumes) and settlement (sedimentation) from the Toondah Harbour Project are expected to be minor outside of the immediate Project area;
- Impacts from sediment suspension and settlement from nearby sites that undergo regular maintenance dredging (Raby Bay and Weinam Creek) would be smaller than those predicted for Toondah Harbour as the amount of material dredged is significantly lower than the Project;
- Sediment plumes from capital dredging associated with the Toondah Harbour Project or future maintenance dredging events are unlikely to overlap with sediment plumes from maintenance dredging at nearby sites spatially or temporally;

- Maintenance dredging at these sites (and many others in Moreton Bay) have been carried out for decades. Habitats within western Moreton Bay have adapted to intermittent increases in turbidity as it is a regular occurrence either from dredging, strong tidal currents and storm events; and
- Future maintenance dredging at Toondah Harbour would be expected to result in similar impacts to existing maintenance dredging events, therefore future impacts would not be additional to what is already occurring.

Terrestrial Threatened Species (Koalas)

The risk of cumulative and consequential impacts to Koalas is considered low to medium. Several management measures will be put in place within the Toondah Harbour PDA to improve existing habitat and allow the small number of Koalas that utilise the area to move through the site including fauna crossing measures. While increased urbanisation of Cleveland will result in increased threats for the local Koala population, the population is not considered to meet national criteria to be considered an MNES and it is expected the implementation of a number of management measures and educational programs in the broader suburb could successfully mitigate against cumulative or consequential impacts to Koala.

Migratory and Threatened Shorebirds

A recent draft report prepared by the University of Queensland for Healthy Land and Water (Fuller et al. 2019 - Managing Threats to Migratory Shorebirds in Moreton Bay Draft report) identified distribution and management of roost sites as the key threat to migratory shorebirds in Moreton Bay. A key concern is the imminent loss of a temporary roost site on the Port of Brisbane reclamation area which currently provides roosting habitat for approximately one third (8,000) of Moreton Bay's shorebirds.

While the Toondah Harbour Project will result in the loss of foraging habitat for migratory shorebirds, there are over 100 km^2 of intertidal habitat in Moreton Bay, constituting substantial potential foraging habitat for migratory shorebirds. Significant residual impacts to roosting habitat is not predicted as a result of the Toondah Harbour Project.

To provide the best conservation outcome for migratory shorebird species in Moreton Bay, the offsets strategy for the Project has focussed on providing additional or improved roosting habitat in areas immediately surrounding Toondah Harbour and other important areas in Moreton Bay, including near to the Port of Brisbane reclamation ponds.

No other known or speculative projects are likely to directly impact on the foraging or roosting habitat on migratory and threatened shorebirds in Moreton Bay as state and local legislation and planning implements generally discourage development within or immediately adjacent to tidal areas. The Toondah Harbour Project is unique in the SEQ region and focused around the existing ferry terminal and harbour uses as well as the PDA, which was established by the Queensland Government and RCC in recognition that Toondah Harbour is the existing and optimum location for an urban and maritime hub in Moreton Bay. While cumulative risk is identified as medium, this is mostly a result of the loss of significant temporary roosting habitat at the Port of Brisbane.

Marine Threatened Species and Habitat

The risk of cumulative impacts to marine threatened species and habitat is considered low. Impacts would be related to other dredging projects in Western Moreton Bay, however risk of impact at each location is considered low as:

- Increases in turbidity and sedimentation during dredging were predicted to be mostly within the dredge area, with some increases over nearby seagrass, coral, mangrove and rubble communities.
- Changes to turbidity and sedimentation due to dredging are likely to be limited to the dredge campaigns, with turbidity returning to ambient levels once dredging ceases.
- Turbidity in Western Moreton Bay is already high, regularly exceeding water quality objectives.
- Predicted increases in turbidity in the dredge campaigns are short-lived, and usually less than ambient maximums. Consequently, the changes to turbidity and sedimentation are unlikely to negatively impact the

seagrass, rubble, coral and mangrove areas in the vicinity of the proposed works as these communities are already adapted to high and variable turbidity.

- The relatively small increases in sediment deposition are unlikely to negatively impact the long-term distribution and growth of seagrass in the area.
- Similarly, the soft sediment benthic fauna, macroalgae and coral communities growing in the areas that may be impacted by increased sedimentation rates, are adapted to current conditions, including the deposition of sediment.

While dugong and marine turtles feed on seagrass, Western Moreton Bay generally is not significant habitat for them, with population densities far higher on the Eastern Banks. Australian Humpback Dolphin is found throughout the bay; however, no areas that would be impacted by these actions would be considered core habitat. Consequently, the direct loss of seagrass habitat in Western Moreton Bay is unlikely to have a significant impact on marine MNES species.

Other Consequential Impacts

Other consequential impacts assessed include increased boat and recreational vessel usage and climate change impacts resulting from the Toondah Harbour Project. The Project is not expected to result in an overall increase in boat traffic as the removal of the existing boat ramp is expected to offset additional trips generated by development of the marina. There is some potential for non-motorised watercraft utilising the new boat ramp to impact on roosting shorebirds at Cassim Island, however a number of management measures will be put in place to minimise impacts. Educational signage, fencing to stop people accessing Cassim Island from the rock breakwater, and the implementation of an exclusion zone around Cassim Island will also be discussed with the Queensland Government and RCC.

The Project itself will not generate significant amounts of carbon and will not contribute to drivers of future climate change. Coastal processes modelling reviewed potential wave and water level impacts of the completed project under various sea level rise scenarios and an extreme weather event. Two different levels of sea level rise were assessed, 0.4 m (likely to occur over the next 50 years based on current predictions) and 1.5 m (specified by the EIS guidelines). Under both scenarios, the extent of existing mudflats at Toondah Harbour will be significantly reduced in a without Project scenario. Modelled maximum water levels during storm events indicate under both extreme event scenarios that the Project footprint effectively provides additional shielding from Toondah Harbour to south of Oyster Point.

MBRS Ecological Character Impact Assessment

To determine if significant impacts to the ecological character of the Moreton Bay Ramsar Site (MBRS) are likely, two levels of assessment have been carried out:

- Review of the impacts against the critical components, processes and services represented within the Project footprint and Zone of Influence and assess the contribution to the ecological character of the; and
- Assessing the impacts against the EPBC Act significant impact criteria for wetlands of international importance.

Based on the findings of this assessment, an analysis of the potential for the Project to change the ecological character of the MBRS or result in an impact on the Ramsar wetlands of international importance MNES has been carried out and the results summarised in Table ES-5.

The Project will result in the loss of wetland habitat including mangroves, saltmarsh, seagrass and unvegetated mud/sand. The area of wetland habitat being lost is relatively small and are well under 1% of comparative habitats in the MBRS.

Potential for impacts outside of the Project footprint, including on adjacent high tide roost sites, is considered to be minimal with any minor impacts expected to be short term (e.g. construction noise) or activities that shorebirds will

habituate to over time (e.g. increased pedestrian use of foreshore public open space and walking/cycle paths). The potential for disturbance will be further minimised through careful placement of designated walking tracks, use of exclusion fencing and educational signage.

As the Project is unlikely to have any significant impact on critical components and processes outside of its footprint, impacts to services will only occur at the local scale. Impacts to these services are expected to be minor and the Project will provide a range of benefits in the context of sustainable development to balance these minor impacts including:

- Creation of approximately 1.5 km of rockwall that will be designed to provide fish habitat and roosting habitat for a number of migratory bird species, including grey-tailed tattler, ruddy turnstone and terek sandpiper.
- Marine structures such as dolphins and jetties will provide habitat for fish species.
- Creation of oyster reefs within the Project footprint will provide further habitat for fisheries species.
- Stormwater treatment will reduce nutrient loads released into Moreton Bay during storm events given that the existing harbour currently has no treatment measures.
- The upgrade of the ferry terminal, turning basin and Fison Channel, and the provision of an education centre as well as a visitor information centre, will add significantly to the recreational, tourism and educational values of Moreton Bay, both of which are considered critical services of the MBRS.
- The interpretation and awareness raising of Aboriginal cultural heritage values through signage, public art and opportunities for land and sea country management and cultural and nature-based tourism activities will promote the Indigenous cultural heritage of Moreton Bay, which is considered a critical service of the MBRS.
- A 3.5 ha foreshore park including an education centre, providing for a range of recreational activities and community engagement with Moreton Bay.

Accordingly, a change in ecological character of the MBRS as defined by the Ramsar Convention will not result from the Toondah Harbour Project. While impacts will be localised and not result in a change to the ecological character of the MBRS, a small area of the wetland (less than 0.02%) will be substantially modified resulting in a significant impact to a wetland of international significance under the EPBC Act.

While the Project is considered likely to have a significant impact as defined by the EPBC Act, avoidance and management measures will ensure impacts are contained to the Project footprint. The habitats impacted are not considered to provide significant or unique values in comparison to other similar areas with the MBRS.

Unavoidable residual impacts to wetland habitats within the MBRS resulting from the Project are:

- 2.5 ha of mangroves;
- 24.7 ha of seagrass, excluding 10.1 ha in the Fison Channel which are likely to recolonise; and
- 7.5 ha of unvegetated intertidal sandbanks and mudflats.

These residual impacts will be offset through the implementation of a fund that will deliver $4.75 million of beneficial projects in the Redland LGA and broader MBRS providing an overall benefit to migratory birds and wetland habitats in the MBRS.

Table ES-5: Potential for Project Impacts to Result in a Change in Ecological Character of the MBRS or Significant Impact on MNES.

EPBC Act Sig Impact Criteria	Summary of Impacts to Critical Components, Processes and Services	Potential for change in Ecological Character	Potential for significant impacts on MNES
Areas of wetland being destroyed or substantially modified	▪ The Project will result in a small area of the MBRS being substantially modified through reclamation the area impacted represents less than 0.02% of the entire 120,000+ ha of the MBRS. ▪ Most of the critical processes, components and services that contribute to the ecological character of the MBRS provide only a minor contribution at the Project footprint scale. ▪ While the Project will have a direct impact on wetland habitat, the area of impact is very small when viewed in the context of the whole MBRS and even the Zone of Influence, which encompasses a large portion of south western Moreton Bay. ▪ The habitats present are not considered to be core or of high value to any threatened marine fauna species. ▪ While the Project footprint provides feeding habitat for a small number of threatened and migratory shorebird species, recent studies have shown Moreton Bay contains an abundance of feeding habitat available for shorebirds. ▪ Indirect impacts to adjacent high tide roost sites will be avoided through implementation of a range management measures. ▪ The Project's environmental offsets strategy outlined in Chapter 29 will provide an overall benefit to migratory birds and wetland habitats in the MBRS.	While a small area of the Ramsar site will be substantially modified as a result of the Project these areas do not provide a major contribution to the ecological character of the wetland therefore no change is likely.	Likely – the project will result in a small area of the MBRS being substantially modified.
A substantial and measurable change in the hydrological regime of the wetland	▪ The Project footprint was assessed as providing a minor contribution to the regulation of coastal processes for the MBRS. ▪ Detailed modelling identified impacts to coastal processes are expected to be highly localised around the Project footprint with even minor changes unlikely outside of the immediate area. ▪ Changes are not expected to have any impact on nearby features such as Cassim Island.	Unlikely	Unlikely
Habitat or lifecycle of native species being seriously affected	▪ The Project footprint was assessed as having a minor contribution to threatened marine fauna, minor contribution to threatened and migratory bird feeding habitat and a major contribution to threatened and migratory bird roosting habitat.	Unlikely	Unlikely

EPBC Act Sig Impact Criteria	Summary of Impacts to Critical Components, Processes and Services	Potential for change in Ecological Character	Potential for significant impacts on MNES
	▪ Five threatened marine fauna species are known to use habitats within and surrounding the footprint: loggerhead turtles, green turtles, hawksbill turtles, dugongs and Australian humpback dolphins. ▪ While dugong and marine turtles feed on seagrass, the Project footprint does not contain significant of high value habitat for them, with population densities far higher on the Eastern Banks of Moreton Bay. ▪ Australian humpback dolphins are found throughout Moreton Bay, Toondah Harbour is not part of their core habitat. ▪ Dredging and reclamation to accommodate the Project footprint will result in a permanent direct impact on 25.6 ha of tidal flat habitat within the MBRS that provides feeding habitat for migratory shorebird species. This corresponds to only 0.18% of the approximately 4,681 ha of habitat in the MBRS. ▪ Potential for impacts outside of the Project footprint, including on adjacent high tide roost sites, is considered to be minimal. Any minor impacts are expected to be short term (e.g. construction noise) or activities that shorebirds will habituate to over time (e.g. increased pedestrian use of foreshore).		
A substantial and measurable change in the availability or functioning of a critical process, component or service	Change to critical components, processes or services that contribute to the ecological character of the MBRS within the Project footprint and the larger Zone of Influence have been assessed within this chapter. All impacts are considered to be minor.	Unlikely	Unlikely
Permanent or long term substantial and measurable change in the water quality of the wetland	Receiving water quality modelling was carried out to assess potential impacts to water quality at the Project footprint and whole-of-Moreton Bay scales. The outcomes of the modelling indicate that: ▪ The marina and internal waterways within the Project are likely to be well flushed, and it is unlikely phytoplankton blooms or eutrophication will occur within these waterways. ▪ While there may be slight increases in the concentration of total nitrogen and phosphorous in the marina and internal waterways, these increases are very small compared to current concentrations.	Unlikely	Unlikely

EPBC Act Sig Impact Criteria	Summary of Impacts to Critical Components, Processes and Services	Potential for change in Ecological Character	Potential for significant impacts on MNES
	▪ In wet weather conditions, a reduction in the concentration of total suspended solids, total nitrogen and total nutrients in the intertidal area southwest of the ferry terminal is likely due to an increase in the proportion of treated stormwater flows. Dredge plume modelling was also carried out and indicates that dredging-related turbidity and deposition rate impacts are relatively small compared to the natural variation in the ambient turbidity and impacts are limited to the areas in close proximity to the Project footprint.		
Establishment of invasive species	Marine pests are introduced invasive, non-native plants and animals that damage the health of the native marine environment. They often reproduce quickly, in large numbers and can spread rapidly. Once established, they are difficult to eradicate and can kill or out-compete native plants and animals for space and food. Marine pests can be introduced via ballast water and hull fouling. While this risk is predominantly from vessels that have been in international waters, there is also a risk of boats spreading pests established in other ports. At Toondah Harbour, the risk from the introduction of marine pests is low, where appropriate management measures are taken.	Unlikely	Unlikely

Environmental Management Framework

To ensure the planning and delivery of the Toondah Harbour Project are responsibly and effectively managed several management plans will be prepared that sit within a broader Environmental Management (EM) Framework. The EM Framework will operate across three categories to ensure site management protects the Environmental Values of Toondah Harbour, the MBRS and MNES, specifically:

- A set of Project-wide procedures that will be apply across all of the Management Plans (MPs) that are part of the EM Framework.
- MNES-specific MPs focusing on avoiding and minimising impacts on any EPBC matters that may potentially be impacted by the Project.
- Activity-specific EMPs (Activity MPs) which will be used on the ground by the site managers and all staff and contractors. Any management measures identified by the MNES MPs must be reflected in the relevant Activity MP.

The EM Framework also provides a procedure for how, post construction, MPs for certain infrastructure (e.g. marina, boat ramp, ferry terminal) will be handed over to their ultimate managers/operators to ensure all environmental obligations continue to be met during operational phases.

A Technical Advisory Panel (TAP) will be commissioned from experts in relevant fields to carry out the EM framework review process. This will ensure proper oversight of environmental management associated with the Project and that the most up-to-date scientific information and methods are being used to manage impacts throughout the Projects construction lifecycle of 15 – 20 years.

A conceptual diagram showing how the EM Framework will be implemented is provided in Figure ES-5 and a brief description of how each management category will be applied is outlined below.

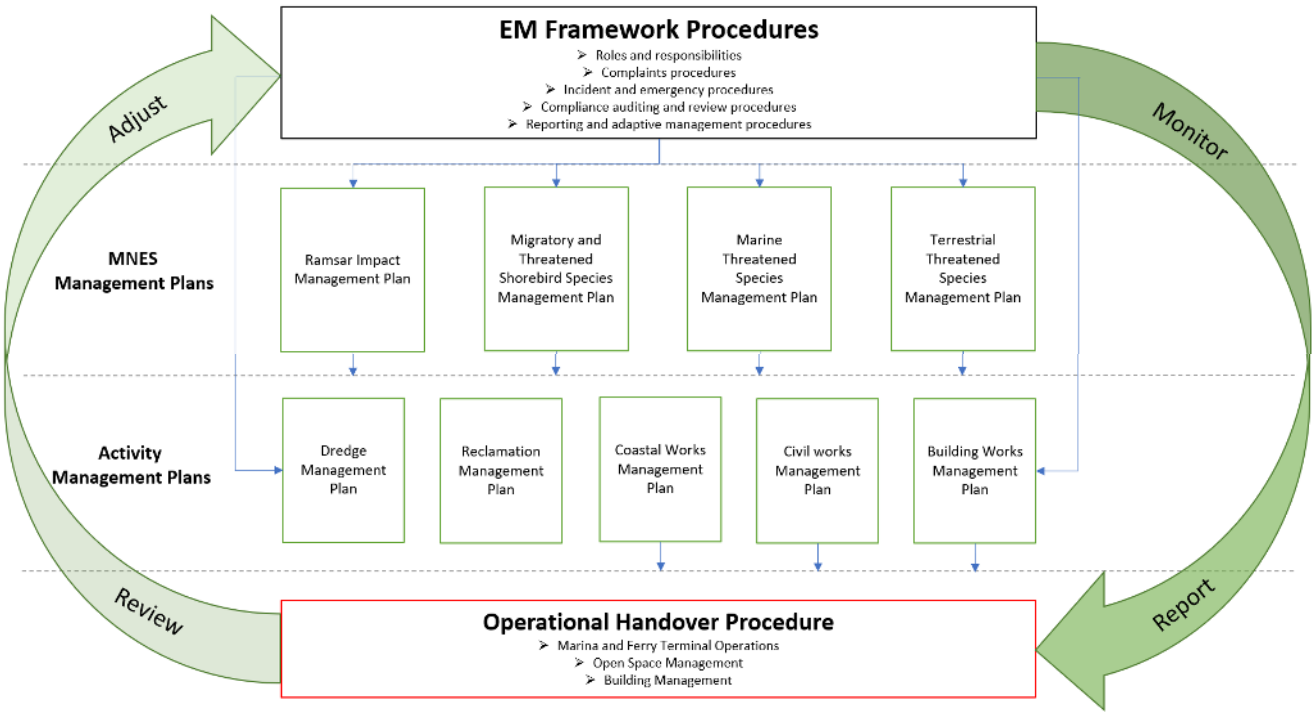


Figure ES-5: Draft Environmental Framework Conceptual Diagram.

Draft EM Framework Procedures

The EM Framework includes overarching procedures that must be utilised for all of the MPs developed for the Project. These procedures will provide a consistent structure for site management and reporting no matter where and when works are being undertaken.

MNES Management Plans

MPs will be developed for all MNES that have the potential to be impacted by the Project. MPs have been divided up based on the MNES and type of threatened or migratory species, given that potential impacts and management measures will be similar for these groups of species. The MNES MPs to be developed as part of the EM Framework are:

- Moreton Bay Ramsar Site Impact MP.
- Migratory and Threatened Shorebird Species MP.
- Migratory and Threatened Marine Species MP.
- Migratory and Threatened Terrestrial Species MP.

In addition, each MP will include a sub-plans detailing management and monitoring measures specific to the MNES being addressed. For example, the Migratory and Threatened Shorebird Species MP will include measures specific to that MNES such as noise buffers and lighting requirements to minimise potential disturbance at roosting sites.

For each sub-plan the overall environmental outcomes and performance and completion criteria will be identified including details such as timeframes and monitoring, corrective actions, and auditing requirements where appropriate.

Activity Management Plans

Activity MPs will be specific to the different types of construction activities carried out on site. Activity MPs will incorporate all management and monitoring measures outlined in the MNES MPs as well as any other management and monitoring measures required to minimise and avoid impacts on environmental values and address other legislative requirements. It is not anticipated that these plans will be required as part of the EPBC Act approval however they will be used across the various construction activities to ensure MNES environmental outcomes and criteria are achieved. While they will not require specific approval under the EPBC Act, Activity MPs will require endorsement from a number of State agencies including the DES, EDQ and MSQ.

Operational Handover Procedure

Upon completion, a number of infrastructure-related Project components will be handed over to other entities to manage on an ongoing basis. The handover will occur once construction has been completed and prior to operations commencing including the. Public areas such as the ferry terminal and associated facilities, ferry car parking and public open space will be handed over to RCC to manage while the marina and buildings will be handed over to specific operators and body corporates to manage.

Ongoing management requirements to avoid and minimise impacts to MNES will form part of contractual documentation provided in the handover and will require acceptance by the relevant parties before handover is completed. It is noted RCC has its own procedures for handover that the Proponent will be required to meet, including establishment of vegetation and amenities in open space areas.

Environmental Offsets Strategy

The overall objective of the offsets strategy is to provide a conservation gain for the MNES impacted by the Project and an overall benefit to the ecological character of the MBRS.

Offset projects are particularly challenging to implement in coastal and marine environments where most available natural areas are under council or state government ownership. The complicated tenure arrangements and overlapping rights and interests make it difficult for non-government organisations to access such areas to undertake physical works or research activities.

As a result of these difficulties, the Proponent proposes to deliver a suite of direct and indirect offsets through a fund managed by a third party with the ability to access public land and obtain approvals not available to a commercial entity such as the Proponent. The fund will be established so that offset projects delivered through it meet the principles outlined in the EPBC Act Environmental Offsets Policy.

Using the Queensland financial offsets calculator, significant residual impacts to 28.9 ha of foraging habitat for threatened and migratory shorebirds, 32.2 ha of marine wetland habitats and 2.5 ha of marine plants requires a financial offset of $4.75 million.

The offset funds will be released in stages aligning with impacts associated with dredging and reclamation stages:

- The northern reclamation and stage 1 dredging will result in approximately 65 per cent of the significant residual impacts therefore $3.09 million will be provided for offset projects prior to the commencement of external sheet piling for the northern reclamation.
- The southern reclamation will result in approximately 35 per cent of the significant residual impacts therefore $1.66 million will be provided for offset projects prior to the commencement of external sheet piling. Initial works on the southern reclamation are expected to start approximately 5 years after project commencement.

The offset will be delivered through an established and experienced third party not for profit or government supported organisation (henceforth referred to as the Offset Fund Manager). While the funds from the Toondah Harbour Project will only be spent on offsets providing a conservation outcome for the significantly impacted MNES (habitat for migratory and threatened shorebirds, marine wetland habitats and marine plants) it is anticipated they will be a catalyst for further environmental investment. The Offset Fund Manager (OFM) may utilise grants, donations and other voluntary regulatory (offset) contributions to fund essential and highly needed landscape-scale environmental works programs throughout SEQ to provide a benefit for Moreton Bay and its tributaries.

The OFM will establish an independent advisory group (IAG), including key stakeholder representatives, to provide advice and oversight for selection and implementation of projects under the fund. The IAG will be made up of scientific, community, government and industry members with knowledge and interest in Moreton Bay.

Delivery of environmental offsets through a third party not for profit or government supported organisation overseen by a panel of independent experts will ensure transparency in the process and provide positive conservation outcomes for the MNES impacted by the Project. It is expected that offset projects will be delivered within the Redland City LGA as well as the broader Moreton Bay area providing benefits at the local and regional scales. While the $4.75 million divested to the OFM from the Project will be used to provide an overall benefit for threatened and migratory shorebird species and wetland habitats, it is expected that it will be the catalyst for further financial contributions that will combine to provide significant conservation benefits to Moreton Bay.