Half Moon Bay Maintenance Dredging 2023 - 2033

Long Term Monitoring & Management Plan 2023 - 2033

For Maintenance Dredging of Half Moon Bay Channels, Half Moon Creek, Half Moon Bay Marina, Bluewater Harbour, Bluewater Marina and the Yorkey's Knob Public Boat Ramp

Version 1.2

February 2024

DOCUMENT APPROVAL

Version	Date	Author	Endorsement
1.0	25/08/2023	N.Miller	
1.1	05/10/2023	N.Miller	
1.2	07/02/2024	N.Miller	

The Cairns Regional Council (CRC) acknowledges the First Peoples within our region who are the Traditional Custodians of this country. Traditional Custodians within the Cairns region include the Djabugay; Yirriganydji; Bulawai, Gimuy Walubara Yidinji; Mandingalbay Yidinji; Gunggandji; Dulabed and Malanbara Yidinji; Wanyurr Majay; Mamu and NgadjonJii peoples. CRC also acknowledges other First Peoples who live within this region.

We would like to acknowledge and thank those who have contributed information used to create this document. We extend our appreciation to all those who shared their thoughts and helped Council to gather the information needed to create this plan. We look forward to working together to strengthen relationships, create opportunities and achieve positive outcomes for the future of Half Moon Bay and the natural environment.

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1. INTRODUCTION

Cairns Regional Council (Council) is responsible for undertaking maintenance dredging at Half Moon Bay, Cairns, Queensland. The activity ensures that channels in the Bluewater canals, Riverside Parade canal, Half Moon Creek, the outer entrance channels, the linking channel and the entrance to the Half Moon Bay Marina remain navigable for commercial and recreational users. If left unmanaged coastal sands and finer sediment deposits build-up in this system through natural sediment transport processes, therefore ongoing dredging works are required to maintain suitable depths.

This is a coordinated dredging program, also involving the Yorkeys Knob Boat Club (YKBC) who are responsible for the maintenance dredging of Half Moon Bay Marina, and also the Bluewater Marina and Department of Transport and Main Roads (TMR) who contribute financially to the maintenance dredging of their assets (Bluewater Marina and TMR boat ramp). The dredge areas and zones are depicted in Figure 1.

Maintenance dredging involves the removal of accumulated sediments that have settled above the design depth of the channels and marinas. The majority of the material dredged is transported via a pipeline to an offshore disposal ground, referred to as the Half Moon Bay Spoil Ground (HMBSG). A small percentage of suitable (clean sand) material is utilised for beach nourishment on Trinity Park Beach to help combat ongoing erosion at the southern end.

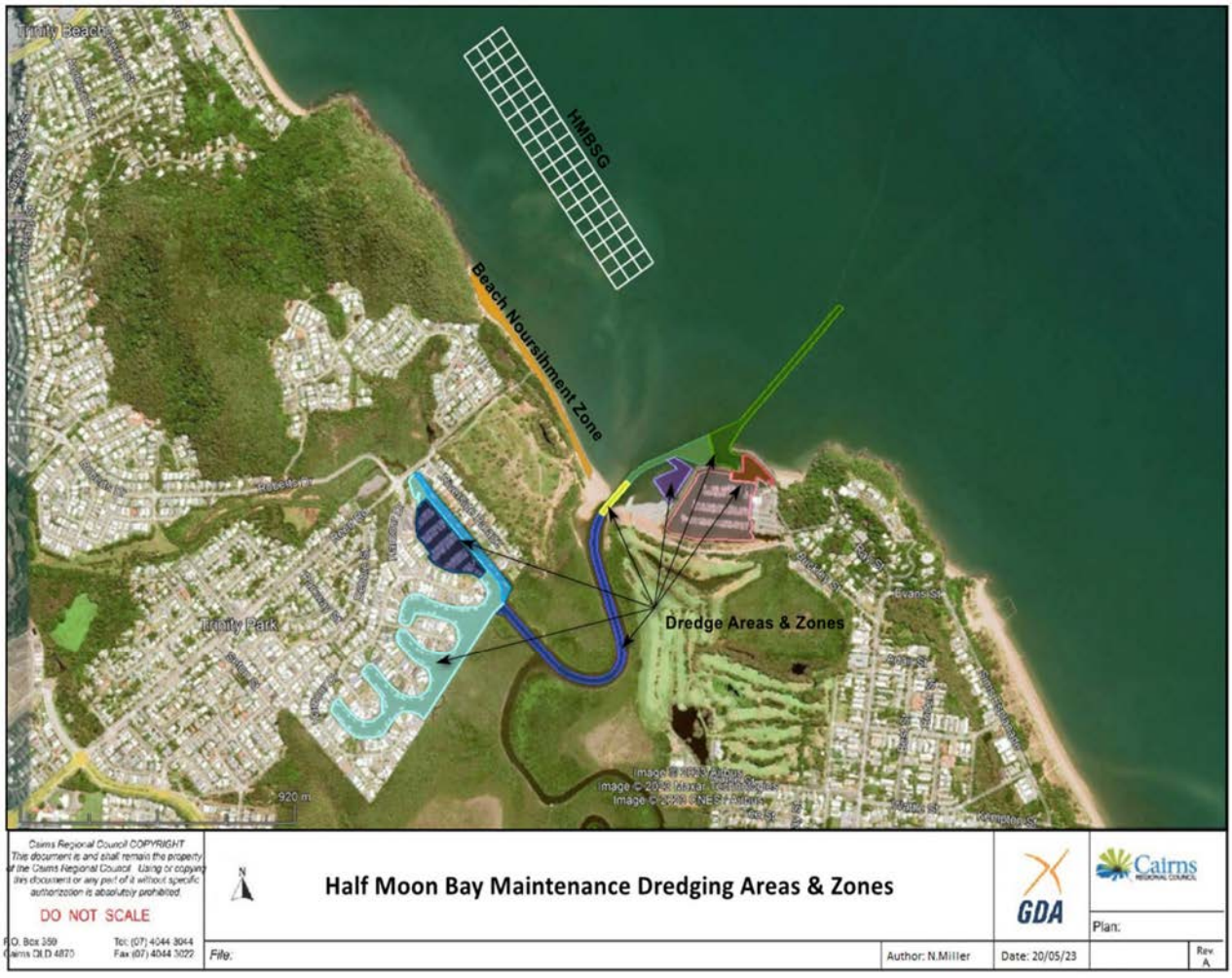


Figure 1: Half Moon Bay Maintenance Dredging Areas & Zones

1.1 Purpose and Objectives

The purpose of this Long-term Monitoring and Management Plan (LTMMP) is to document the strategy for managing natural sediment accumulation in the Half Moon Bay area. The document outlines the context and purpose of the activity and details Councils objectives in relation to the management of sediments dredged during the operation.

The objectives of the LTMMP include:

1. Detail the framework for maintenance dredging in the Half Moon Bay area for the next 10 years that is consistent with the Queensland's Maintenance Dredging Strategy.
2. Provide transparency to Councils planning approach for managing the dredging operation and the disposal of sediments.
3. Outline the operational, planning, consultation, permit and monitoring arrangements.
4. Highlight the local environmental values and detail how these will be monitored and maintained during dredging periods.
5. Detail how the operation does not adversely impact upon the Outstanding Universal Values (OUV) of the Great Barrier Reef World Heritage Area (GBRWHA).
6. Identify any improvement opportunities in the management of sediments and dredging actions.

The document has been structured utilising the guidance provided in the State Governments *Guideline for Long-term Maintenance Dredging Management Plans* and addresses the information requirements for a LTMMP under the Sea Dumping Act.

1.2 Policy Context

Cairns Regional Council implemented a long-term monitoring and management plan while this maintenance activity was undertaken from 2018 – 2023. This Plan has built on the original plan by utilising information gathered through the ongoing monitoring program and specific investigations.

Like the previous plan, this Plan has considered and aligned with the principles, elements and objectives described in a range of high-level policy documents relating to the management of maintenance dredging activities within Queensland, including:

- Reef 2050 Long term Sustainability Plan (CoA 2015)
- Reef 2050 Long Term Sustainability Plan 2021-2025 (CoA 2021)
- Environmental Code of Practice for Dredging and Dredge Material Management (Ports Australia 2016)
- GBRWHA Maintenance Dredging Strategy (SOQ 2016)
- National Assessment Guidelines for Dredging (NAGD) (CoA 2009)

The Reef 2050 Long-term Sustainability Plan (Reef 2050 Plan) is the Australian and Queensland Government's overarching framework for protecting and managing the Great Barrier Reef to 2050. The Plan was released in 2015 and outlines management measures for the next 35 years to ensure the Outstanding Universal Value of the Reef is preserved now and for future generations. It is a flexible framework that is reviewed every five years to ensure the plan remains current and addresses emerging issues utilising current data and science.

In response to the first five-yearly review, the Australian and Queensland Government released the Reef 2050 Long Term Sustainability Plan 2021-2025 in December 2021. The Plan was developed with

advice from the Reef 2050 Plan Independent Expert Panel, Reef 2050 Advisory Committee, a group of Traditional Owners and input from an open public consultation process.

Both Plans set clear actions, targets, objectives and outcomes to drive and guide the short, medium and long-tern management of the Reef. While Half Moon Bay is not the Port of Cairns, it is within Port limits. Therefore, the following port related actions detailed in the Plan have been adopted for this maintenance dredging operation:

- *The need to understand the sedimentation characteristics;*
- *Where possible avoid and reduce impacts of sediment management; &*
- *Establish long-term management arrangements that include consultation, monitoring and reporting activities.*

Queensland's ***Maintenance Dredging Strategy (MDS) for Great Barrier Reef World Heritage Area Ports*** launched in November 2016 and is a framework for maintenance dredging that is targeted at ports located within the GBRWHA. It builds on the current regulatory requirements to ensure the ongoing protection of the GBR and the continued operating efficiency of ports.

The MDS requires ports within the GBRWHA to develop and implement long-term maintenance dredging management plans. It is supported by the Guidelines for Long-term Maintenance Dredging Management Plans (TMR, 2018) which set out the content and requirements of LTMMPs to ensure consistency with the QLD-MDS.

This Plan has been developed in accordance with the principles of the strategy and has followed the guidelines for LMDMPs to ensure the contents are consistent with regulatory requirements.

Port Australia's Environmental Code of Practice for Dredging and Dredge Material Management sets out a series of environmental principles that Australian ports follow when undertaking dredging and when reusing, relocation or disposing of dredge material. Australian Ports have invested considerable time and resources into understanding and monitoring the environment in which they operate. This has been a significant contribution to the existing scientific knowledge on coastal environments in Australia.

The principles in the code have been defined on the basis of ecologically sustainable development principles and for this reason they have been adopted for the long-term management of the operation at Half Moon Bay.

The ***National Assessment Guidelines for Dredging (NAGD)*** were implemented in 2009 and are the Australian governments framework for the environmental impact assessment and permitting of the ocean disposal of dredge material based on the materials suitability for ocean disposal. The document is intended to provide greater clarity about the assessment and permitting process as well as provide guidance on opportunities for longer-term strategic planning.

This Plan has adopted the NAGD as the majority of the material dredged will be disposed of at sea.

1.3 Legislation Pertaining to Maintenance Dredging at Half Moon Bay

Maintenance dredging is subject to a number of Commonwealth and Queensland government legislation. Those that are applicable to this activity include:

(i) *Environment Protection (Sea Dumping) Act 1981* (Sea Dumping Act): applies when dredged material is proposed to be placed at sea.

(ii) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act): triggered when a development proposal, which could include maintenance dredging, has the potential to have a significant impact on matters of national environmental significance (MNES). Note: no referral is required for maintenance dredging in Cairns.

(iii) *Queensland Planning Act 2016*: applies to approvals for operational works and environmental authorities (EAs) related to maintenance dredging and pollution control.

(iv) *Queensland Marine Parks Act 2004*: dredging activity within the GBR Coast Marine Park may be subject to a Marine Park permit. Note: The *Marine Parks Amendment Act 2003* sets out specific provisions (Section 158 of the *Marine Parks Act 2004*) which include permitted works for ongoing maintenance dredging of Bluewater harbour and the entrance channels and the disposal of dredge spoil within the Marine Park. The Half Moon Bay Marina is not exempt from requiring a Marine Park Permit.

(v) *Queensland Environment Protection Act 1994*: regulates activities that may impact upon environmental values and/or cause environmental harm and requires an Environmental Authority for the conduct of an Environmentally Relevant Activity (ERA16) - Maintenance Dredging.

(vi) *Queensland Coastal Protection and Management Act 1995:* provides for the regulation of dredging, tidal works and other activities in the coastal zone, particularly in coastal management districts and erosion prone areas. Additionally, the Act regulates the removal of material from tidal water, such as may occur with maintenance dredging, which typically requires a development permit and/or allocation of quarry material.

(vii) *Queensland Fisheries Act 1994*: regulates activities that may impact upon both fisheries resources and fisheries habitats. A series of departmental policies and guidelines outline the requirements for approvals that address social, cultural, commercial, and recreational use of the fisheries resource, where dredging activity is likely to affect such fisheries habitats, resource or values a development permit is typically required.

1.4 Maintenance Dredging Approvals for Half Moon Bay

To undertake this activity at Half Moon Bay, a number of approvals are necessary. Those currently held by Cairns Regional Council and the Yorkeys Knob Boat Club are detailed below.

PERMIT/S	ISSUED	EXPIRY
Cairns Regional Council:		
Sea Dumping Permit SD2018/3842	13 December 2023	**31 December 2033**
Environmental Authority EPPR00795313	17 August 2021 (latest version)	N/A
Development Permit SPDC05566213	16 May 2013	N/A
Resource Allocation Authority 2017CA0150	16 October 2019	01 November 2024
MCU Beach Replenishment	5 September 2017	N/A
Yorkeys Knob Boat Club:		
Environmental Authority EPPR00448013 YKBC	26 September 2019 (latest version)	N/A
MCU – ERA IPCE00596707 and IPCC00596807	IPCC00596807: 26 June 2007	N/A
QT (MSQ)	QT: 14 May 2007	
MPP19-002434 Marine Park Permit	22 January 2020	**30 October 2023**

1.5 Review and Changes to the LTMMP

The LTMMP has been developed for the purpose of managing the maintenance dredging and disposal activities at the site from November 2023 until November 2033. The plan is supported by technical investigations and historical data collected over many years of maintenance dredging in this region.

The LTMMP will be reviewed and updated every five (5) years or if any of the following occur:

- A permit condition change or amended, or new permits are issued.
- Monitoring results demonstrate substantially different impacts than have not been previously observed or predicted.
- An incident occurs that poses a significant risk to environmental values, including the OUV of the GBRWHA.

The approved LMMP will be made available on Councils website.

1.6 Roles and Responsibilities for Maintenance Dredging at Half Moon Bay

Half Moon Bay is located within the Port limits of Cairns (Figure 2) however, the ongoing maintenance of the canals and entrance channels is the responsibility of Cairns Regional Council and the Yorkeys Knob Boating Club under a coordinated dredging program. The various responsibilities for dredging and maintenance of the navigability of these waterways falls under the *Coastal Protection and Management Act 1995* as per the original *Canals Act 1958* and *Harbours Act 1955* approvals.

Cairns Regional Council notes the legislative and policy context of the Half Moon Creek and Bluewater Harbour which includes state level Canals Act and Harbours Act approvals; and specific legislative amendments to the State Marine Parks Act to provide for the construction and maintenance dredging of Bluewater Harbour and Half Moon Bay Marina. These approvals and the Environmental Authority

and Marine Parks Permit currently in place, have all been issued in the context of the World Heritage status of the area. Council further notes the importance of dredging for safe navigation, as set out in a letter from the Regional Harbour Master, provided as an attachment – refer to section 15.

Figure 2: Port of Cairns Limits

Figure 3 depicts the areas approved from maintenance dredging under the state approvals and defines the extent to which these are maintained by each party. Cairns Regional Council (green) and the Yorkeys Knob Boat Club (pink).

Figure 3: Maintenance Dredging Responsibilities (CRC & YKBC)

Responsibilities outside the physical nature of the maintenance dredging include the following:

Council is responsible for:

- Ensuring compliance with the LTMMP.
- Ensuring a revised SAP is prepared and sediment sampling is undertaken to ensure currency of chemical and toxicity data of the sediments dredged in accordance with the NAGD.
- Convening and facilitating the meetings of a Technical Advisory Consultative Committee (TACC).
- Maintaining a contractual relationship with a dredging contractor which requires compliance with the LTMMP and Sea Dumping Permit conditions.
- Undertaken monitoring and reporting tasks not delegated to the dredging contractor.
- Reporting to the relevant QLD and Commonwealth agencies.

Council engages dredging contractors on a 3–4-year contract and as such there may be various contractors during the life of this LTMMP.

The dredging contractor is responsible for:

- Adhering to the LTMMP and implementing aspects of the plan.
- Developing and implementing an Environmental Management Plan (EMP) which ensures day to day compliance with all permits, licences.
- Undertaking monitoring and reporting tasks delegated by Council.
- Reporting on monitoring results, as required.
- Reporting incidents/emergencies to Council and other agencies.
- Maintaining hazardous goods containment and spill clean-up equipment and other plant and equipment necessary to reduce environmental risks.

1.7 Stakeholder Consultation and Involvement During the Life of the LTMMP

In accordance with the NAGD, a Technical Advisory Consultative Committee (TACC) was established in 2017. The Cairns Regional Council formally constituted the Bluewater Maintenance Dredging Technical Advisory Consultative Committee (BMDTACC) at its meeting of 16 August 2017. Section 11 sets out the role and membership of the TACC. The Terms of Reference (ToR) is provided as an attachment, refer to section 15.

The BMDTACC was established in 2017 for the following purposes:

- Provide continuity of direction and effort in protecting the local environment.
- Aid communication between stakeholders and provide a forum where points of view can be discussed and conflicts resolved Assist in the establishment, as appropriate, of longer-term permitting arrangements, including reviewing the development and implementation of Sampling and Analysis Plans, Management Plans and research and monitoring programs.
- Review ongoing management of dredging and dumping activities in accordance with the NAGD Guidelines and permitting arrangements, and;
- Make recommendations to Cairns Regional Council and the determining authority as necessary or appropriate.

The following stakeholder organisations/individuals have been appointed to the TACC, including:

- Manager Bluewater Marina
- Yorkeys Knob Boating Club (YKBC)
- Maritime Safety Queensland (MSQ)
- James Cook University (JCU)

- Ports North (PN)
- Residents representative
- Department of Agriculture and Fisheries (DAF)
- Department of Environment and Science (DES)

Cairns Regional Council representatives on the Committee are:

- Associate Director Service Delivery - Cairns Infrastructure and Assets
- Executive Manager Strategic Asset Management and Planning
- Division 8 Councillor
- Division 9 Councillor

1.7.1 BMDTACC Review of LTMMP

Upon completing the draft of this LTMMP it will be provided to the BMDTACC for comment. BMDTACC members will be give three weeks to provide any feedback for comments they may have. Once endorsed, any major changes made to the document will also be presented to and reviewed by the BMDTACC.

With members of the BMDTACC being specialists in areas of work relevant to the dredging activity, Council is confident that the document will be reviewed by suitably qualified experts and will not be required to go through an independent review.

1.7.2 TACC Terms of Reference and Membership

A copy of the TACC terms of reference is provided as an attachment.

2. SITE, DREDGE AREAS & ZONES, & THE ACTIVITY

2.1 Overview

Half Moon Bay (HMB) is located approximately 16km north of the Port of Cairns at the north end of Yorkeys Knob. The Bay extends from the northern tip of Yorkeys Point to the eastern point of Earl Hill in Trinity Park (refer to Figure 4).

HMB contains the Half Moon Bay Marina and a dredged entrance channel. East of the bay is Half Moon Creek, also a dredged channel, that connects the bay to Bluewater Marina. Bluewater Marina was constructed in 2004 and includes canals with waterfront residential properties as well as the marina (refer to Figure 4).

Figure 4: Half Moon Bay

This entire area is within the port limits as defined in the regulations of the *Transport Infrastructure (Ports) Regulation 2005* (refer to Figure 2) however, the Cairns Regional Council is responsible for the ongoing maintenance of the entrance channels and canals, and the Yorkeys Knob Boat Club (YKBC) and the Bluewater Marina are responsible for maintenance of the marinas under their control. To ensure these areas remain navigable the maintenance dredging is undertaken under a coordinated

dredging program. Maintenance dredging has been conducted in this area, in varying intensities, for ~20 years.

The works provide navigable waters for a range of users. These include recreational fishing boats, leisure boats (sailing and motor), stand up paddle boarders (SUPs), and outrigging canoe and kayakers. The entrance channels, Bluewater Harbour, Bluewater canals, Half Moon Bay Marina and Half Moon Creek are vital to the ongoing viability of many tourism, fishing, cruise ship hosting and pilotage operations. Further, maintained, navigable entrance channels, Bluewater Harbour, Bluewater canals, Half Moon Bay Marina and Half Moon Creek are vital for search and rescue services and cyclone contingency. Maintaining suitable depths for all users is critical as the waters are accessible 24 hoursa day, seven days a week.

2.2 Dredging Areas & Disposal Ground

Maintenance dredging currently occurs in three distinct areas (Dredge Area); however, a fourth area will be established for the next permitting period with a new boat ramp and mini harbour recently constructed in the area by the Department of Transport and Main Roads (TMR).

Most of the Dredge Areas are split into separate zones, primarily for commercial and financial reasons, as some stakeholders contribute to the cost of the operation in certain zones. For management under NAGD there are four relevant Dredge Areas, refer to Figure 5.

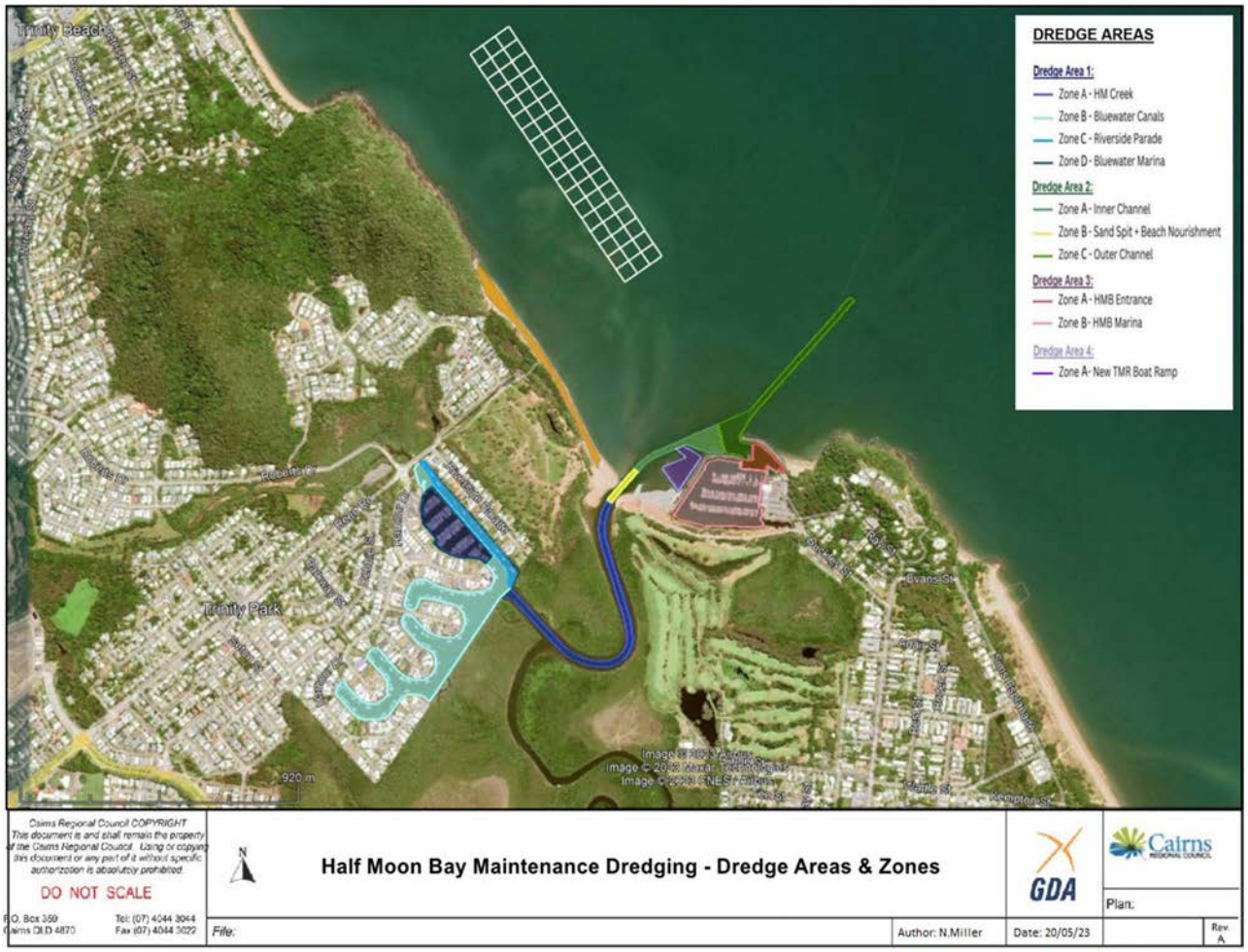


Figure 5: Half Moon Bay Maintenance Dredging Areas & Zones

2.2.1 Dredge Area 1 - Bluewater Harbour and Half Moon Creek

Dredge Area 1 is made up of four zones, as defined in Table 1 below. Each of the zones contains sediments of similar characteristics which are primarily fine silts which have accumulated by settlement of suspended sediment from coastal processes. There is very little accumulation from terrestrial sources. For this reason, sediment accumulation is slower in Dredge Area 1 than it occurs in Dredge Area 2.

It is predicted that the maximum volume of sediment to be dredged from this area over the next ten (10) years is 250,000m3. This is inclusive of a contingency for extreme weather events that may exacerbate the rate of deposition.

Table 1: Zones of Dredge Area 1

Zones	Description	Chainage
Zone A	Half Moon Creek (from entrance of creek mouth to the canals)	0m to 1000m
Zone B	Bluewater Canals	N/A*
Zone C	Riverside Parade frontage (properties lining the canal)	0m to -500m
Zone D	Bluewater Marina	-130m to -430m

2.2.2 Dredge Area 2 – Half Moon Bay Channels

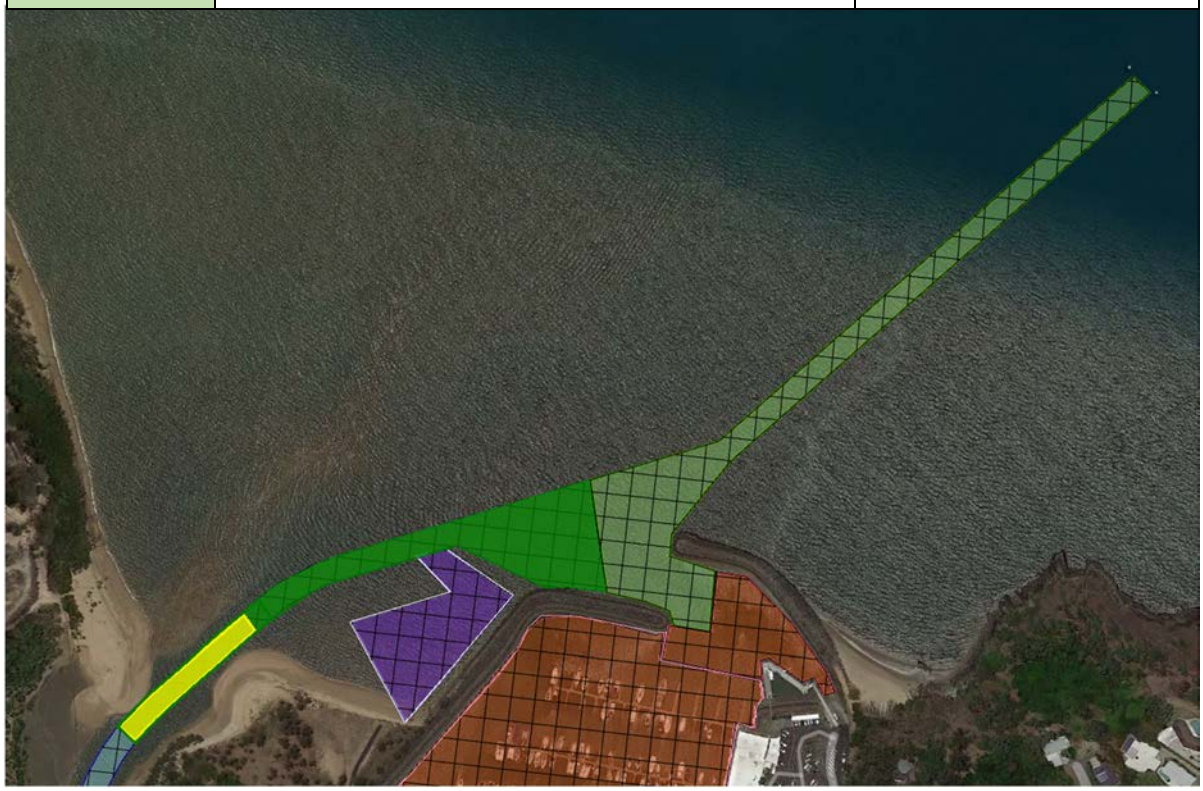
Dredge Area 2 is made up of three (3) zones, as defined in Table 2 below. There is a difference in the sediment characteristics found in this area, with the sediments that settle in Zone B (Sand Spit) being primarily sand and sediments outside this zone mostly fine silts. The majority of sediments dredged from Zone B and not disposed of at of the offshore disposal ground but instead put back onto Trinity Park Beach to combat ongoing beach erosion that is occurring at the southern end of the beach. This is referred to as Beach Nourishment and is one way Council reduces the volume of sediment needing to go to ocean disposal.

The sediments in Dredge Area 2 accumulate by settlement of suspended sediment from coastal processes. The environment is highly dynamic and accretion rates vary from year to year, but quite rapidly. The highest rate of accumulation is in Zone B with multiple dredging events required each year in this zone. Zones A & C are typically dredged once a year to maintain a suitable depth.

It is predicted that the maximum volume of sediment to be dredged from this area over the next ten (10) years is 750,000m3. This is inclusive of a contingency for extreme weather events that may exacerbate the rate of deposition or completely fill in the channels e.g., Tropical Cyclones.

Table 2: Zones of Dredge Area 2

Zones	Description	Chainage
Zone A	Inner Entrance Channel	1000m – 1450m
Zone B	Sand Spit	1000m – 1100m
Zone C	Outer Entranced Channel	1450m – 2065m



2.2.3 Dredge Area 3 – Half Moon Bay Marina

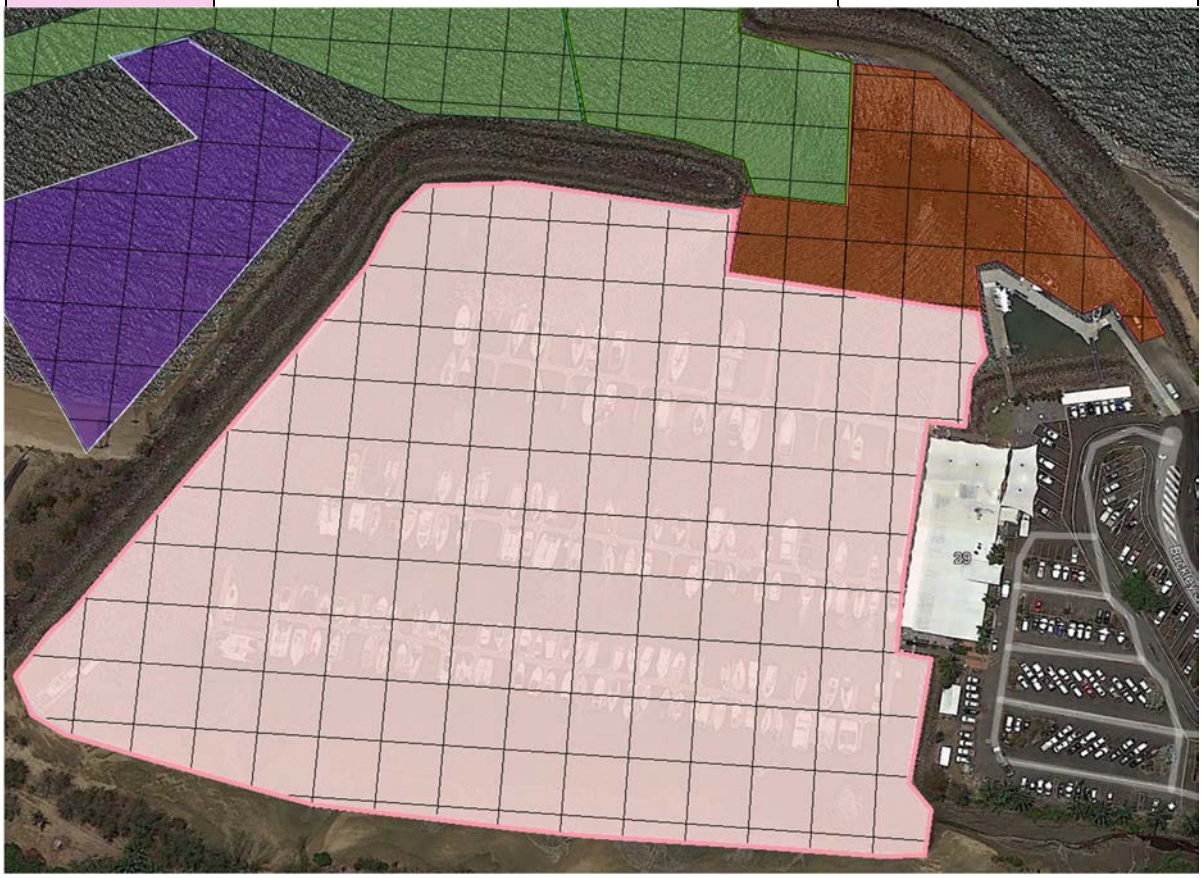
Dredge Area 3 has two (2) zones, as defined in Table 3 below.

The sediments found in Dredge Area 3 are primarily silts that enter each flood tide and settle-out. Resuspension of settled sediments occurs during tidal and vessel movement, which moves sediment throughout Zone B across the marina basin. The accumulation rate is higher in Zone A than it is Zone B.

It is predicted that the maximum volume of sediment to be dredged from this area over the next ten (10) years is 220,000m3. This is inclusive of a contingency for extreme weather events that may exacerbate the rate of deposition.

Table 3: Zones of Dredge Area 3

Zones	Description	Chainage
Zone A	Entrance to Half Moon Bay Marina (including fuel pontoon)	Entrance from the channel ~1400m to 1600m
Zone B	Half Moon Bay Marina and Berths	N/A*



2.2.4 Dredge Area 4 – New TMR boat ramp and mini harbour

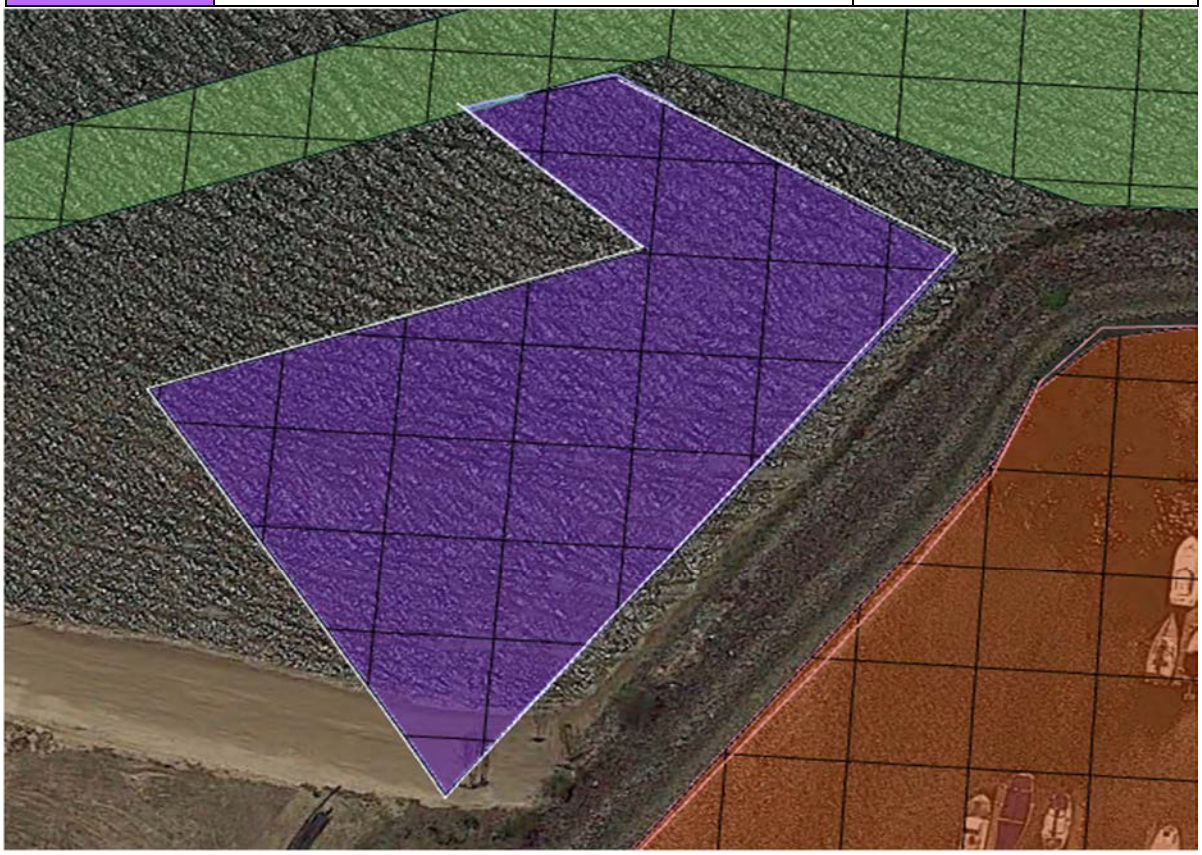
Dredge Area 4 is a new site that will require maintenance dredging in future years. It is currently unknown the level of dredging that will be required i.e., volumes and frequency, and Council will be monitoring the rate of accumulation using hydrographic surveys.

It is predicted that the sediments that accumulate at the entrance will consist of fine silts and sand, whereas the sediment that settles in the mini harbour will likely be fine silts; this is consistent with findings in Dredge Areas 1 & 3.

It is estimated that the maximum volume of sediment to be dredged from this area over the next ten (10) years is 40,000m3. This is inclusive of a contingency for extreme weather events that may exacerbate the rate of deposition. Council will gain a better understanding of dredging volumes in this area over the next 10 years.

Table 4: Dredge Area 4

Zone	Description	Chainage
Zone A	Entrance to Mini Harbour from Inner Channel & Mini Harbour Basin	Entrance from the channel is at ~1500m



NOTE: *To avoid any doubt, the use of zones to describe areas is for commercial reasons as to which stakeholders contribute to costs of dredging of areas and for contractual arrangements with the contractor. The delineation of the four Dredge Areas is to identify areas which are distinct in terms of application of the NAGD as distinct source areas for dredge spoil disposal, with unique and distinct sediment contamination risks (EcoSustainAbility, 2018).*

Table 5 provides an overview and breakdown of the volumes to be removed from each area over the next five (5) years. It contains an estimate on campaign frequency and a contaminant list specific to each of the areas, which is based on an understanding of the catchment and the results of previous sediment sampling and analysis undertaken in the last seven (7) years.

Table 5: Amounts to be dredged from each area, contamination status and final volume

Dredge Area	Dredging volume (insitu m^3)	Campaign Frequency (estimate)	Sediment characterisation (probably clean/probably contaminated/contaminated)
Dredge Area 1	125,000m3	Every 1 – 2 years	***Probably clean –*** Low risk TBT, Cu, Zn, possibility. Unlikely to be contaminated
Dredge Area 2	375,000m3	Annually	***Probably clean –*** Very low risk, unlikely to be contaminated
Dredge Area 3	110,000m3	Annually	***Probably clean –*** Low risk TBT, Cu, Zn Very low risk PAH Possible TPH near Fuel Wharf/pontoon Unlikely to be contaminated sediments.
Dredge Area 4	20,000m3	Every 2 – 5 years	***Probably clean –*** Low risk TBT, Cu, Zn Very low risk PAH Possible TPH in Mini Harbour Unlikely to be contaminated sediments.

3. HALF MOON BAY ENVIRONMENTAL VALUES

To manage the sediment and the dredging activities undertaken, Cairns Regional Council has investigated the environmental, social and cultural values within this region. The information has been drawn from the previous LTMMP (2018) and new information gathered over the last five years. A summary of the key values at a national, regional and local level are provided in this section. The values are described with respect to the maintenance dredging and the disposal activity, and areas within the predicted zone of influence.

3.1 World Heritage Areas (WHA)

Half Moon Bay (HMB) is located within the limits of the Great Barrier Reef World Heritage Area (GBRWHA). The GBRWHA covers the waters to the low water mark along the coastline and extends into Half Moon Creek to Bluewater Harbour.

The GBRWHA is listed based on it meeting four World Heritage criteria for OUV:

- Natural beauty and natural phenomena (Criterion (vii)).
- Major stages of the Earth's evolutionary history (Criterion (viii)).
- Ecological and biological processes (Criterion (ix)).
- Habitats for conservation of biodiversity (Criterion (x)).

The GBRWHA was also listed as a National Heritage Place (GBRNHP) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Of the important environmental values present in the region, five are considered to contribute significantly to the OUV of the GBRWHA. These include:

- Coral reefs
- Seagrass meadows and mangroves communities
- Habitats for threatened species
- Coastal islands of exceptional beauty
- Many species of coral, macroalgae, crustaceans, polychaetes, molluscs, fish, seabirds, mammal, and reptiles.

However, Half Moon Bay and adjacent nearshore shoreline locations are in a modified condition as a result of anthropogenic influences over the years and many of these values do not exist at this location or the integrity of the values that do exist varies. These values are explored in further detail in the sections below.

3.2 State Marine Parks

Half Moon Bay (HMB) is located within the Great Barrier Reef Coast Marine Park. However, The *Marine Parks Amendment Act 2003* sets out specific provisions (Section 158 of *the Marine Parks Act 2004*) which include permitted works for ongoing maintenance dredging of Bluewater harbour and the entrance channels, and the disposal of dredge spoil within the Marine Park. The area within the Half Moon Bay Marina, Dredge Area 3, is not included in this provision and for this reason a Marine Park Permit is held by the Yorkeys Knob Boat Club (YKBC) for the dredging of Half Moon Bay Marina.

3.3 Declared Fish Habitat Area (FHA)

A section of Half Moon Creek is mapped as a declared Fish Habitat Area (FHA) under the *Fisheries Act 1994.* The extent of this area is demonstrated in Figure 6.

Figure 6: Declared Fish Habitat Area (Management B)

The boundaries of this area are outside areas that are actively dredged or where sediments are deposited. However, the disposal pipeline does cross through sections of the FHA mapped within Half Moon Creek. For this reason, Council holds a Resource Allocation Authority (RAA) issued by the Department of Agriculture and Fisheries (DAF). The permit allows for the placement of the disposal pipeline in sections of this management area. As demonstrated in Figure 7, there is a temporary placement area and a permanent section.

Council must hold a valid RAA for the interference required for the placement of the pipeline in this declared FHA.

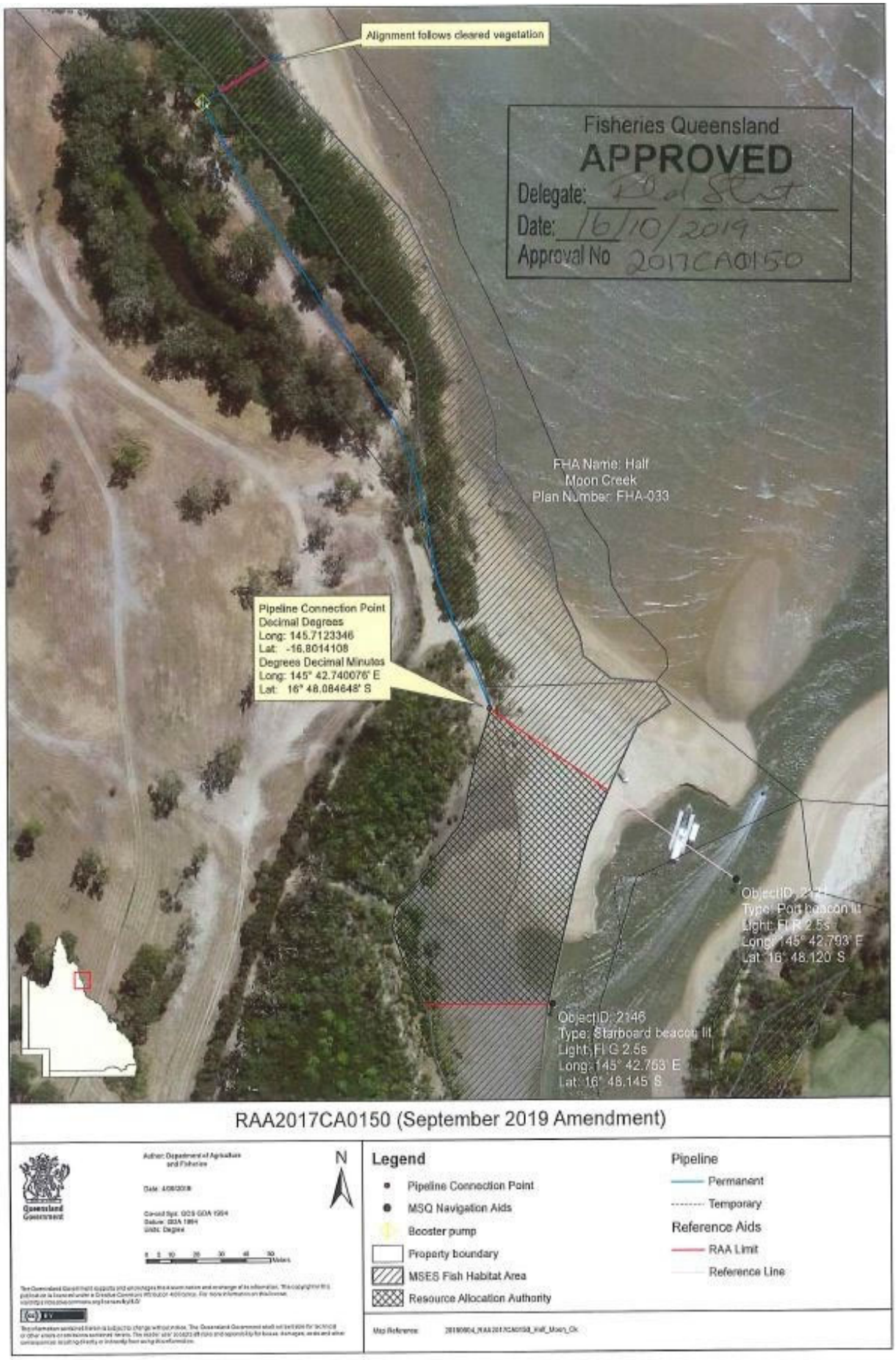


Figure 7: RAA Approved Area (permanent and temporary pipeline)

3.4 Matters of National Environmental Significance (MNES)

Utilising the Departments of Climate Change, Energy, the Environment and Water's (DCCEEW) Protected Matters Search Tool (PMST) Council has identified the species and areas within Half Moon Bay that are protected under the EPBC Act. In the tables below the MNES relevant to the maintenance dredging operation have been listed and described.

Table 6: Overview of MNES identified in the area (Aug 2023)

MNES	No.
World Heritage Properties	1
National Heritage Places	1
Wetlands of International Importance (Ramsar)	None
Great Barrier Reef Marine Park	1
Commonwealth Marine Area	None
Listed Threatened Ecological Communities	2
Listed Threatened Species	43
Listed Migratory Species	49

Table 7 lists and describes the potential relevance of the MNES identified to the maintenance dredging and the disposal activity.

Table 7: MNES Relevant to the Half Moon Bay Maintenance Dredging Operation

MNES	Description
World Heritage Properties and National Heritage Place	The Great Barrier Reef World Heritage Area (GBRWHA) extends throughout most of the dredge area. The exception is several canals within Bluewater Harbour (Dredge Area 1). The GBRWHA is listed as a National Heritage Place.
Great Barrier Reef Marine Park (GBRMP)	The waters of Half Moon Bay are mapped as a GBRMP General Use Zone (GU-16-6004 VI). The objective of this zone is to provide opportunity for reasonable use of the GBRMP, while still allowing for the conservation of these areas.
Listed Threatened Ecological Communities	The two threatened ecological communities identified in the search include: – Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall North Queensland; & – Lowland tropical rainforest to the wet tropics
Listed Threatened Species and Migratory Species	There are numerous threatened and migratory species identified as known or likely to occur near the area. The full list identified in the PMST search provided as an attachment.

3.5 Matters of State Environmental Significance (MSES)

Matters of state environmental significance (MSES) are a component of the biodiversity state interest that is defined under the State Planning Policy (SPP) and defined under the *Environmental Offsets Regulation 2014 (*Offset Regulation). MSES includes certain environmental values that are protected under Queensland legislation.

The mapped MSES present in the area are demonstrated in Figure 8.

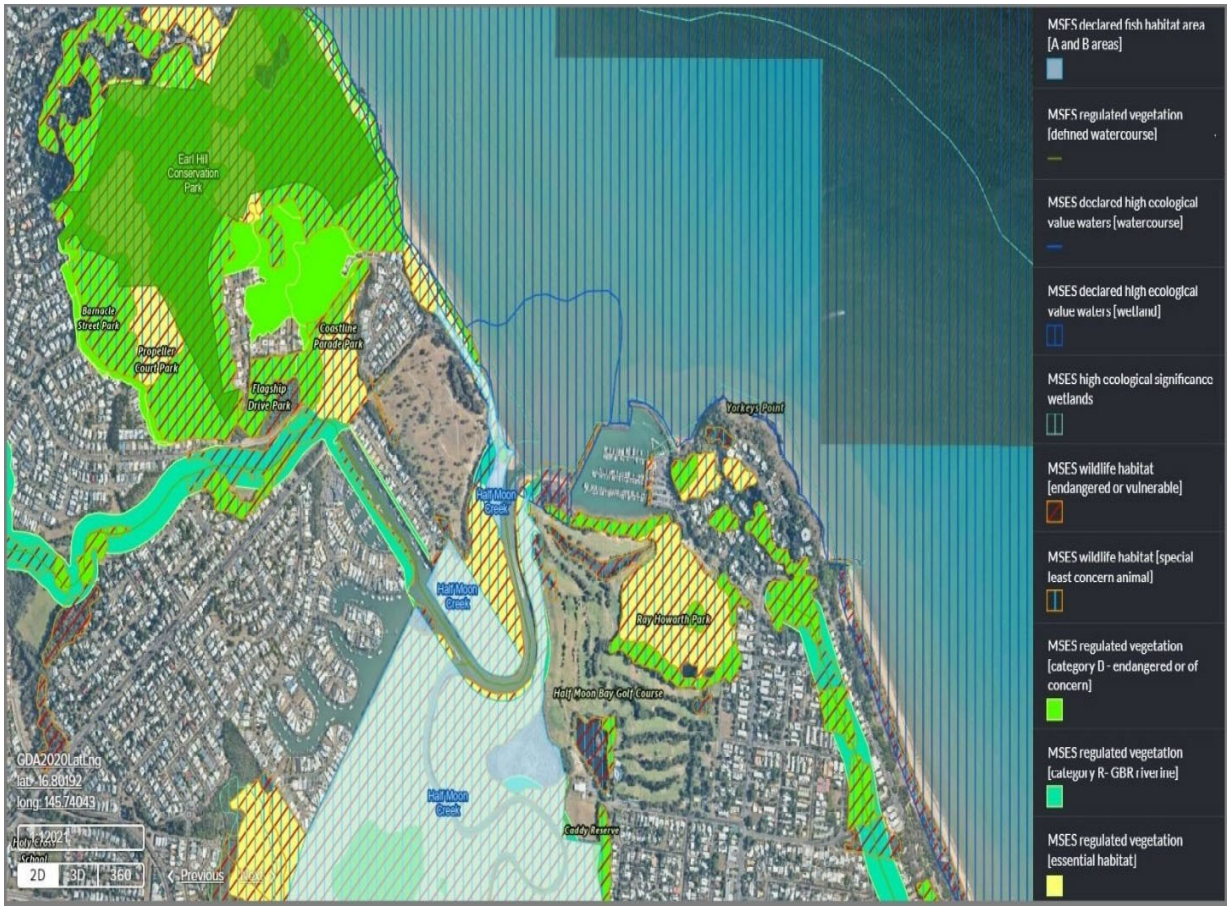


Figure 8: Matters of State Environmental Significance within Half Moon Bay

The *Significant Residual Impact (SRI) Guidelines* (Queensland Government, 2014), set criteria for determining whether an impact on a MSES is significant or not. The key MSES identified in the search that are relevant to the maintenance dredging in Half Moon Bay include the following:

- Declared High Ecological Value Waters (wetland);
- High Ecological Significance Wetland;
- EVNT Habitat; &
- Marine Plants.

The extent of each is depicted in the figures below and a brief description is provided in Table 8.

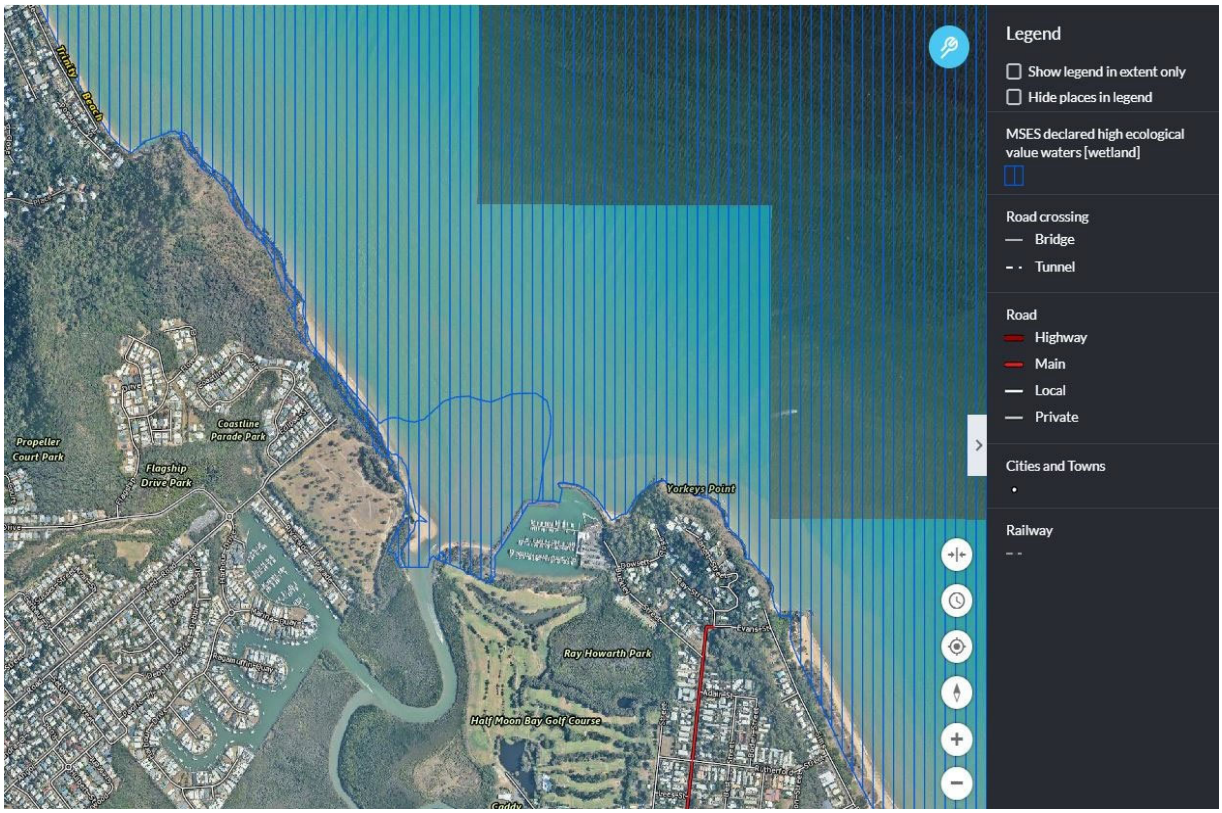


Figure 9: MSES declared high ecological value waters (wetland)

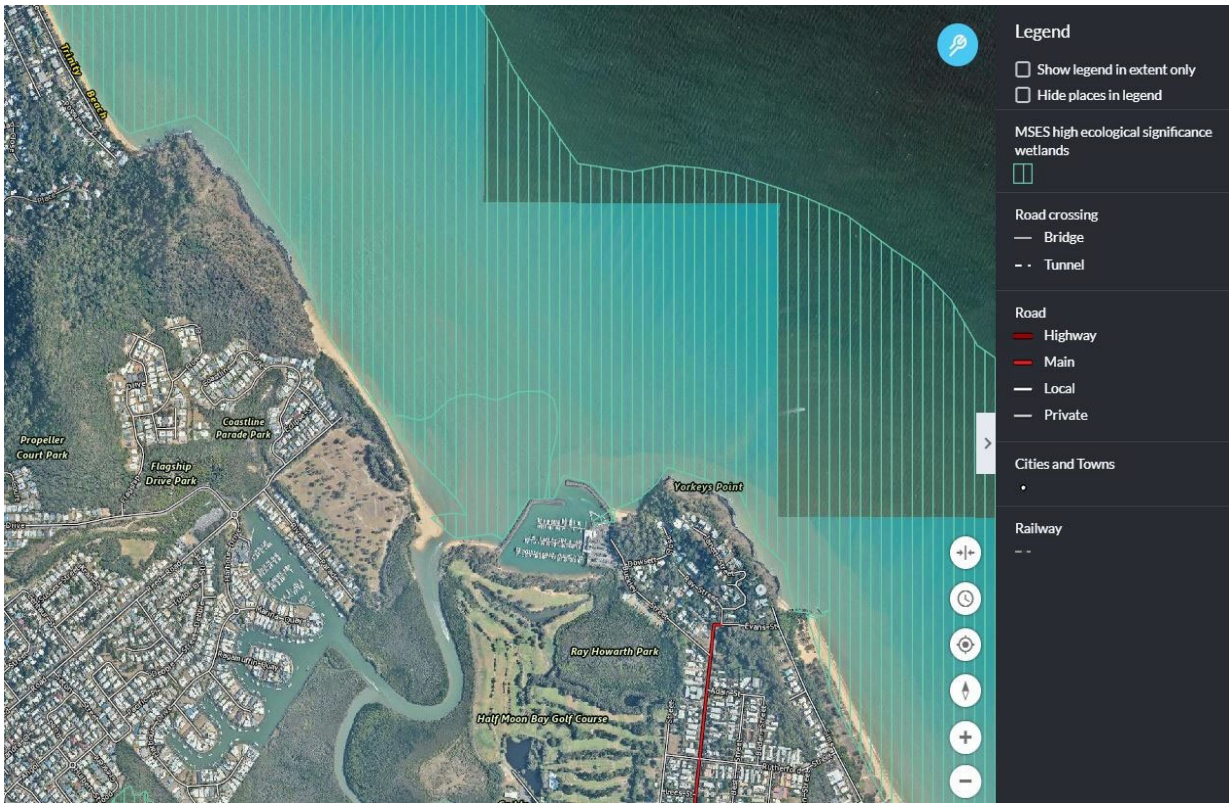


Figure 10: MSES high ecological significance wetland

Table 8: MSES identified within activity area

MSES	Description
High Ecological Value Waters	HEV waters are mapped as the biological integrity of the water is effectively unmodified or highly valued. The mapping indicated that the waters in Half Moon Creek (the mouth) and Half Moon Bay are of this value. Effectively meaning that the maintenance dredging operation must maintain the natural water quality conditions to ensure that these waters continue to support local ecosystems and species.
High Ecological Significance Wetland	The waters in Half Moon Bay are classified as a marine wetland waterbody. According to the Queensland Wetlands Program wetland definition, marine wetlands extend to a depth of 6m below the Lowest Astronomical Tide, as detailed in Figure 10. Pest animals, plants and disease are major threats to wetland values. The maintenance dredging activity must be managed to ensure it does not pose a biosecurity risk to these wetland values.
Habitat for Endangered, Vulnerable and Near Threatened (EVNT) and special least concern species	Many threatened species have the potential to occur in Half Moon Bay and the surrounding area. Those that have been identified using the PTMS that have a likelihood of being found in the activity area, are detailed in Table 9 below.
Marine Plants	Queensland has a very high diversity of marine plants species, including mangroves, seagrass, saltcouch, algae samphire vegetation and adjacent species such as melaleuca and casuarina. While no seagrass is known to exist in the area, Half Moon Creek has an extensive mangrove community that also supports a declared Fish Habitat Area (Qld), described in section 3.3.

3.6 Local Environmental Values

3.6.1. Mangroves

Half Moon Creek has an extensive mangrove community. Like other areas within the region there is a diversity of mangroves and marine species present. A total of 21 species of mangrove have been recorded in the Cairns region. Within Half Moon Creek, both sides of the banks are lined with a healthy population of mangroves and within Bluewater Harbour, there is a significant mangrove community on the southern boundary (away from the houses).

3.6.2 Rocky Headlands

Earl Hill and Yorkeys Knob are rocky headlands with relatively depauperate littoral communities. These are not "sensitive communities" and are naturally subject to high levels of wave and current action, with consequent turbidity from the naturally occurring silts and coastal littoral drift of sediments. The nearby rocky headlands are not considered sensitive areas, nor an area that will be affected by the disposition of sediments in HMB. (EcoSustainAbility, 2018).

3.6.3 Coral Reef

Haycock Reef is the closest coral reef and is located ~6km to the north of Earl Hill. It represents the largest reef within proximity of the activity. The reef flat is comprised of a broad inner sediment zone that is surrounded by a rim of corals and algae along the reef front (BMT, 2022). The inner sections of the reef flat contain a mosaic of seagrass, macroalgae and bare sediments. A large sand spit extends in a north-south orientation along the north-western part of the reef flat. (BMT, 2022).

3.6.4 Seagrass

Council has not found physical evidence of or recorded any seagrass communities in HMB. The presence of seagrass been documented on one occasion in a field survey undertaken in December 2018 by BMT for an infrastructure project (new TMR boat ramp), which found the presence of *Halodule pinifolia* in the intertidal zone to the north of Half Moon Creek mouth. However, a subsequent survey conducted in September 2019 found that the species was no longer present. This is common with this species of seagrass; it is ephemeral with rapid turn-over and high seed set and is well adapted to high levels of disturbance. The species can grow rapidly and is a fast coloniser (Walker et al., 1999).

The lack of other seagrass species found in the area during targeted surveys (2018, 2019, 2022) suggests that natural conditions in the bay do not support the colonisation of more sensitive/less tolerable seagrass species.

3.6.5 Benthic Habitat

Half Moon Bay and the dredge areas have the potential to provide benthic habitat. The dominant taxa recorded in surveys are the polychaete and oligochaete worms which is expected in areas of such shallow coastal habitat of fine to medium sands and silts which are highly mobile.

3.6.6 Estuarine Habitat

Half Moon Creek is estuarine habitat which is a declared Fish Habitat Area (FHA). Half Moon Creek has a recognised estuarine habitat which is not sensitive to the ongoing maintenance dredging of the design channels/canals (EcoSustainAbility, 2018).

3.6.7 Terrestrial Habitat

The area contains the habitat suitable to support a number of terrestrial species including birds, reptiles and mammals. However, these environments exist outside the activity's footprint existing along the foreshore above the line of the Highest Astronomical Tide (HAT). No terrestrial fauna species are expected to be affected by the maintenance operation.

3.6.8 Marine Fauna

The Protected Matter Search Tool (PMST) helped identify species that could be found in the areas. This data has been scrutinised to include those that are likely to frequent or known to be found in HMB or areas within the zone of impact. Recent field data surveys have also been reviewed and helped to inform the assessment of the potential impacts on these species as a result of the activity. Table 9 summarises these species. Of those identified turtles, dolphins and saltwater crocodiles are more likely to be found in the area as they are less affected by the naturally turbid waters.

Marine turtles may occur in the area however, this is a highly dynamic and disturbed environment that is not typically suitable for nesting turtles. The lack of seagrass in the bay also lessens the potential for the variety of species that exist in the Cairns region to be found in the bay (i.e., Loggerhead, Green. Hawksbill, Leatherback, Olive Ridley and Flatback turtle species).

Dolphins are sighted regularly along the northern beaches. Two species of dolphin may occur within the zone of impact. As detailed in Table 9, the Australian snubfin dolphin (*Orcaella heinsohni*) and Indo-Pacific humpback dolphin (*Sousa chinensis*) are known to occur in the Cairns region. Based on habitat studies, the species are both known to prefer shallow nearshore waters close to river mouths. Therefore, while there have not been confirmed records for Half Moon Bay, it is assumed that individuals could occur (BMT, 2020).

Crocodiles are known to exist in the area, predominately in the estuary where the mangroves provide habitat. Local experience has seen "known" individuals grow from juveniles into larger mature crocodiles over decades within the estuary (EcoSustainAbility, 2018). Several sightings have been recorded by the Qld government and some crocodiles have also been removed by Queensland Parks and Wildlife Service. Crocodiles are listed as vulnerable under the Nature Conservation Act.

3.6.8 Terrestrial Fauna

Trinity Park Beach and some low-lying areas of Half Moon Bay have the potential to attract shorebirds and migratory seabirds. The intertidal area of Half Moon Bay is the product of historical maintenance dredge material placement and is highly disturbed habitat that is not known to support significant intertidal foraging opportunities (BMT, 2020). The actual value of this area to shorebirds is therefore considered to be low and not of relevance in assessing impacts at a population or regional scale (BMT, 2020).

Several seabirds were identified in the PMST as they could occur in the area. These species would utilise intertidal habitat for roosting purpose and foraging. The number of birds occurring in the project area would be insufficient to represent an ecologically significant proportion of the population of any of these species.

Table 9: Protected Matters Search – Half Moon Bay

Common name	Scientific name	Listing	Type of presence (from PMST)	Assessment of occurrence
Shorebirds and seabirds				
Common sandpiper	*Actitis hypoleucos*	Mi	Species or species habitat known to occur within area	International migratory shorebirds are either known or likely to occur in the area, utilising the various intertidal flats and associated habitats within Half Moon Creek and Half Moon Bay.
Sharp-tailed sandpiper	*Calidris acuminata*	Mi	Species or species habitat known to occur within area	
Red knot	*Calidris canutus*	EN, Mi	Species or species habitat known to occur within area	
Curlew sandpiper	*Calidris ferruginea*	CR, Mi	Species or species habitat known to occur within area	
Pectoral sandpiper	*Calidris melanotos*	Mi	Species or species habitat likely to occur within area	
Latham's snipe	*Gallinago hardwickii*	Mi	Species or species habitat may occur within area	
Bar-tailed godwit (baueri)	*Limosa lapponicabaueri*	VU, Mi	Species or species habitat known to occur within area	
Northern Siberian bar-tailed godwit	*Limosa lapponicamenzbieri*	CR, Mi	Species or species habitat may occur within area	
Eastern curlew	*Numenius madagascariensis*	CR, Mi	Species or species habitat known to occur within area	
Common greenshank	*Tringa nebularia*	Mi	Species or species habitat likely to occur within area	
White-bellied storm-petrel (Tasman Sea)	*Fregetta grallariagrallaria*	VU	Species or species habitat likely to occur within area	Seabirds are either known or likely to occur in the area based on suitability of foraging habitat and roosting habitat throughout Half Moon Creek and Half Moon Bay.
Common noddy	*Anous stolidus*	Mi	Species or species habitat known to occur within area	
Fork-tailed swift	*Apus pacificus*	Mi	Species or species habitat likely to occur within area	
Lesser frigatebird	*Fregata ariel*	Mi	Species or species habitat known to occur within area	
Greater frigatebird	*Fregata minor*	Mi	Species or species habitat known to occur within area	
Little tern	*Sternula albifrons*	Mi	Species or species habitat may occur within area	
Marine megafauna				
Bryde's whale	*Balaenoptera edeni*	Mi	Species or species habitat may occur within area	As the area of potential impact represents shallow, nearshore waters, whales are not relevant to the assessment.
Blue whale	*Balaenoptera musculus*	VU, Mi	Species or species habitat may occur within area	
Humpback whale	*Megaptera novaeangliae*	VU, Mi	Species or species habitat known to occur within area	

Australian snubfin dolphin	*Orcaella heinsohni*	Mi	Species or species habitat known to occur within area	Inshore dolphins are likely to occur in the area as individuals.
Indo-pacific humpback dolphin	*Sousa chinensis*	Mi	Foraging, feeding or related behaviour known to occur within area	
Killer whale	*Orcinus orca*	Mi	Species or species habitat may occur within area	While there is potential for killer whales to be present in the Cairns region, any such occurrences are typically anomalies, and it is generally considered unlikely that the species will be present.
Dugong	*Dugong dugon*	Mi	Species or species habitat known to occur within area	Dugong are known to occur in the Cairns region andindividuals may transit through Half Moon Bay.
Loggerhead turtle	*Caretta caretta*	EN, Mi	Breed likely to occur within area	Marine turtles are known or likely to occur in the area as individuals. The area is within the known distribution and occurrence of each species.
Green turtle	*Chelonia mydas*	VU, Mi	Breeding known to occur within area	
Leatherback turtle	*Dermochelys coriacea*	EN, Mi	Breeding likely to occur within area	
Hawksbill turtle	*Eretmochelys imbricata*	VU, Mi	Species or species habitat known to occur within area	
Olive ridley turtle	*Lepidochelys olivacea*	EN, Mi	Breeding likely to occur within area	
Flatback turtle	*Natator depressus*	VU, Mi	Foraging, feeding or related behaviour known to occur within area	
Salt-water crocodile	*Crocodylus porosus*	Mi	Species or species habitat likely to occur within area	Crocodiles are known to occur in the Cairns regionand could occur from time to time within Half Moon Creek or Half Moon Bay.
Freshwater sawfish	*Pristis pristis*	VU, Mi	Species or species habitat known to occur within area	Sawfish are considered highly unlikely to occur within the area as there are no known occurrences in recenthistory of sawfish within Half Moon Creek, Half Moon Bay or the surrounding area.
Green sawfish	*Pristis zijsron*	VU, Mi	Breeding likely to occur within area	
Narrow sawfish	*Anoxypristis cuspidata*	Mi	Species or species habitat likely to occur within area	
White shark	*Carcharodon carcharias*	VU, Mi	Species or species habitat may occur within area	While there is potential for white sharks and porbeagles to occur in the Cairns region, any suchoccurrences are typically anomalies, and it is

Porbeagle	*Lamna nasus*	Mi	Species or species habitat may occur within area	generally considered unlikely that the species will occur.
Whale shark	*Rhincodon typus*	VU, Mi	Species or species habitat may occur within area	As the relevant area of potential impact represents shallow, nearshore, and estuarine waters, whale sharks are not relevant to the assessment.
Reef manta ray	*Manta alfredi*	Mi	Species or species habitat may occur within area	Manta rays are more commonly associated with reef and pelagic habitat and therefore are not consideredrelevant to the assessment.
Giant manta ray	*Manta birostris*	Mi	Species or species habitat may occur within area	
Other species				
Red goshawk	*Erythrotriorchisradiatus*	VU	Species or species habitat known to occur within area	There is suitable habitat in the project area and surrounds for woodland and coastal bird species. However, no vegetation impacts are proposed therefore this habitat is not at risk from the proposal. Therefore, these species are not considered relevant to the assessment.
Grey falcon	*Falco hypoleucos*	VU	Species or species habitat likely to occur within area	
White-throated needletail	*Hirundapus caudacutus*	VU, Mi	Species or species habitat known to occur within area	
Australian painted snipe	*Rostratula australis*	EN	Species or species habitat likely to occur within area	
Masked owl (northern)	*Tyto novaehollandiaekimberli*	VU	Species or species habitat likely to occur within area	
Oriental cuckoo	*Cuculus optatus*	Mi	Species or species habitat known to occur within area	
Barn swallow	*Hirundo rustica*	Mi	Species or species habitat known to occur within area	
Black-faced monarch	*Monarcha melanopsis*	Mi	Species or species habitat known to occur within area	
Spectacled monarch	*Monarcha trivirgatus*	Mi	Species or species habitat known to occur within area	
Yellow wagtail	*Motacilla flava*	Mi	Species or species habitat known to occur within area	
Satin flycatcher	*Myiagra cyanoleuca*	Mi	Species or species habitat known to occur within area	
Rufous fantail	*Rhipidura rufifrons*	Mi	Species or species habitat known to occur within area	
Osprey	*Pandion haliaetus*	Mi	Species or species habitat known to occur within area	
Haines's orange mangrove	*Bruguiera hainesii*	CR	Species or species habitat likely to occur within area	Haines's orange mangrove is known to occur in the Cairns region and there is a very small possibility that it may occur within Half Moon Creek. Regardless the project does not pose a risk to marine plants or any vegetation.

3.7 HMB Conditions: Climate, Weather and Sediment Movement

3.7.1 Bathymetry

Half Moon Bay is a shallow bay with moving sand and silt banks. The seafloor is subject to significant natural and anthropogenic changes due to coastal processes and activities occurring in the bay.

3.7.2 Prevailing Weather

There is the prevailing south-easterly trade wind which blows in varying force throughout most of the year. These winds assist with the movement of sediments north along the coastline and into the bay. In summer months the wind can move to a north-easterly and consequently the directing of inshore waves will change, which can mobilise sediments in a different manner to the normal south-easterly. This is exacerbated by the north-westerly monsoon, which when active can create major movement of sediment (EcoSustainAbility, 2018).

3.7.3 Currents and Waves

The following outlines the various current considerations:

- Half Moon Bay has constant tidal current movement and generally a northward coastal flow (driven by the prevailing south easterly winds).
- Half Moon Creek has tidal streams which can reach 3 knots during spring tides at the creek mouth. There is a strong >2 knot current during spring flood and ebb at the confluence of Avondale Creek and Half Moon Creek.
- The entrance to Half Moon Bay Marina has tidal currents on the flood and ebb tides. There is a flooding set southward on the eastern shore of the marina basin (under the YKBC clubhouse deck), with flow northward on the ebb.
- Bluewater Harbour and canals have little current in the basins but there is a noticeable (<1knot) current at the confluence of Half Moon Creek and Bluewater Harbour (where the channels diverge to the canals and marina).
  (EcoSustainAbility, 2018).

Wave observations: There is no oceanic swell owing to the presence of the Great Barrier Reef, however the shallow water and long fetch to the southeast and northeast ensures that even in low wind conditions that there are at least 1m wind-waves across Half Moon Bay. During a strong monsoon trough and cyclonic conditions 3-4m waves can occur in the bay. The current at the mouth of Half Moon Creek can set up standing waves on some tides and/or during flood/storm outflows from the creek (EcoSustainAbility, 2018).

In late 2018, BMT deployed an Acoustic Doppler Current Profiler (ADCP) instrument within Half Moon Bay to measure waves and currents (BMT 2019). The data collected is presented in Figure 11 and shows a typical significant wave height (Hsig) of 0.3-0.6 m and a typical current speed of 0.1-0.3 m/s. The measured current and wave energy is sufficient to mobilise fine sediments (silts and clays) and this is reflected in the regional and local turbidity data presented in section 3.7.6 (BMT, 2021).

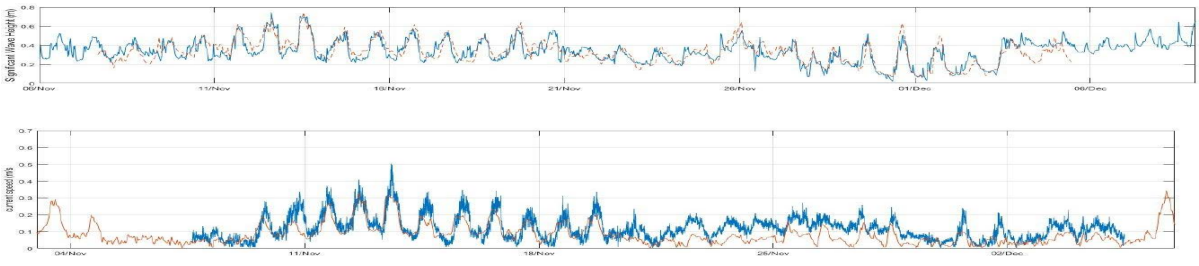


Figure 11: Half Moon Bay Significant Wave Height (top) and Currents (bottom) - recorded data shown in blue.

3.7.4 Rainfall

The average rainfall is 1992mm on an average 154 days with the majority falling during summer between January and March. The years 2022 and 2021 both received above average fall with 2037mm recorded in 2022 (over 124 days) and 2485mm recorded in 2021 over 145 days (BoM, 2023).

3.7.5 Coastal Processes and Sediment Movement

A conceptual understanding of sediment movement in Half Moon Bay and the dredge areas is provided in Figure 12.

An understanding of coastal processes and sediments movement to, within and from Half Moon Bay has been developed from investigations, monitoring and observations made over the years. This has included the Queensland Beach Protection Authority's 1984 report, contractor and consultant observations, and information drawn from consultant reports for other development projects or operations in the area, such as:

- Cairns Shipping Development Project Environmental Impact Statement (2017)
- Yorkeys Knob Boat Ramp Facility – Investigation Report (BMT, 2019)
- Trinity Beach Coastal Processes Report (BMT 2018).

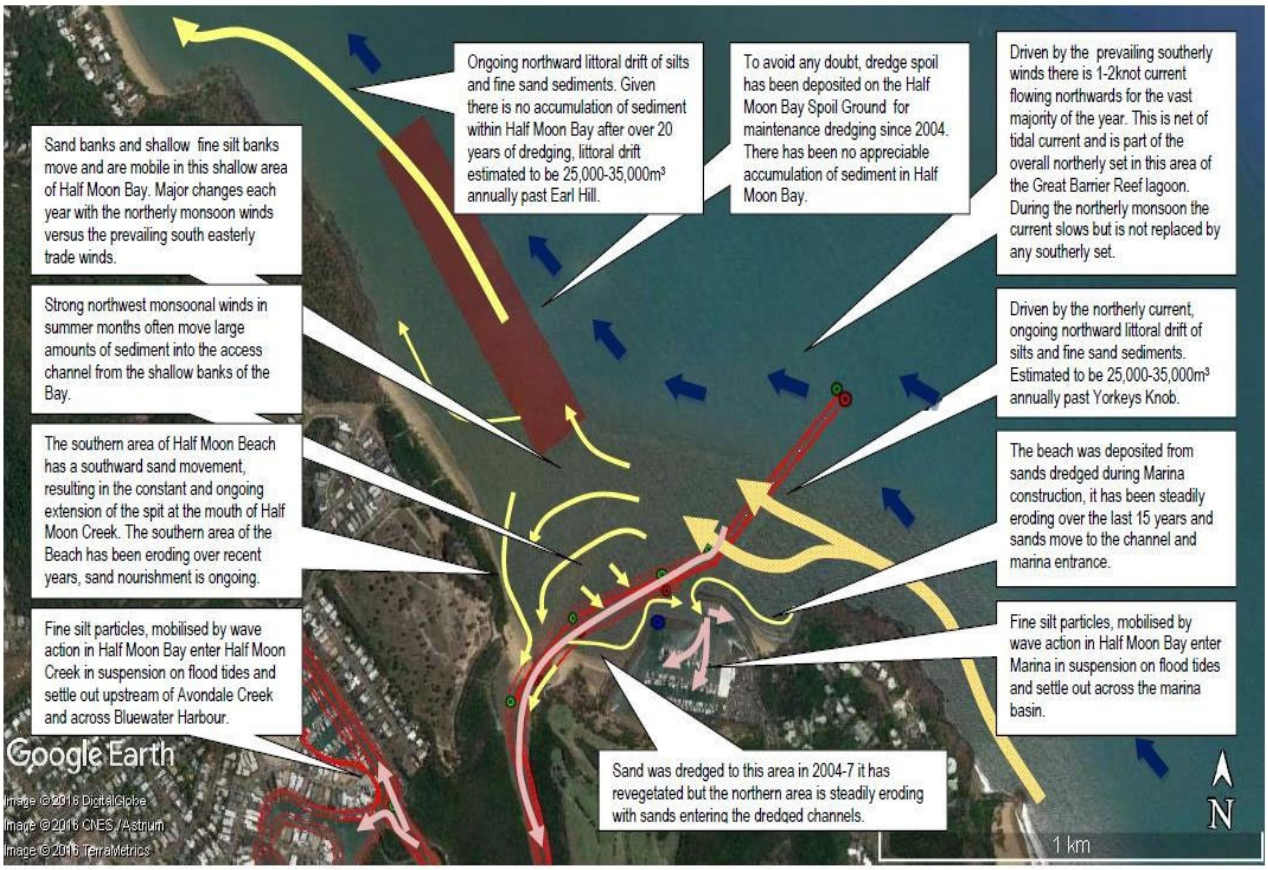


Figure 12: Coastal Processes and Sediment Movement in Half Moon Bay (from EcoSustainability, 2018)

Key findings have included:

- There is an ongoing northward littoral drift of sediments carried by a 1-2 knot northerly current (driven by the prevailing south easterly winds). The "gutter" of the outer entrance channel fills with this sediment and there is ~25,000-35,000m^3 of accumulation annually.
- Fine sediments (silts) are mobilised into suspension by wave action in Half Moon Bay, these enter the Half Moon Bay Marina (HMBM) and Half Moon Creek (HMC) and Bluewater harbour (BH). The silts settle out before the tide ebbs and slowly accumulate. The greatest accumulation is inside

the HMBM basin and at the entrance to Bluewater Harbour, where the tidal velocity slows (allowing the suspended silts to settle out).

- Sand banks and shallow fine silt banks move and are mobile in the shallow area of Half Moon Bay. There are major changes in sand and mud banks each year with the northerly monsoon winds versus the prevailing south easterly trade winds.
- There is an ongoing northward littoral drift of silts and fine sediments from the HMBSG. This is a northward flow past Earl Hill.
- Analysis of recent hydrographic surveys at the HMBSG suggest over 90% of the material placed at the site between May 2018 and April 2021 has dispersed, consistent with previous assessments of earlier placement activities (BMT, 2021).
- Coarser sediments that are placed in the bay (i.e., sand) move much slower in the littoral drift.
- The beach areas are highly active.
- The beach on the HMBM northern breakwater wall was deposited from sands dredged during construction of the HMBM, it has been steadily eroding over the last 15 years and sands move west to the outer channel and marina entrance.
- The coastal processes within Half Moon Bay have been modified by development, particularly the Bluewater Channel that provides safe access to Bluewater Harbour. The channel is within an active sediment transport zone and requires regular maintenance dredging, and its presence has likely contributed to shoreline recession at Trinity Beach.
- The material that accumulates in the channel is predominantly (>90%) fine silts that are naturally resuspended by the prevailing coastal processes, as reflected in the regional and local turbidity datasets.
- The southern area of Trinity Park Beach has a southward sand movement, resulting in the constant and ongoing extension of the spit at the mouth of HMC. The southern area of the beach has been eroding for ~10 years, numerous beach nourishment events are conducted each year to combat this erosion.

3.7.6 Water Quality Values

The waters of HMB are naturally turbid, as sediments are constantly resuspended by natural conditions occurring along the coastline (wind, waves, current). During the wet season, sediments from the Barron River are deposited at various locations within the bay depending on the sediment particle size. Coarse sediment grain sizes (sands and gravels) tend to settle out near the Barron River entrance, shoreline channels or along the beaches. Finer sediment particles settle out within mangroves or within the centre of Trinity Bay (e.g., Carter et al 2002).

Turbidity data was collected in 2013/14 and again in 2016/17 at several locations in Trinity Bay by BMT for the Cairns Shipping Development Environmental Impact Statement (EIS). Two of these monitoring locations along the northern beaches, Palm Cove and Yorkeys Knob, could be considered representative of water quality near Half Moon Bay.

A water quality instrument was deployed offshore from Palm Cove (near Double Island) in 2013/2014 and collected 12 months of data (July 2013 to July 2014). A further three months of data was collected at this location in 2016. Both datasets are presented in Figure 13.

A water quality instrument was also deployed just offshore from Yorkeys Knob in 2013/2014 and collected 12 months of data (July 2013 to July 2014). This data is presented in Figure 14.

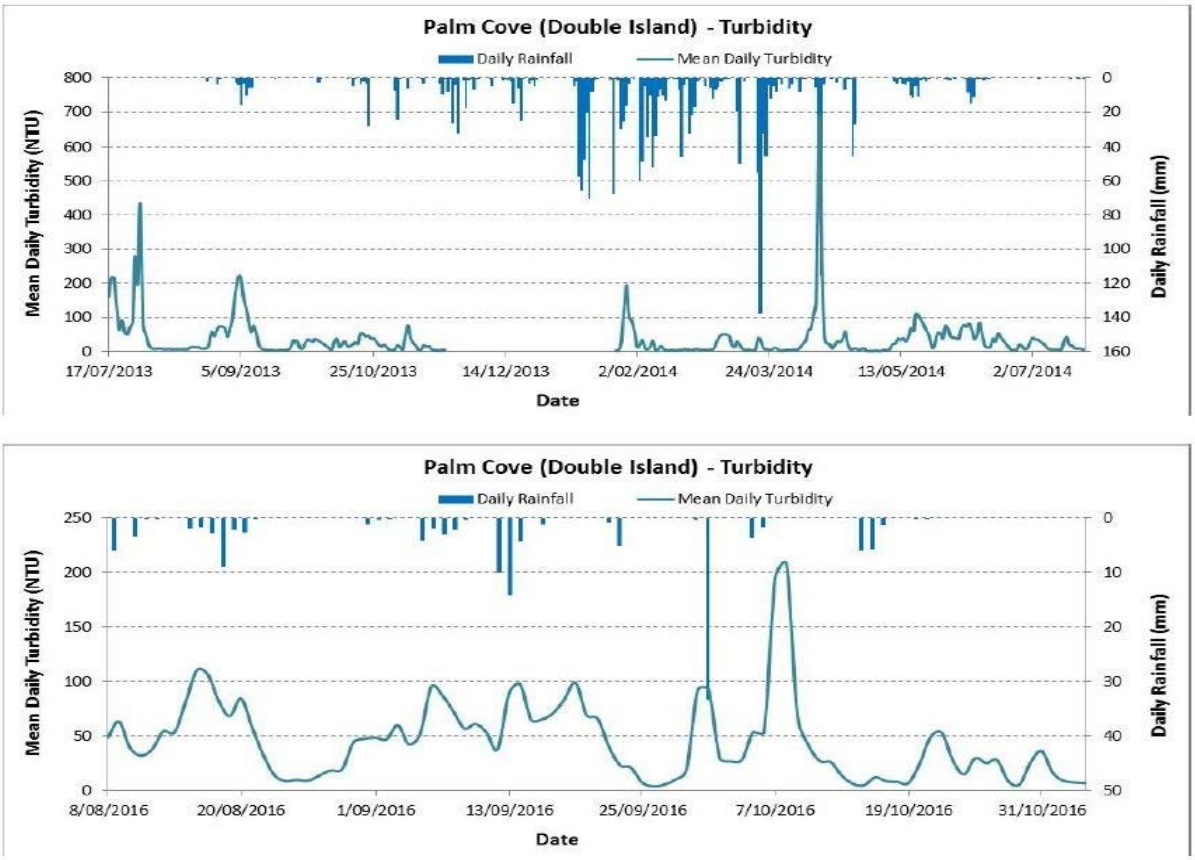


Figure 13: Palm Cove (Double Island) Turbidity Data – 2013/14 (top) & 2016 (bottom)

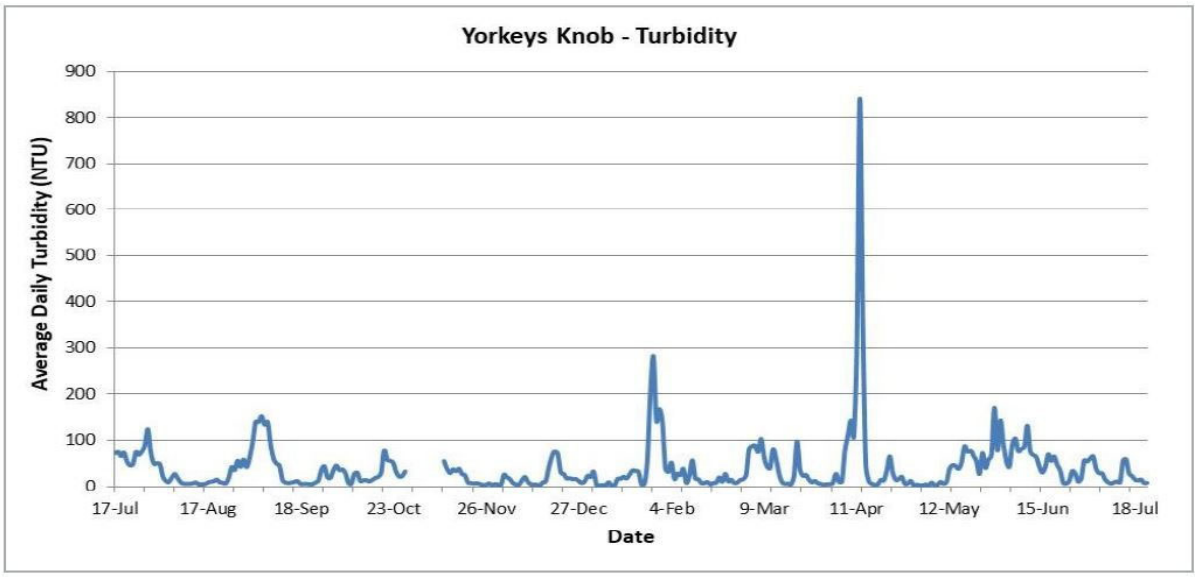


Figure 14: Yorkeys Knob Turbidity Data (2013/14)

This data indicates the following:

- Turbidity at Palm Cove (Double Island) in 2016 was around 40 NTU for most of the time (median of 40 NTU), with some larger spikes in turbidity around 100 – 200 NTU. Turbidity during the 2013/2014 deployment period was slightly lower in general (median of 17 NTU), however there were some larger turbid spikes up to around 400 - 700 NTU.
- Turbidity at Yorkeys Knob in 2013/14 was similar to Palm Cove with a median turbidity of 18 NTU with larger spikes occasional spikes above 100 NTU.

Council has been undertaking water monitoring at specific monitoring points since the maintenance dredging commenced. Council has clean and reliable data on file from 2007, which has helped inform an understanding of the natural parameters of turbidity (NTU), pH and DO (%) in the bay.

The data is collected at three monitoring points in the bay, two are indicative of an impact site (site 9 & 10) and one a reference/background site (site 11). Refer to Figure 15.

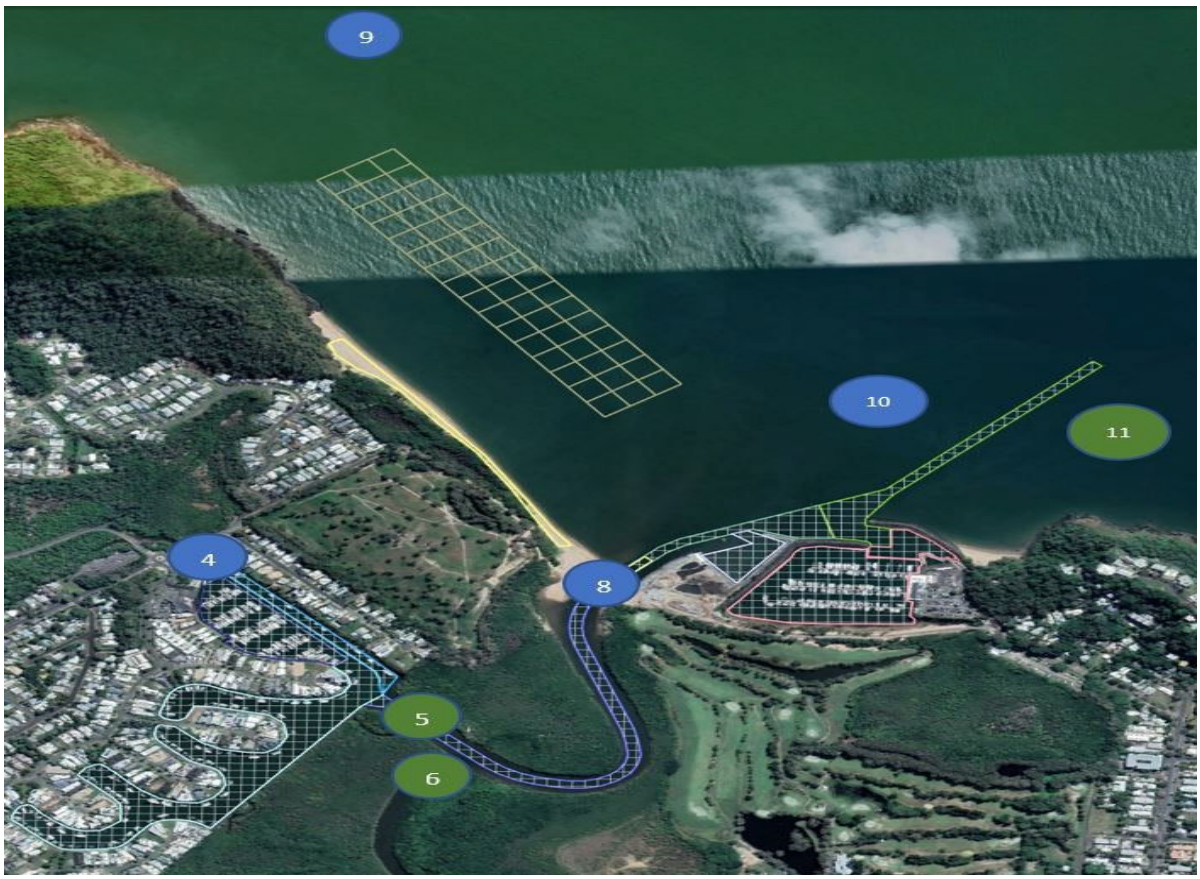


Figure 15: Water Quality Monitoring Points (impact & reference)

The data collected at site 11 is indicative of background/natural water quality condition. The results of the monitoring of Turbidity (NTU) at this site between 2007 and 2023 are depicted in Figure 16. The data indicates great variance in turbidity levels, with the lowest recorded value of 0.10 NTU and the highest being 120.3 NTU. Over the monitoring period the mean turbidity is calculated as 14.53.

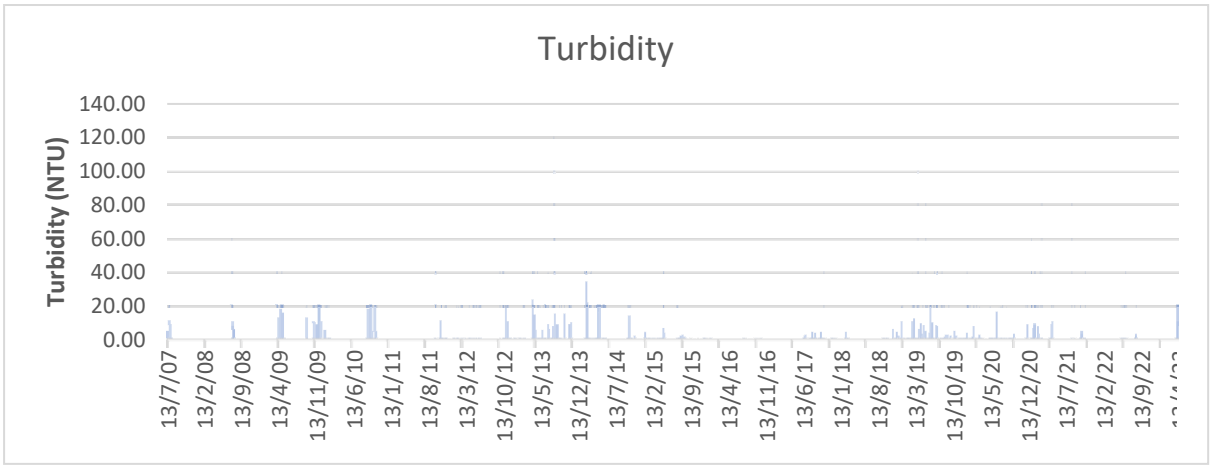


Figure 16: Background Turbidity Data (2007 – 2023)

The pH level of the water sampled at site 11 over this same period (2007-2023) is depicted in Figure 17. From this data it is evident that there is some variance in the pH level, with the lowest recorded at 5.92 and the highest being 8.91. The mean level of pH over this period is recorded as 8.16.

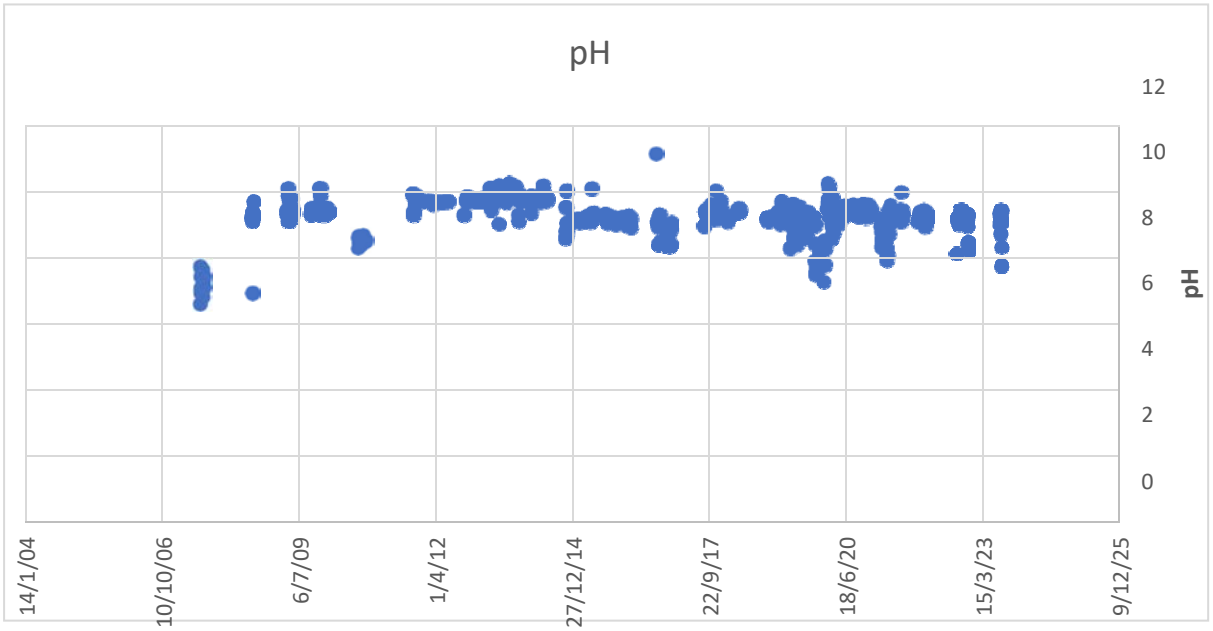


Figure 17: Background pH Data (2007-2023)

The DO (%) level of the water sampled at site 11 over this same period (2007-2023) is depicted in Figure 18. From this data it is evident that there is great variance in the DO levels recorded, with the lowest recorded at 20.7% (removing anomalies) and the highest at 150%. The mean level of DO over this period is recorded as 70.24%.

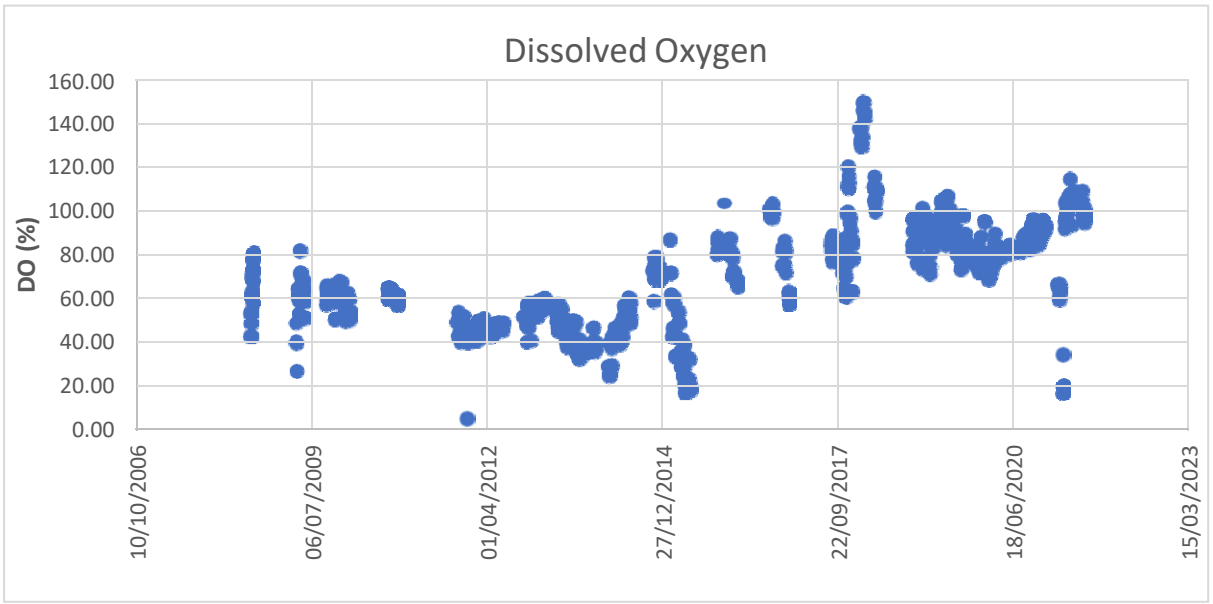


Figure 18: Background DO% Data (2007-2023)

3.7.7 Social and Recreational Values

The Cairns community has a significant population of recreational boat users (over 12,000 registered boats in the Local Government Area (LGA)). This is highlighted by the construction of a multi-lane (six land) boat ramp currently being constructed in Half Moon Bay/Yorkeys Knob. Upon its completion there will be three (3) boat ramps available to the public within this area – one (1) at Bluewater and two (2) at Yorkeys Knob. Each of these facilities rely on the maintenance dredging undertaken by CRC to ensure the channels of Half Moon Creek and/or Half Moon Bay are navigable and safe. The Marinas (Bluewater & Half Moon Bay) also rely on these channels to support a variety of users; commercial and recreational.

The area is also important to a range of other recreational users. Trinity Park Beach is a popular walking and fishing beach, and the canals and waterways are used by sailing boats, SUPs, kayaks. Vessel traffic is not impeded by the activity, and recreational users may continue to use the channels during dredging operations.

The activity does restrict access to areas of HMB where the disposal activity is undertaken. However, Half Moon Bay is essential a shoal bay with shallow water and much of the bay is identified as an unsafe navigation zone, with some navigational charts depicting the area as an exclusion zone for large vessels. Therefore, vessel traffic in the bay is low.

3.7.8 Commercial Values

Commercial fishing, tourism and pilotage vessels can use the channels to access the two marinas and Bluewater Harbour. Providing safe, navigable waters is vital to the ongoing operation of these ventures. Dredging within the channel can cause the displacement of vessels attempting to transit to and from the different Dredge Areas. However, the operation never results in the complete closure of a channel. Dredging works are coordinated in consultation with the Regional Harbour Master, as well as local stakeholders, should restrictions be in place to ensure delays were minimised as far as practicable.

The continuation of the maintenance dredging activity will not result in any negative economic impacts. The failure to continue this maintenance operation would impact commercial operations in this area.

3.7.9 Cultural & Spiritual Values

Cultural and spiritual values exist within the area. The Djabugay Nation are the Cultural Heritage Party and Native Title Claim Group who have a claim over the area. This claim group is made up of multiple tribes including Djabugay, Yirrgay, Buluwai, Nyakali and Guluy. On the coast the Yirrgay/Yirrganydji tribe, now known as the Yirrganydji Gurabana Aboriginal Corporation (YGAC) manage Cultural Heritage and Native Title in this area. Jeanette Singleton is the named representative on Cairns Regional Claim Native Title and is spokesperson for the group along with next generation Gavin Singleton. The Yirrganydji Land and Sea Rangers also play an active role in the management of this area of Cairns.

A search of the Aboriginal and Torres Strait Islander Cultural Heritage Database (DATSIP, 2022) identified that there is a cultural heritage site point in this area. The site is located at the southern end of Trinity Park Beach, towards the mouth of Half Moon Creek approximately 70m offshore (refer to Figure 19). The site is a suspected historical fish trap.

A site inspection of the area was undertaken by Everick Heritage Consultants, CRC and members of the Djabugay Nation on 6th October 2022 which resulted in the discovery of the site. The possible fish trap is located subsurface and is now buried by sand. Using sea level data, the age of the structure is predicted to be seven thousand years old (Everick, 2022).

Council is in consultation with the Party, and it is likely that additional survey work will be undertaken to confirm the true extent of the fish trap. The Party has also been consulted with on the maintenance dredging activity, with details of the proposal sent to the Party via the correct communication channels and no issues have been raised by the ongoing maintenance activity.

Advice from the experts has also negated the concern that tropical cyclones, high-traffic areas, and high-energy currents may have detrimentally impacted the fish trap. Recent studies have proven that cyclonic activity does not impact sub-water structures (Cook Hale et al. 2022; Benjamin 2022). Additionally, research has identified the level of energy required for a sea current to move rocks in tidal areas is significantly higher than is naturally occurring (Benjamin et al. 2022, 2020). The site is located outside of any areas that are actively dredged or where sediments are disposed. Therefore, the activity does not have the potential to impact the structure.

Council maintains good communication lines with the Pary and should any concerns arise, these will be addressed accordingly.

Figure 19: Study Area and subsurface finds (points)

4. SEDIMENT ASSESSMENT

An understanding of sediment movement along the coastline of the northern beaches and how sediments move into, within and from the bay, has been gained over the many years of this maintenance dredging activity being undertaken. This has been developed through observations and targeted assessments (studies), as well as from information gathered for other developments and maintenance activities in the region (e.g., Trinity Inlet maintenance dredging, TMR boat ramp construction, etc.). From this understanding it is understood that the majority of sediments that accumulate in the dredge areas are from coastal origins.

The ongoing sediment characteristic and quality sampling and analysis undertaken as part of the maintenance dredging operation, informs Council on the contamination status of the material and its acceptability for ocean disposal.

This information is critical when assessing if there is an ongoing need to continue the dredging activity and also when reviewing options or opportunities to reduce the amount of dredging that is required. This section provides a description of the nature of the sediments and opportunities that have been investigated.

4.1 Sediment Knowledge, Characteristics and Quality

The characteristics and quality of the sediments in each of the dredge areas is well known. Sediments are sampled and analysed every five years in accordance with the NAGD and an approved Sediment Sampling and Analysis Plan (SAP), which also includes the annual testing of sediments to be removed from a dredge area for specific heavy metals.

Over the years there has been extensive sediment sampling for particle size and potential contaminates. A summary of the years that sediment sampling has been undertaken since 2006 is provided in Table 10.

Table 10: Sediment Sampling 2006 - 2023

Parameter	Dredge Area 1		Dredge Area 2		Dredge Area 3			Half Moon Bay Spoil Ground
Zones	Zones A - D Half Moon Creek andBluewater Harbour	Zones A - D Half Moon Creek andBluewater Harbour	Zone A Inner Entrance Channel (HMC mouth to HMBM)	Zone C Outer Entrance Channel -HMBM to Outer Leads	Zone D Half Moon Bay Marina Entrance to Boat ramp	Zone E Inner Half Moon Bay Marina	Zone E Inner Half Moon Bay Marina	Spoil Ground
Sites	HMC #16-20	Additional 10 Sites	HMC	HMC #20,21,22,23	HMBM #1	HMBM #1-4	Additional 14 sites	HMC 22

Particle Size	2023, 2022, 2021, 2020, 2019, 2017, 2013	2023, 2022, 2021, 2020, 2019, 2017, 2013	2023-2017, 2015, 2012, 2011, 2010, 2009	2023-2017, 2015, 2012, 2011, 2010, 2009	2023, 2022, 2020, 2017, 2012	2023, 2021, 2020, 2017, 2006		2023, 2021 - 2017, 2015, 2015, 2012, 2011, 2010, 2009
Metals (Qld): Cu, Pb, Zn, TBT	2023-2018, 2013	2023-2018, 2013	2023 - 2017, 2015, 2012, 2011, 2010, 2009	2023-2017, 2015, 2012, 2011, 2010, 2009	2023, 2012	2023, 2009	2023,	2023, 2022 2017, 2015, 2012, 2011, 2010, 2009
TBT Elutriate							2006	
NAGD Metals	2023, 2017	2023, 2017, 2009	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016
NAGD Organics	2023, 2017, 2016	2023, 2017, 2016	2017, 2016	2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2017, 2016
NAGD TOC	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016
NAGD Radionuclide's	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023, 2017, 2016	2023 2017, 2016	2023, 2017, 2016

Since 2016, sampling has been undertaken in accordance with an approved (by DCCEEW) SAP. Under these plans a total of 169 samples have been collected and analysed from the areas dredged (Dredge Area 1, 2 & 3). Initially, in 2016 testing was for the full suite of Analytes listed in Table 2of the NAGD. The 2017 & 2023 testing was refined with the suite of analytes chosen for testing based on an understanding of potential contamination sources at each location (i.e., each Dredge Area). In these years the sediments were tested for the following:

Dredge Area 1: Grain size, TOC, Cu, Pb, Zn, Cr, Ni, Cd, Hg, Arsenic, TBT, PAHs and BTEX.
Dredge Area 2: Grain size, TOC, Cu, Pb, Zn, Cr, Ni, Cd, Hg, Arsenic and TBT.
Dredge Area 3: Grain size, TOC, Cu, Pb, Zn, Cr, Ni, Cd, Hg, Arsenic, TBT, PAHs and BTEX.
Dredge Area 4: Grain size, TOC, Cu, Pb, Zn, Cr, Ni, Cd, Hg, Arsenic, TBT, PAHs and BTEX.
Half Moon Bay Spoil Ground: Grain size, TOC, Cu, Pb, Zn, Cr, Ni, Cd, Hg, Arsenic, and TBT.

The full results of the testing completed each year are contained in the Sediment Analysis Plan (SAP) Reports.

Further to the five yearly pre-dredging sediment testing, sampling is also conducted annually from the areas that are to be dredged that year. Samples are collected from fixed monitoring sites and tested for grain size, Zinc (Zn), Copper (Cu), Lead (Pb) and Tributyltin (TBT). Between November 2018 and 2023, 52 samples were tested for these analytes. These results are kept on file in Councils data management system (#5980093).

4.2 Contaminants Testing 2023

The results of the 2023 SAP testing were similar to previous years however, it was the first year that the screening level of a contaminate was exceeded, which occurred in Dredge Area 4. A summary of the results is provided in Table 11, a full copy of the results is provided in the SAP Report 2023.

Table 11: Summary of results of sediment contamination testing undertaken in May 2023

Dredge Area	Date	Number of Samples	Sampling results
Dredge Area 1	23–24 May 2023	10	All results below NAGD Screening levels
Dredge Area 2	23–24 May 2023	13	All results below NAGD Screening levels
Dredge Area 3	23–24 May 2023	10	All results below NAGD Screening levels
Dredge Area 4	23–24 May 2023	4	All results below NAGD Screening levels except **Arsenic** (95%UCL **21.34mg/kg**).
HMBSG	23–24 May 2023	2	All results below NAGD Screening levels

All samples analysed in Dredge Area 1, 2 & 3 have returned results below NAGD Screening Levels. This provides a good indication that the sediments in these areas are probably clean.

The Arsenic (As) concentrations found in three (3) of the four (4) samples collected in Dredge Area 4 returned results just outside the NAGD screening level, with each exceeding by 1mg/kg. However, given Arsenic levels are known to be higher in Australian sediments and there are no known Arsenic contamination sources within the catchment, its presence in these quantities is likely natural and within the natural variability of sediments. Therefore, the results are not considered a concern.

The result of this testing again provides a good indication that the sediments removed as part of this activity, regardless of the area they have been dredged from, are probably clean and suitable for ocean disposal.

4.3 Reducing Sediment Accumulation and/or Dredging Requirements

The dredging operation at Half Moon Bay is relatively small as the area does not have deep channels, compared to the likes of major ports in Queensland. The volumes removed each year varies but on average ~90,000m^3 are dredged and disposed of at the HMBSG. In addition to this, ~30,000m^3 of sand is removed from the entrance channel into Half Moon Creek (Dredge Area 2, Zone B) and placed onto the beach as a beach nourishment activity to combat ongoing erosion that occurs at the southern end of Trinity Park Beach.

Sediments accumulate in Half Moon Bay as a result of coastal processes and weather conditions. Little can be done to reduce the rate of accumulation in the dredge areas without impact natural processes. Removing sediment from the system, through offsite recycling, beneficial reuse or land disposal, would unlikely impact current accretion rates, but would have detrimental impacts on the coastal processes of the northern beaches of Cairns (EcoSustainAbility, 2018). Therefore, land disposal is inappropriate and would have long-term effects.

Reducing dredging frequency and intensity has been investigated, specifically targeting the inner entrance channel where multiple dredging events are required each year to keep the channel navigable. This investigation determined that the best solution would be the construction of a training wall at the southern end of Trinity Park Beach to capture sediments moving south in the bay and into the channel (refer to section 3.7.5 for further detail on sediment movement in the bay). Figure 20 details the design and location selected for the training wall.

It was estimated that the structure proposed would significantly reduce the dredging required in this zone and would be a long-term solution to preventing the ongoing beach erosion. However, the discovery of the cultural heritage site in 2022 put this proposal on hold. The cultural site discovered is located directly in the middle of the proposed training wall, as detailed in Figure 19. As the location and positioning of the training wall cannot be altered for it to be affective, it is likely that this option is no longer viable.

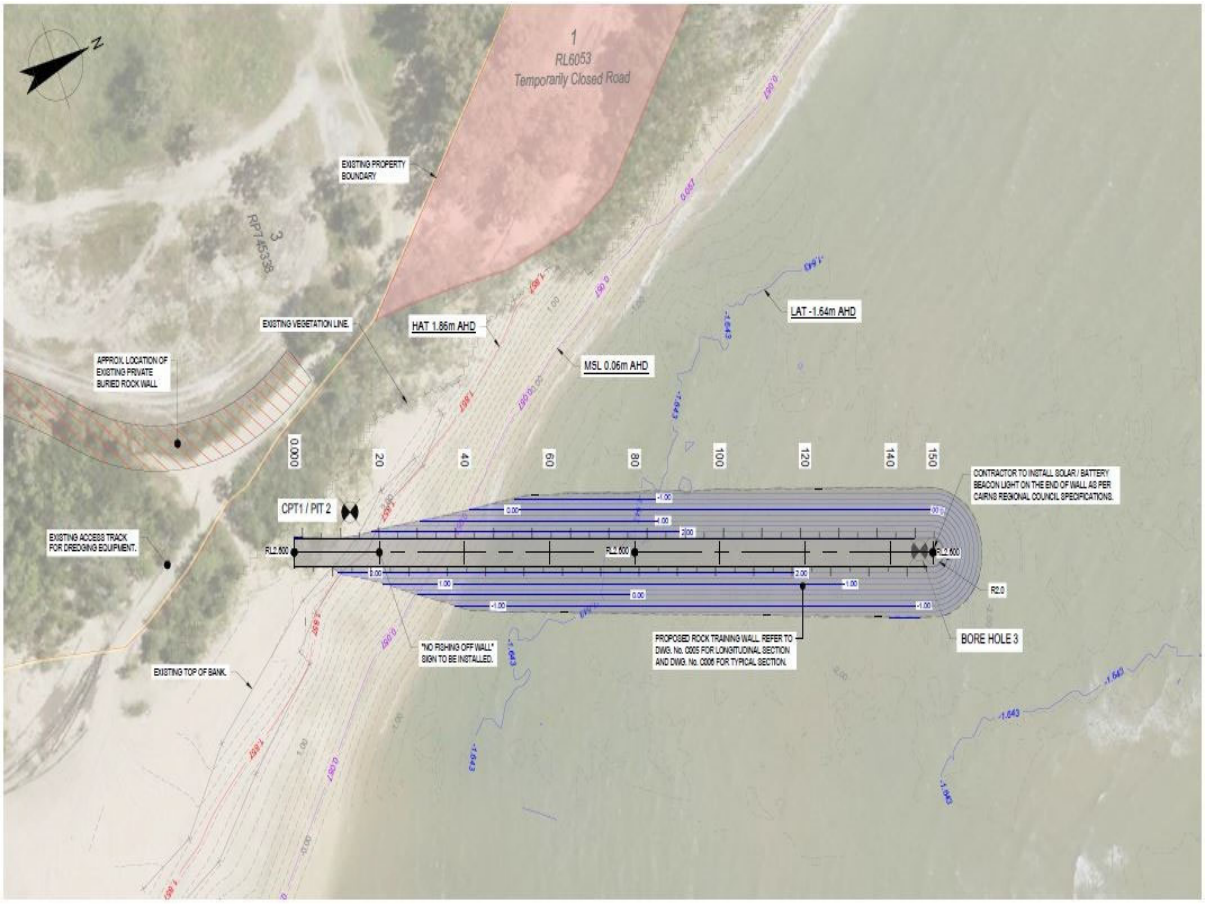


Figure 20: Trinity Beach Training Wall Design

Without the option for hard engineering solutions, Council is limited to two strategies for minimising the maintenance dredging requirements at Half Moon Bay. These include:

1) **Bed levelling**: bed levelling is used to level out high points in a channel/area, without the need for dredging. This is often undertaken in Dredge Area 1 and targets problem areas that build up more frequently than other. The activity reduces the frequency of dredging and can improve the efficacy of a dredging campaign as the depth profile becomes more consistent.

2) **Hydrographic surveys**: ongoing hydrographic surveys in the dredge areas identify where sedimentation has occurred and where the maintenance dredging should be focused, this ensures that the activity is only undertaken when and where it is required. For this reason, the frequency of the hydrographic surveys has increased in recent years.

5. CONTINUATION OF MAINTENANCE DREDGING AT HALF MOON BAY

The maintenance dredging operation is critical to maintaining navigable waters as there is no other practical solution to the removal of the constantly accumulating silt in this area.

This LTMMP is proposed to maintain suitable navigational depths in the area for over 20 years. Council has held a one-year sea dumping permit, and a five-year, now the intention is to hold a ten-year permit. As with previous years it is expected that two (2) to three (3) dredging campaigns will occur each year, depending on any cyclonic conditions there may be a requirement for more frequent scheduling of dredging activity.

The maximum volume Council expects to dredge in the next 10-year period is ~1,260,000m3. This number is significantly reduced if there are no (or few) cyclones or significant weather events over the period. Over the last permitting period (five years) the region did not experience a cyclone and the total volume that has been removed is ~420,735m3 of the 667,000m3 quota.

5.1 Dredging and Disposal Method

The maintenance dredging will be undertaken using a cutter-suction dredge and the material is transported to the disposal location via a pipeline.

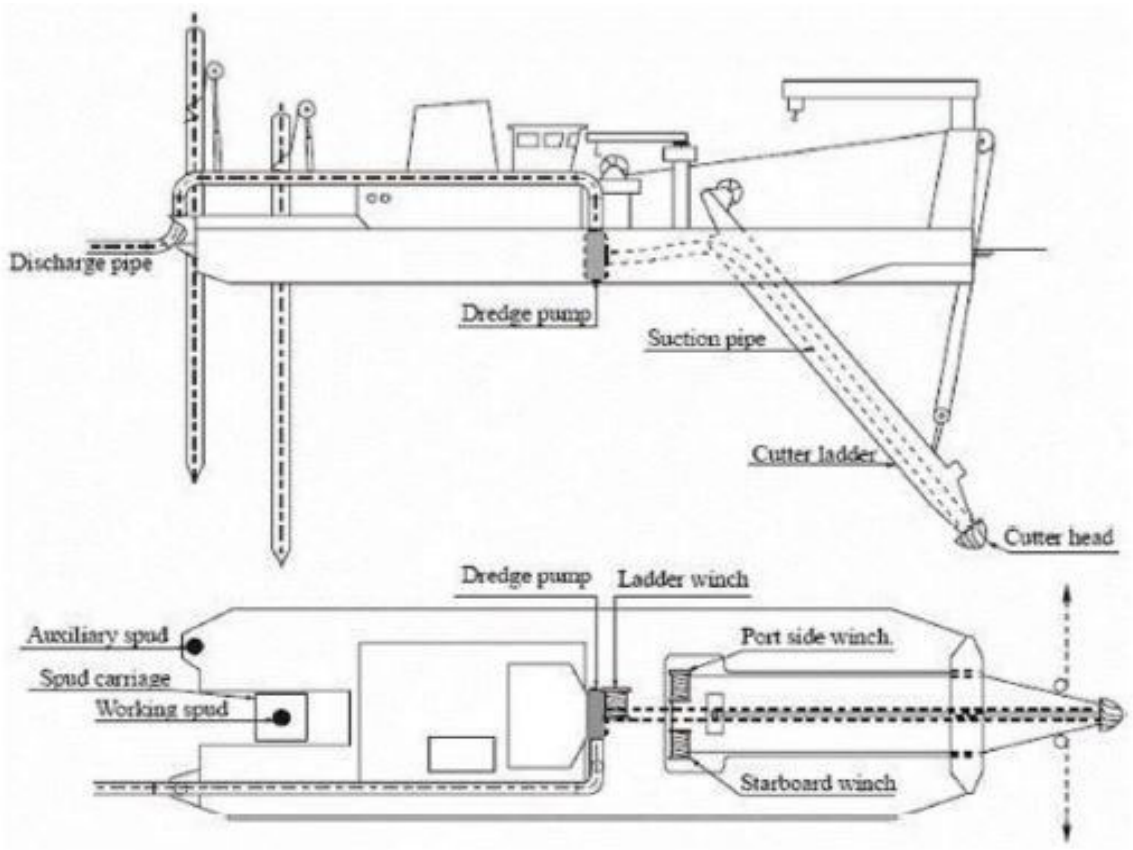


Figure 21: Typical CSD design

The information below details the specifications of the equipment typically utilised to undertake the maintenance dredging at Half Moon Bay.

5.2 Dredging Equipment

The dredge is a stationary Cutter Suction Dredge (CSD) that mechanically breaks the cohesion between the soil particles to be dredged via a rotating cutter head (Jaden Dredge Cutter). The soil is subsequently sucked up via the suction mouth by the flow of the dredge pump(s) along a suction pipe. The suction mouth, suction pipe and cutter head are mounted to the cutter ladder. The ladder is lowered to the required depth and the dredge moves by pulling and slacking on the two (2) front side line wires by means of the side wire winches. The thickness of the layers that can be removed by one swing (cut thickness) shall vary depending on ground conditions.

The cutter suction method is preferred as it allows the use of a pipeline, and the method minimises turbidity at the inlet as the cutter speed can be matched with the suction to ensure negative pressure at the suction pipe.

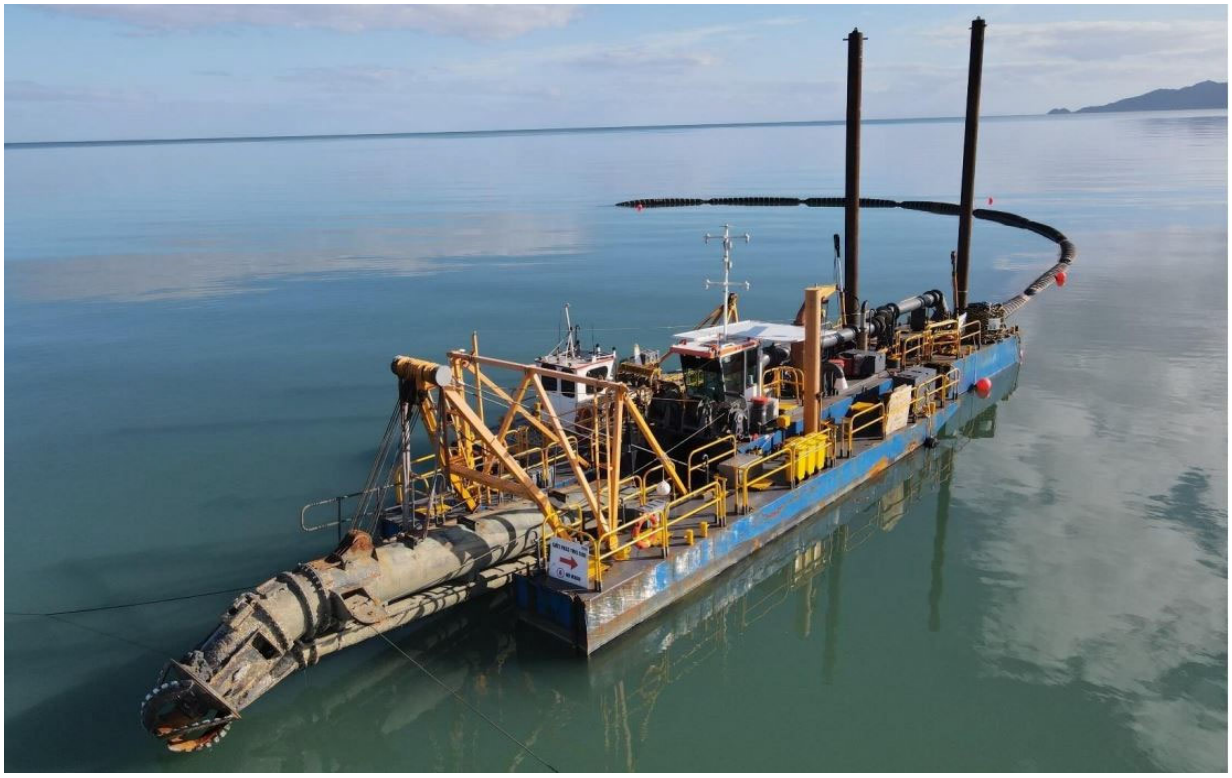


Figure 22: Mabuiag IHC Beaver 1200 CSD

The monitoring system provides the dredge operator accurate real time dredge information as it shows, amongst others the position of the cutter relative to the design to be dredged. Dredging is adjusted based on the results of regular or interim hydrographic surveys.

The CSD will utilise a Real-time kinematic (RTK) GPS positioning system. These systems provide centimetre accuracy in horizontal and vertical planes. A tide gauge will be installed as backup for the vertical level reference (guaranteeing an accurate back up for the dredge depth indication). A dredge monitoring system shows in real time the position of the cutter and ladder relative to the chosen reference datum and coordinate system used. This monitoring system is connected to the RTK-GPS system used on the dredge vessels. The monitoring system also shows the actual survey data and the dredge design.

Disposal: The dredged material is transported hydraulically through a pipeline. The pumps on-board the CSD produce a flow that lifts the dredged material from the seabed and transports it as a water-soil slurry through a pipeline from the dredge to the discharge point. The spoil pipeline is made up of several HDPE pipe sections joined together with compression flange joints. Typically, sections lengths are 20 metres.

The outlet of this pipeline is positioned in the area of the HMBSG that is being targeted (based on available capacity) and is held in place by anchors, this outlet is moved throughout the spoil ground as sediment accumulates. The frequency for this varies dependant on the density of the material being removed but typically the pipe is moved every couple of days.

The dredge pumps at ~200m3/hr of insitu sand. The dredge will have a ~10 hour per day shift with, on average, 5 hours dredging per day at the above rate (the rest of time anchor movements, pipe changes, blockages etc.). Typical volumes moved each day is between 1,000 – 1,200m3. Based on this, the dredge can move ~40,000m3 in six (6) weeks.

Booster pump: A dredge like a IHC Beaver 1200 CSD can transport fine sediments ~1.5km and coarser sediments ~1km however, a booster pump may be used to enable the dredge to pump material greater distances. When the dredge is operating in the western sections of Dredge Area 1, a booster must be utilised to reach the spoil ground.

The booster pump is typically set up on land, and this is always the preference. However, if this is not an option a floating booster can be utilised; its location can vary. Figure 23 depicts the typical pipeline arrangements and booster pump locations for the operation at Half Moon Bay.

The dredge can operate all year round, but timing and schedules are dependent on the rate of accumulation in each dredge area.

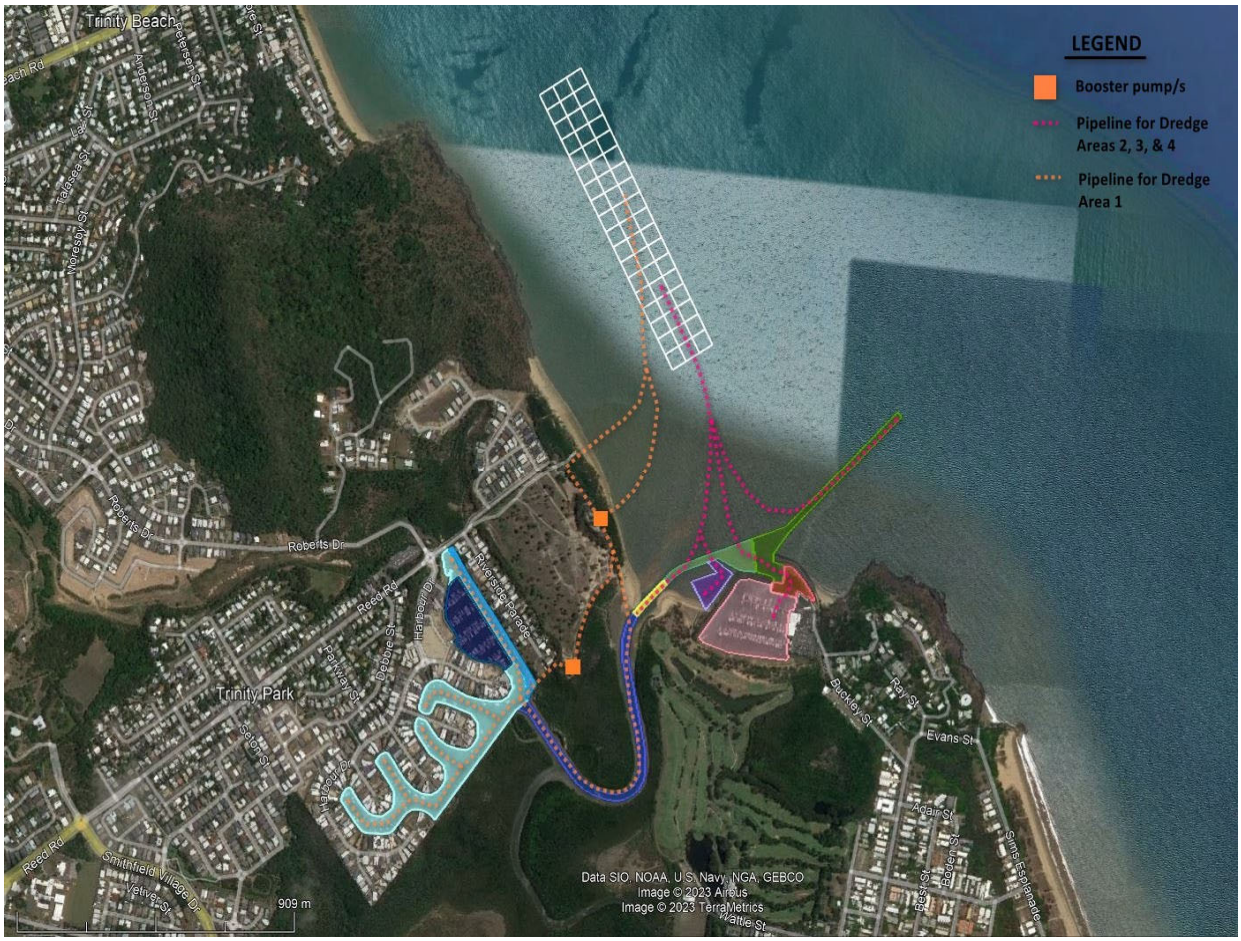


Figure 23: Booster pump locations and pipeline arrangements

Further information on current dredging practices, standards and management systems is detailedin the contractors Integrated Project Management Plan, which can be provided upon request.

5.3 Disposal Site

As outlined, there are no appropriate or practical alternatives to the use of an offshore disposal site for the ongoing maintenance dredging required. For the last ~20 years the same offshore disposal site has been utilised for the activity. This site has now filled to a level that it is difficult to operate vessels and equipment in the area, especially outside spring high tides. An investigation into the spoil grounds suitability was undertake by a consultant (BMT) in 2021 which identified that 80% of the spoil ground is inaccessible unless it is a spring high tide and the remaining 20% of the grounds is only accessible at a tide above 1.5m LAT. (BMT, 2021). Since this assessment was completed a further ~100,000m^3 of material was placed at the HMBSG, adding to the build-up of material and reducing the grounds capacity.

Accordingly, investigations have been undertaken to identify an appropriate new offshore disposal site for future use. A suitable disposal site must be a dispersive site that is located within the littoral (longshore) drift zone of Half Moon Bay (HMB). The depth of a site is also important as it will rely on wave action to resuspend the placed sediments so that they continue to move north in the littoral drift. The current HMBSG functions this way as has been evident over the last +20 years of disposing material at the site.

Estimates on the dispersal rate of the current site predict that 25,000 – 35,000m^3 of material moves past Earl Hill annually. While this rate is not completely sufficient for an operation that disposes of ~100,000m^3/year, it is enough to make this site, and a site with similar characteristics, viable for +20 years. The new HMBSG had to have similar natural influences and depth characteristics.

Habitat considerations are equally important. A suitable site must be void of marine plants (seagrasses and algae) and located far away from sensitive receptors such as coral reefs to ensure the activity does not have direct or indirect impacts on these habitats.

A marine plant survey was conducted in Half Moon Bay on the 1 December 2022 to gain a better understanding of the presence of benthic communities in the bay that may be directly affected by the placements of sediments. The survey collected sediment samples from forty-four (44) sites across the bay and found no algae or any other benthic habitat forming species in the study area, refer to Figure 24 below. The sediments collected during the survey were predominately mud or sand, or a combination of both.

These results confirmed what previous investigation have also, that the bay is void of seagrass or other sensitive benthic habitats. Therefore, the placement of dredged sediments at the site will not directly impact sensitive habitats.

Figure 24: Habitat assessment sites ((sediment sampling locations) from TropWATER, 2022)

With the marine plant survey results, Council's knowledge of coastal process in Half Moon Bay, and the recent hydrographic survey results, Council was able to identify a new disposal site (Figure 25 & 26). The grounds have the appropriate depth, are located within the littoral drift zone and are void of sensitive habitats.

Figure 25: Current and new Half Moon Bay Spoil Ground

The new grounds are located directly to the east of the current grounds but extend further to the north and not as far south. The grounds have the appropriate depth profile (max depth of -2.4 LAT), are located within the littoral drift zone of HMB and are void of sensitive habitats or seagrass. On top of the site's optimal characteristics, other reasons for its section include:

1) Sediments can only be transported via the pipeline ~1.5km. All Dredge Areas, besides the western sections of Dredge Area 1, are within this range.
2) Sediment movement observations over the last two years have identified that sediments placed in the northeast of the current HMBSG disperse at a more rapid rate than other areas of the grounds. Very little movement has been observed from the southern sections of the current HMBSG. For this reason, the new grounds have been moved to the north into this active littoral zone and further away from the entrance channels (Dredge Area 2).
3) The site is larger than the current grounds to ensure that it caters for future years of maintenance dredging, refer to Table 12 below.

Table 12: Spoil Ground Comparison (current vs new)

Site	Number of grids	Grid dimension	Total area
Current HMBSG	48	~50m x ~50m	~122,000m^2
New HMBSG	**54**	~50m x ~50m	~135,000m2

Figure 26: New Half Moon Bay Spoil Ground

6. POTENTIAL IMPACTS ASSOCIATED WITH THE ACTIVITY

All dredging activities, especially those that dispose of sediments into the ocean, have the potential to have an impact on environmental values, including the environment and its users. Some of these impacts can be short term and others long term. This section breaks down the potential impacts associated with the maintenance dredging activity at Half Moon Bay and assesses their likelihood and severity.

The dredging of sands and silts to a coastal, exposed and shallow bay could have the impacts detailed in Table 13.

Table 13: Potential Impacts associated with maintenance dredging activities.

Impact Category	Description of potential impacts
Physical	• Movement of sediment and smothering of benthic habitat • Build-up of sediment and consequent changes in seabed profile • Should seabed profile change effects on waves, currents and local sediment movement • Turbidity in the water column from spoil disposal plume • Turbidity in water from resuspension of spoil • Light attenuation from turbidity • Noise impacts • Light impacts
Biological	• Smothering of seagrasses or other benthic flora habitats • Smothering of benthic fauna • Turbidity plume causing light attenuation with consequent effects on benthic flora and fauna. • Introduction of flora/fauna species • Translocation of species • Effects on vertebrate marine species • Vessel Strike
Chemical	• Nutrients • Dissolved Oxygen • Acidity • Bioavailability of contaminants • Hydrocarbon and Chemical Spills
Socio-economic	• Effects on Commercial Users • Effects on Recreational Users • Effects on Cultural and Spiritual Values • Effects on Search and Rescue

(EcoSustainAbility, 2018)

This section sets out a consideration of these potential impacts.

6.1 The Predicted Zone of Influence

To assess the potential impacts associated with the activity, it is critical to understand the spatial extents of the impact areas. These include the areas dredged (Dredge Areas 1, 2, 3 & 4) and the disposal ground. As sediments are disposed of directly into the water column, the potential impact area at the spoil ground is greater than the static site. Identifying the actual extents of this impact zone can be gained through the tracking of sediment movement once it has been deposited into the ocean. This impact area is referred to as the **predicted zone of influence**.

The predicted zone of influence relevant to this activity is the areas dredged, the extent of the Half Moon Bay Spoil Ground (HMBSG), and a wider area zone. Using sediment plume monitoring data and sediment movement data, this wider area zone has been estimated to extend 250m to the north, 200m east, directly inshore to LAT and south to the entrance channels. Refer to Figure 27.

Figure 27: HMB Wider Area Impact Zone (zone of influence)

Sediment plume modelling has help Council to identify the extent of the wider area zone of impact (i.e., zone of influence). Modelling of the sediment plume generated at the pipe disposal outlet (at the HMBSG) is undertaken annually to inform Council of how sediments disposed offshore move once they have been released.

Each year there are similar results. At the pipe outlet (0m) turbidity levels are high and there is a rapid fallout over the next 75m. In 2022 turbidity levels dropped to ~10NTU at 75m down current on the centreline. It is not uncommon to see resuspension of the sediment and spikes in turbidity levels beyond the 75m mark, however these will resettle further from the outlet. Using 2022 as an example, at 75m turbidity levels dropped to 7.3NTU and at 100m rose to 44.5NTU, before dropping again to 11.6NTU at the 150m mark; on the centreline.

From the data collected, typically turbidity levels will return to background levels 100-250m down current of the outlet. This is evident in the results taken at the centreline and 100m either side in all plume extent surveys. The modelling conducted in 2022 is provided in Figure 28.

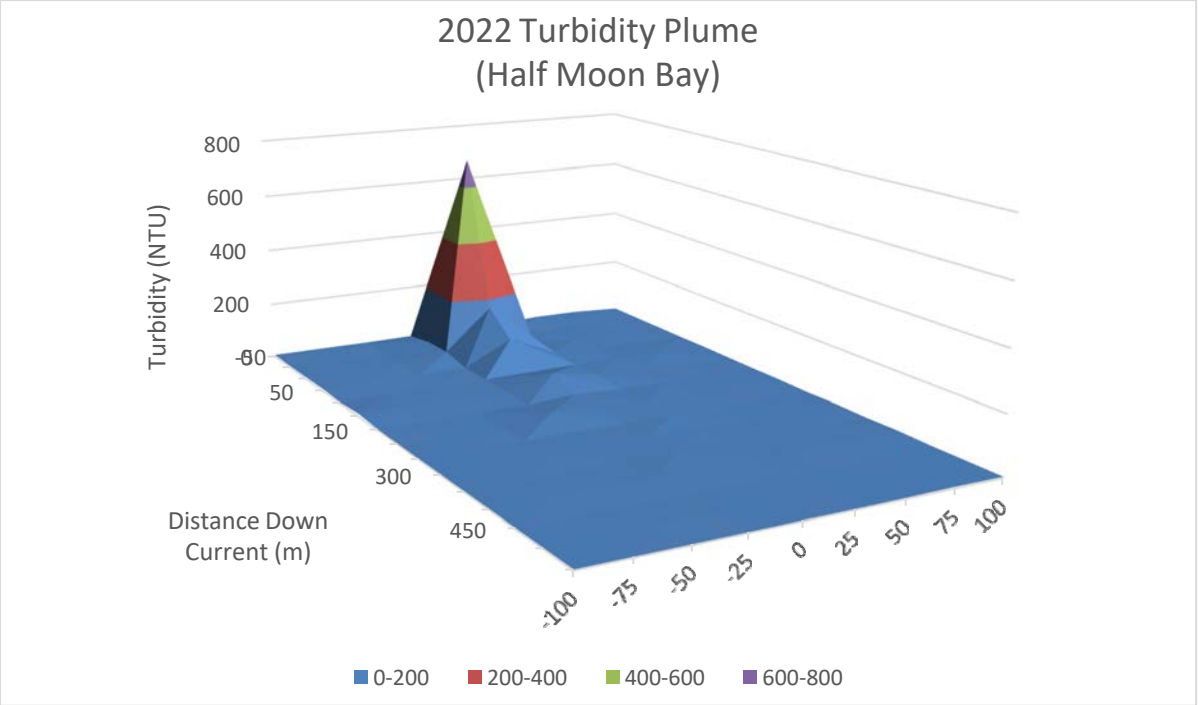


Figure 28: Turbidity Plume Extent 2022

Sediment movement monitoring is also utilised to "track" the sediments disposed of at the HMBSG to the north of the grounds. This monitoring is undertaken annually whereby sediments are collected from the northern edge (boundary) of the HMBSG on a centreline at 100m intervals for 800m. These samples are then analysed for particle size. The results of the monitoring undertaken in 2022 are consistent with the findings from previous years, with coarser material found in the first 200m, with 47% - 80% retained at 75µm (0.075mm). Beyond the 200m mostly fines/muds are present, which is typical for areas to the north of the current HMBSG. This provides further indication that the zone of influence to is ~250m to the north of the HMBSG.

The placement of sediments at an ocean disposal site has the potential to smother biota, change the substrate and reduce light attenuation for benthic habitats, should they be present. The activity also has the potential to influence water quality parameters which may affect specific species. The likelihood of impacts is greatest in the area where the sediments are placed, however impacts can also occur at the dredge sites and anywhere within the predicted zone of influence. This section has identified thepotential impacts associated with the activity and assessed each.

6.2 Changes to Seabed Bathymetry

The seabed topography of HMB has a slow slope to seaward with an undulating seabed of low sand banks and mud banks. Generally, the seabed has muds comprising silts to seaward and coarser finer to medium sands closer inshore, however this is a generalisation and mud banks of silt are found in shallow areas and sand banks in deeper areas.

The highly dynamic nature of the bay and its shallow waters do not provide a suitable environment to support seagrasses and other sensitive habitats such as reefs.

The disposal activity does alter the depth of the seabed over time, as has been observed at the current HMBSG, however, this impact is not considered significant as the bay is void of sensitive habitat characteristics. The highly dynamic environment is in a constant state of change and regardless of the disposal activity the seabed bathymetry (and the coastline) is influenced by natural conditions (wind, wave, currents, flood, etc.). The disposal of sediments in the bay will not have a significant short- or long-term effect on the bathymetry of HMB that would result in biological impacts. Further assessment of the potential impacts to benthic fauna is provided in section 6.4.

6.3 Water Quality

The waters of HMB are highly turbid, and sediments are constantly resuspended by wave action and currents along the coast. In this context, with a highly turbid background environment the effects of turbidity generated by the activity are considered to be temporary and minor.

The temporary nature of this change is proven in the sediment plume monitoring data and historical water quality data. The sediment plume monitoring data shows the rapid fall-out of turbidity levels at the pipe outlet, with levels of turbidity typically returning to background levels 100- 250m down current of the outlet, refer to section 6.1.

From the water quality sampling data collected, it is evident that the disposal activity is not having cumulative or long-term effects on water quality in HMB, specifically pH and Turbidity which are monitored daily while the dredge is in operation. An initial, temporary change to turbidity levels is unavoidable, however a review of the data collected between 2007 and 2023 shows that the mean value of each of these parameters is very similar at each of the monitoring sites (impact and reference sites, refer to Figure 15). Examples are given in the table below.

Table 14: Mean value of turbidity & pH at ocean monitoring sites (9, 10 & 11) 2007 – 2023

	Site 9 (impact)	*Site 10 (impact)*	*Site 11 (reference)*
Turbidity	*13.11*	*13.16*	*14.43*
pH	*8.17*	*8.16*	*8.14*

Dissolved Oxygen (DO) levels have also been monitored in the bay for ~15 years (2008 - 2022), and over this period no changes to DO concentrations have not been detected during dredge spoil disposal operations which could affect marine and benthic vertebrate and invertebrate species.

The potential for the activity to alter nutrient levels in the water column is another consideration. However, as the sediments being dredged are marine sands and silts primarily from coastal origins, they are unlikely to contain nutrients levels high enough to influence the background nutrient status of HMB. Therefore, there is considered to be no likely effect on the productivity of local ecosystems or changes in species composition that could result if nutrient levels were significantly influenced.

From the analysis of the sediment sampling undertaken it is evident that contaminants are not being deposited into the water, refer to section 4. Therefore, the disposal of this dredge spoil will not result in toxification which could affect benthic communities' productivity and species composition, nor will it result in a re-release of toxins into the water column causing any wider ranging pollution affects.

From the data and observations, it is concluded that the pH and DO levels in the waters of HMB are not impacted by the activity, and the impact from temporary spikes in turbidity levels generated from the disposal of sediment in HMB is not a factor that will significantly affect biota or result in environmental harm. Due to the origins of the sediments dredged and their chemical and physical characteristics, impacts to nutrient and contamination levels of the waters in HMB are not a significant risk.

6.4 Benthic Fauna

The Bay is void of reefs and flora, and from benthic and hydrographic surveys it is evident that there are no large rocks that could provide a suitable habitat for certain marine species.

As such, arguably much of HMB only provides a suitable habitat for invertebrate species. Since 2014 three separate benthic surveys have been conducted in the bay whereby samples were collected pre and post dredging to assess the changes to infauna following the disposal of sediments and assess the presence of invasive species. Overall, these surveys found poor numbers and diversity of species. The results of the pre and post dredging comparisons also showed inconsistent patterns. For example, in 2014 there was a decrease in species post-dredging, in 2019 there was an increase in species post-dredging and in 2020 there was a decrease in species post dredging. The sites that were monitored in the Bay are detailed in Figure 29 (B# & BSG).

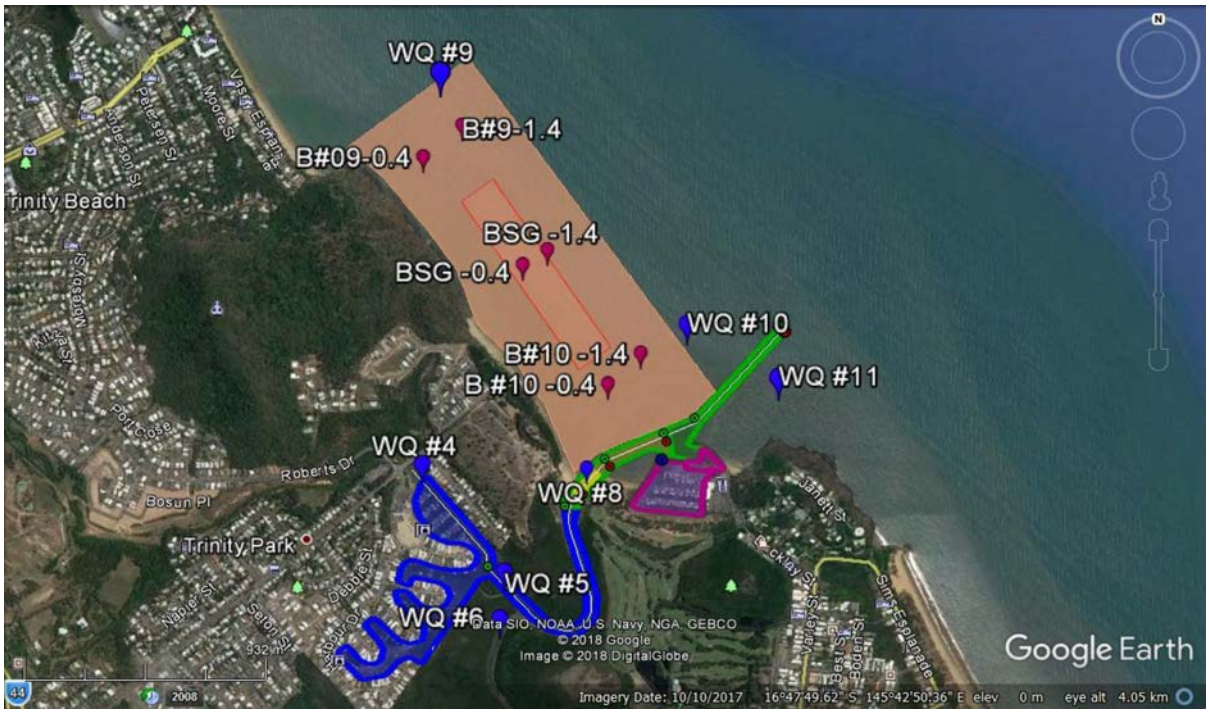


Figure 29: Benthic Habitat Monitoring Sites (B# & BSG)

These targeted assessments were not considered sufficient to identify any statistically meaningful results or patterns, and from the results it was concluded that benthic fauna communities can change rapidly depending on seasonal patterns and natural events, more so than from the placement of sediments at the site. The results also demonstrated that there are no known benthic invasive species within the areas dredged and none have been identified in the benthic testing undertaken in the bay. Based on these findings, there is the potential for some short-term changes in benthic communities associated with activity, however it is unlikely the deposition of spoil at the HMBSG will have any long-term effect on the benthic infauna at the spoil ground or in HMB

For reference, Table 15, 16 & 17 below demonstrate the observations made pre and post dredging each sampling year (2014, 2019, 2020). The full reports are kept in Councils data management system.

Table 15: Benthic Survey Results Pre and Post Dredging 2014

	Pre Dredging Results										Post Dredging Results							
	Nenis sp	Polycheate A	*Polycheate B*	*Lagarnum depressum*	Oligocheate A	Bivalve A	Chthamalidae	Paguridae	Amphipoda	Schapopoda	Total Pre Dredging	*Nenis sp*	Polycheate C	Oligocheate B	Oligocheate C	*Aceates australis*	*Amphioxus sp*	Total Post dredging
BHMC bend	4	0	0	0	34	1	9	0	0	0								
BHMC(AC)	3	0	0	0	0	0	0	0	0	0								
BSG 0.4	1	0	0	1	1	0	1	0	0	0	**4**	0	0	0	0	0	0	**0**
BSG 1.4	10	1	0	0	9	0	0	0	0	0	**20**	0	0	0	0	1	2	**3**
B9-0.4	8	0	7	0	19	0	0	0	0	3	**37**	4	1	8	0	0	0	**13**
B9 -1.4	5	0	12	0	13	0	0	0	0	0	**30**	3	0	0	1	0	0	**4**
B10-0.4	0	0	0	0	0	0	0	1	1	0	**2**	0	0	0	4	0	0	**4**
B10-1.4	3	0	0	0	11	0	0	0	0	0	**14**	0	0	0	1	1	0	**2**
TOTAL	**34**	**1**	**19**	**1**	**87**	**1**	**10**	**1**	**1**	**3**	**107**	**7**	**1**	**8**	**6**	**2**	**2**	**26**

Table 16: Benthic Survey Results Pre and Post Dredging 2019

	Oligochaeta sp A	Oligochaeta sp B	Oligochaeta sp C	Oligochaeta sp D	Oligochaeta sp E	Polychaete Sp A	Polychaete Sp B	Polychaete Sp C	Polychaete Sp D	Polychaete Sp E	Polychaete Sp F	Polychaete Sp G	Euphausiidae	Amphipoda	Bivalvia Sp A	Bivalvia Sp B	Stomatopoda	Echinoderm	Copepoda Calanoida	Anthozoa	Porifera	Total
B9-0.4 Pre Dredging	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
B9-0.4 Post Dredging	*4*	*0*	*0*	*1*	*0*	*3*	*3*	*0*	*1*	*0*	*1*	*1*	*0*	*0*	*0*	*1*	*0*	*0*	*3*	*0*	*0*	*18*
B9-1.4 Pre Dredging	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
B9-1.4 Post Dredging	*0*	*1*	*0*	*0*	*0*	*3*	*0*	*1*	*0*	*1*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	*0*	*10*	*0*	*0*	*18*
B10-0.4 Pre Dredging	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**
B10-0.4 Post Dredging	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*2*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*5*
B10-1.4 Pre Dredging	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
B10-1.4 Post Dredging	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*
BSG-0.4 Pre Dredging	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
BSG-0.4 Post Dredging	*0*	*0*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*2*	*0*	*1*	*1*	*0*	*0*	*0*	*7*
BSG-1.4 Pre Dredging	**0**	**1**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**
BSG-1.4 Post Dredging	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*2*		*3*

Table 17: Benthic Survey Results Pre and Post Dredging 2020

Pre Dredging June 2020 / *Post Dredging 2020*	Amphipoda		Bivalvia					*Copepoda Calanoida*	Echinoderm	Euphausiidae	Oligochaeta					Polychaete								Sipuncula	Total Individuals	Total Taxa
	Sp A	Sp B	Sp A	Sp B	Sp C	Sp D	Sp E				Sp A	Sp B	Sp C	Sp D	Sp E	Sp A	Sp B	Sp C	Sp D	Sp E	Sp F	Sp G	Sp H	Sp A		
B#9-0.4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**11**	**15**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**3**	**1**	**1**	**35**	**8**
B#9-0.4	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*2*	*0*	*11*	*4*	*0*	*2*	*0*	*9*	*1*	*0*	*0*	*4*	*0*	*0*	*0*	*18*	*52*	*9*
B#9-1.4	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**5**	**3**	**1**	**0**	**0**	**2**	**2**	**0**	**0**	**7**	**0**	**2**	**0**	**0**	**31**	**10**
B#9-1.4	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*3*	*0*	*0*	*5*	*3*	*0*	*3*	*0*	*12*	*0*	*0*	*1*	*3*	*3*	*4*	*0*	*8*	*45*	*10*
B#10-0.4	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**2**	**10**	**1**	**2**	**0**	**0**	**3**	**0**	**1**	**0**	**2**	**3**	**2**	**0**	**0**	**33**	**13**
B#10-0.4	*0*	*0*	*1*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*3*	*2*	*1*	*0*	*0*	*13*	*0*	*0*	*0*	*0*	*2*	*3*	*0*	*1*	*27*	*9*
B#10-1.4	**3**	**1**	**1**	**1**	**3**	**1**	**0**	**0**	**1**	**1**	**9**	**28**	**0**	**1**	**1**	**2**	**0**	**4**	**5**	**9**	**3**	**2**	**2**	**0**	**78**	**19**
B#10-1.4	*1*	*0*	*1*	*0*	*0*	*0*	*0*	*3*	*0*	*0*	*4*	*19*	*0*	*0*	*0*	*4*	*1*	*0*	*5*	*0*	*0*	*4*	*0*	*9*	*51*	*10*
BSG-0.4	**2**	**3**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**2**	**0**	**57**	**0**	**0**	**0**	**8**	**0**	**0**	**1**	**0**	**1**	**1**	**2**	**0**	**80**	**11**
BSG-0.4	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*6*	*10*	*0*	*0*	*0*	*5*	*4*	*0*	*0*	*7*	*0*	*5*	*0*	*3*	*41*	*8*
BSG-1.4	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**14**	**0**	**0**	**13**	**0**	**1**	**0**	**0**	**6**	**1**	**0**	**2**	**0**	**6**	**2**	**0**	**0**	**49**	**10**
BSG-1.4	*0*	*1*	*2*	*0*	*0*	*0*	*0*	*2*	*1*	*1*	*5*	*4*	*0*	*0*	*0*	*5*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*22*	*9*

6.5 Species Impact Assessment

As discussed in section 3.6, an assessment to identify sensitive receptors has been undertaken and concluded that very few exist in or near this area. However, the bay still has the potential to supporta variety of species, Table 9 in section 3 of the plan details the species identified in a PMTS that are either known or likely to occur in the area.

The dredging activity has the potential to affect species in a range of ways including modifying or destroying habitats, disrupting breeding cycles, reducing an area of occupancy, translocating species, or directly via a vessel strike. Table 19 has identified the potential impacts on species and assessed their risk. For the impact assessments a risk matrix has been utilised to generate a relevant risk score. The matrix used is detailed below.

Table 18: Risk Matrix

		Consequence			
		Minor	**Medium**	**Major**	**Critical**
Likelihood	**Almost Certain**	Moderate (5)	High (9)	Extreme (13)	Extreme (16)
	Likely	Low (3)	Moderate (7)	Hight (11)	Extreme (15)
	Unlikely	Low (2)	Moderate (6)	(Hight (10)	Extreme (14)
	Rare	Low (1)	Low (4)	Moderate (8)	Extreme (12)

Table 19: Risk assessment of potential impacts on species present in the predicted zone of influence.

Potential Impact	Species	Assessment	Risk score
Modification or destruction of habitat, including smothering.	All	No sensitive habitats have been identified in the bay. HMB do not provide high value habitat for any listed threatened or migratory shorebirds, seabirds or marine megafauna species. The listed species that **may** occur in the area would be individuals that move across the range of habitats available in this region (BMT, 2020). Therefore, it is unlikely that the activity would have a direct impact.	Low (4)
Translocation of marine pests.	All	The introduction of marine pests can cause damage to the health of the native marine environment. However, there are no known benthic invasive species within the areas dredged and none have been identified in any of the benthic testing undertaken in the bay. Therefore, it is unlikely that the activity will result in the translocation of marine pests.	Low (4)

Changes in water quality: Release of nutrients, increased turbidity, changes in chemical composition.	All	Due to the origins of the sediments dredged, they are relatively void of nutrients. The contamination testing undertaken, informs that the sediments are unlikely contaminated therefore their placement will not result in the bioaccumulation of contaminates. The WQ data gathered demonstrates that the activity does not impact DO levels or pH levels, and the effect on turbidity is temporary and contained to the potential zone of influence. Furthermore, the area is not known as a critical breeding environment, and no sensitive habitats are known to exist in the potential zone of influence. Therefore, temporary changes to water quality (turbidity) are unlikely to have an impact on any species.	Low (1)
Vessel Strike	Marine Megafauna	The dredge vessel is slow moving and poses low risk to marine fauna. The smaller monitoring vessel utilised is no different to other recreational vessels used in this area. No vessel strike incidents have been recorded while the operation has been undertaken. The EMP contains information on the process to follow should an incident occur. It is unlikely that the activity will influence the number of vessel strikes.	Low (4)
Noise: Underwater and above water.	All	The activity creates noise above and below the water. However, the potential for impacts associated with the noise generated is low. Noise sensitive species such as whales are not known to occur in the area. Other species that do occur in the area are exposed to regular commercial and recreational vessel activity in the channels, and bay. It is unlikely that the underwater noise from the activity will impact any local species. The noise generated above the water is also unlikely to impact wildlife due to the levels generated and its periodic nature. The dredging is undertaken in campaign blocks, with gaps between each. Therefore, the noise generated when the dredge is operational is only temporary.	Low (1)
Hydrocarbon or other chemical spills	All	Chemical spills can impact species in varying degrees (dependant on the quantity and substance). Specific controls are detailed in a	Low (4)

		EMP to manage any chemicals or fuels stored on the vessels. To reduce the potential of accidental spills occurring when refuelling, the dredge is refilled at the designated refuelling dock in Half Moon Bay Marina. This is equipped with appropriate refuelling equipment and spill response equipment. To be prepared for accidental spills (e.g., hydraulic hose burst) the dredge is equipped with spill response materials. The EMP outlines the procedure to follow in the event of a spill. With these controls in place the likelihood of a significant spill occurring that could impact local species is rare.	

6.6 Impacts on Users

Impacts on other users of this area are detailed in the table below. These include recreational users, residents, commercial users and operations, and cultural and spiritual users.

Table 20: Potential impacts on Users

User group	Impact Assessment	Risk score
Recreational users	Dredging operations and disposal of dredge spoil can affect recreational vessels and other recreational users. There are recreational users directly accessing Half Moon Bay Spoil Ground. Recreational fishing, boating, sailing, stand up paddle boarding, outrigger canoeing and kayaking users do use the dredged channels and indeed depend on them for access to the marinas. The activity does not impede vessel traffic when the dredge is operational. All recreational users may continue to use the channels during this time. The operation of the dredge is in accordance with the international Prevention of Collisions at Sea Regulations and local Harbour Master's directions; therefore, the activity has no adverse impacts on recreational users.	Low (1)
Residents and homeowners	Dredging can cause disturbance to the community through the noise generated and the lighting required on the dredge and the pipework. **Noise** is generated by the engines on the dredge. To reduce the impact the engines are fitted with acoustic mufflers on their exhaust and are located inside the dredge, which has an acoustic insulated engine room. The noise generated has the potential to disturb natural condition, especially on calm days. However, the impact is periodic and within working hours (7am-5pm). Any noise generated must not cause	Low (4)

	environmental nuisance to a sensitive place (Qld EA condition). Should complaints be made about noise, these are investigated with noise monitoring undertaken. **Lighting** is utilised on the dredge and floating sections of the pipeline. To mitigate this impact low wattage navigation lights and beacons are utilised. No bright lights are utilised. Based on the periodic nature of the operation and the limited frequency of dredging required around properties in Bluewater Harbour, the impact from light and noise on residents is rare and minimal.	
Commercial users	Dredging operations and disposal of dredge spoil can affect commercial vessels and other commercial users. Commercial fishing, tourism and pilotage vessels use the dredged channel for access to the marinas. The activity does not impede vessel traffic when the dredge is operational. All commercial operators may continue to use the channels during this time. The operation of the dredge is in accordance with the international Prevention of Collisions at Sea Regulations and local Harbour Master's directions; therefore, the activity has no adverse impacts on commercial users	Low (1)
Cultural and Spiritual users	Cultural heritage features are known to exist in the area (refer to section 3) however, the activity does not occur within this area. There is also a potential for other sites or items to be buried in the subsurface material of Half Moon Bay. The maintenance dredging only removes material that has accumulated in the dredge areas and not deeper sediments which decreases the likelihood of cultural heritage features being impacted by the activity. The area also holds intangible cultural heritage for local Traditional Owners (TO). Council has consulted with the TOs for this area and no concerns about the activity have been raised to date. The potential impact of the activity on cultural and spiritual values is unlikely.	Low (4)

6.7 Impacts of Not Dredging

Not dredging would severely affect all users. Cessation of the activity would likely result in the complete blockage of the mouth of Half Moon Creek, preventing vessel movement in and out of Bluewater Harbour. Those most affected would be the commercial operators and homeowners in Bluewater Harbour. The entrance channels would also fill over time, creating boating hazards and restricting movements on certain tides, which will affect search and rescue services, and the recreational boating community. This would result in significant and unacceptable social and economic impacts which is why not-dredging is not an option.

7. MANAGEMENT MEASURES

The Half Moon Bay Maintenance Dredging operation is appropriately managed to reduce the potential for environmental harm. The contractor undertaking the activity must operate under an Environmental Management Plan (EMP) which provides details of the field-based practices required to minimise the potential for impacts to the environment.

An EMP is reviewed and approved by Council, and must cover all aspects of the dredging operation including (but not limited to):

1. Location and description of the activities.
2. Timing of the dredging operations.
3. Measures to meet permit conditions.
4. Standard management measures for potential impacts identified relating to:
    a. Waste
    b. Noise and Vibration
    c. Emissions
    d. Chemicals
    e. Spill response
5. Adaptive management measures relating to:
    a. Water quality
    b. Marine fauna
    c. Biosecurity
    d. Cultural Heritage
    e. Climate and weather conditions
6. Equipment calibration.
7. Environmental Induction and training.
8. Operation and incident reporting.
9. Emergency procedures and contacts.

Council also has Project Environmental Management Plan which provides direction to the Project Team, Contractor, and the Environmental Unit on the requirements of the State and Commonwealth permits held for the activity. The document assists with identifying the requirements of permit conditions that must be satisfied before, during, and after the dredging in the approved areas with specific reference to the annual dredging program, each campaign, and events within each campaign.

Current EMP #7257781

Current Project EMP #5948996

8. MONITORING FRAMEWORK

Monitoring of the activity has occurred under a LTMMP for six years. These monitoring actions have been successful, and many have been adopted into this plan. An overview of the monitoring proposed over the next 10 years includes:

Sediment Quality Assessment for Disposal:

- Undertake sediment sampling:
  - In all Dredge Areas every five years in accordance with the approved SAP.
  - in the first week of dredging in each dredge area for select heavy metals (in accordance with QLD environmental authority).

Predicted Zone of Influence Monitoring:

- Water Quality Monitoring
  - Daily at long term monitoring background and impact sites within Half Moon Bay (in accordance with QLD environmental authority).
- Turbidity Plume Extent Monitoring
  - An annual measurement of the turbidity plume extent.
- Sediment sampling and analysis down current of spoil ground
  - Sites down current of spoil ground, analysed for seabed sediment particle size annually.
- Benthic Flora and fauna Survey
  - Pre and post dredging of Dredging Area 1 (>10,000m3 spoil) with particle size analysis.
- Bathymetry Monitoring
  - Annual hydrographic survey across Half Moon Bay predicted zone of influence.

Wider Area Monitoring:

- Turbidity Plume Monitoring
  - A measurement of the turbidity plume is taken daily when in operation.
- Sediment sampling and analysis down current of spoil ground
  - Sites down current of spoil ground, analysed for seabed sediment particle size every two years.
- Extended Bathymetry Monitoring
  - A wider area hydrographic survey extending a further 400m from the predicted zone of influence undertaken every five years.

8.1 Sediment Quality Assessment for Disposal

The Half Moon Bay Sediment Sampling and Analysis Plan (SAP) has been created for the ongoing maintenance dredging at Half Moon Bay. The purpose of the plan is to set out the sediment sampling and analysis framework for this maintenance dredging activity over the next ten (10) years. This includes five yearly sampling program, and annual testing.

The first round of sampling occurred in May 2023, to identify the suitability of the material for ocean disposal and to obtain the data required to apply for the new long-term sea dumping permit. Further rounds of sampling will be undertaken in 2028 and again in 2033 (prior to the next permit renewal).

The sediment testing that was undertaken and to be repeated in another five years is based on the expected volumes to be removed from each of the dredge areas every five (5) years. This includes the following:

Table 21: Max Volumes to be Dredged & number of samples tested

Area	Maximum Volume removed / 5 years	Maximum volume / year	Number of samples / 5 years	Annual samples*
Dredge Area 1	125,000m^3	50,000 m^3	10	4
Dredge Area 2	375,000m^3	100,000m^3	13	4
Dredge Area 3	110,000m^3	30,000m^3	10	4
Dredge Area 4	20,000m^3	10,000m^3	4	1
HMBSG	-	-	2	
Total:	**630,000m^3**	**190,000m^3**	**39**	**13**

*Number of pre-dredge samples to be collected and analysed in years dredging occurs in that Dredge Area.

The contaminant list detail in Table 22 identifies those with a probability of being found in each of thedredge areas and is based on the catchments history, current uses, and previous sampling results. To ensure the currency of data, the sampling of the primary contaminant list will be undertaken every five (5) years and the secondary list annually, before a campaign commences in a dredge area.

Table 22: Primary and secondary contaminant list

Dredge Area	Primary contaminant list	Secondary contaminant list (annually in years dredged)	Miscellaneous list (All locations)
Dredge Area 1	TOC, Cu, Pb, Zn, Cr, Ni, Cd, Hg, Arsenic, TBT, PAHs and BTEX.	Cu, Pb, Zn & TBT	Moisture content Particle size
Dredge Area 2	TOC, Cu, Pb, Zn, Cr, Ni, Cd, Hg, Arsenic, TBT	Cu, Pb, Zn & TBT	Moisture content Particle size
Dredge Area 3	TOC, Cu, Pb, Zn, Cr, Ni, Cd, Hg, Arsenic, TBT, TPH, PAHs and BTEX.	Cu, Pb, Zn & TBT	Moisture content Particle size
Dredge Area 4	TOC, Cu, Pb, Zn, Cr, Ni, Cd, Hg, Arsenic, TBT, TPH, PAHs and BTEX	Cu, Pb, Zn & TBT	Moisture content Particle size

8.1.1 Five yearly sediment testing

Sample locations will be selected at random and then detailed (mapped, including coordinates) in the Sediment Analysis Report. To ensure alternative sites are selected every five years, a grid will be laid over the different dredge areas, as per the method detailed in Appendix D of the NAGD, making sure the number of grids is greater than the minimum number of samples required, and the sites sampled will mapped and documented. Alternative sites to those previously sampled will be selected for the

further rounds of testing. Each round of testing will ensure that all zones in a dredge area have been represented e.g., a sample collected from each of the canals (fingers) in Dredge Area 1.

8.1.2 Annual Sediment Sampling

The annual sediment sampling will be undertaken in accordance with the sampling conditions outlined in Councils Qld Environmental Authority EPPR00795313. This involves the sampling of key sites (refer to Figure 30) annually for the target analytes of TBT, Cu, Zn and Pb. Results for each analyte must be below NAGD screening levels (refer to Table 23). Sampling sites vary depending on area to be dredged:

- **Dredge Area 1**
  - When dredging canals: sites: 16, 18 and 19.
  - When dredging marina sites: 18 and 19, and 17 (several locations within marina).
  - When dredging Half Moon Creek sites: 19 and 20.
- **Dredge Area 2**
  - When dredging inner and outer entrance channels: sites 21, 22 and 23.
- **Dredge Area 3** (as per various permits held by YKBC)
  - When dredging Half Moon Bay Marina, four sites within marina are sampled.
- **Dredge Area 4**
  - When dredging TMR mini harbour, one site is selected within the zone.

Figure 30: Annual sediment monitoring sites & Daily Water Quality Monitoring sites

Table 23: NAGD screening Level of targeted heavy metals

Analyte	Copper, Cu	Lead, Pb	Zinc, Zn	Tributyltin (TBT)
Unit	**mg/kg**	**mg/kg**	**mg/kg**	**µg Sn/kg**
NAGD Screening Level	**65**	**50**	**200**	**9**

Note: The SAP 2023 must be reviewed and followed when undertaking the sediment sampling. It contains the appropriate sampling methods, procedures, sample handling and quality assurance, and sampling practicalities and contingencies.

8.2 Predicted Zone of Influence Monitoring

As detailed in section 4.1, the predicted zone of influence relevant to this activity is the areas dredged, the extent of the Half Moon Bay Spoil Ground (HMBSG), and a wider area zone estimated to extend 250m to the north, 200m east, directly inshore to LAT and south to the entrance channels.

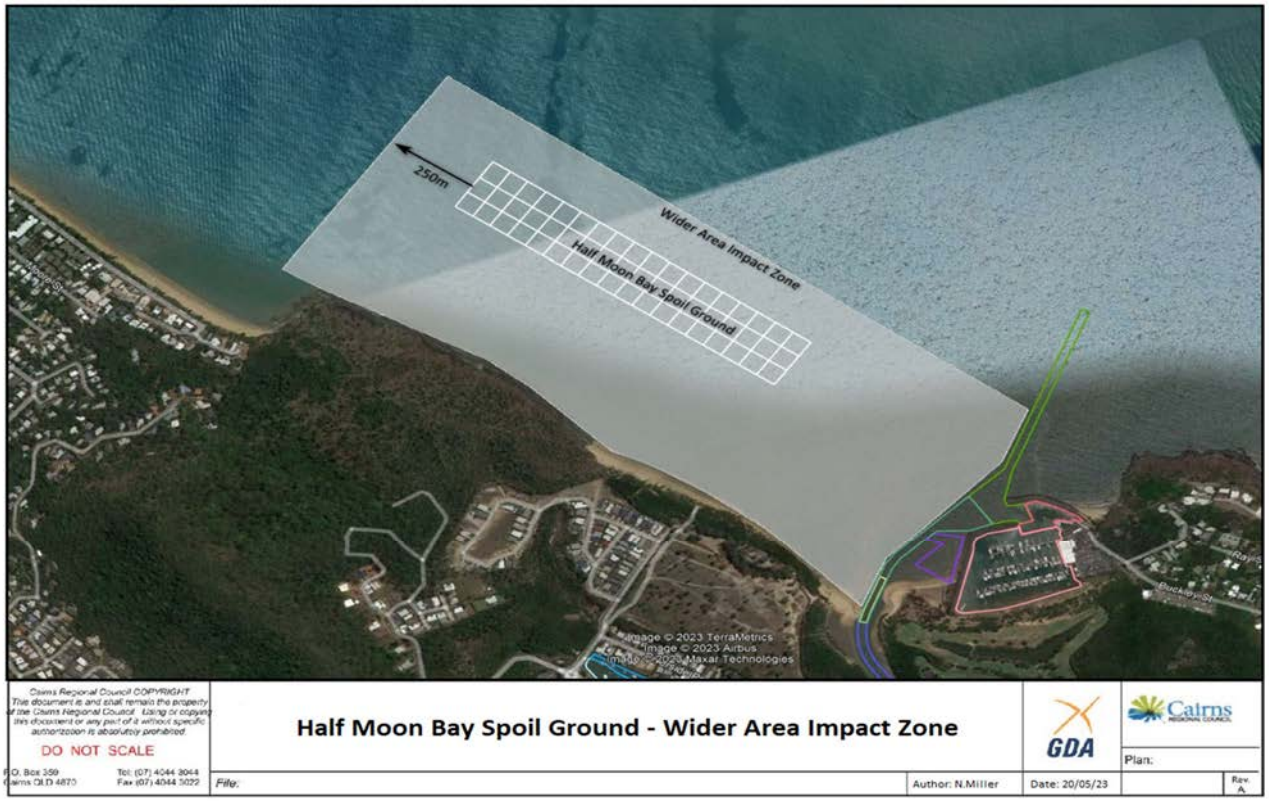


Figure 31: Predicted Zone of Influence

8.2.1 Daily Water Quality Monitoring

Daily water quality monitoring to be undertaken when dredging to the HMBSG.

- Turbidity (NTU) & pH are the parameters monitored at:
  - Site 9 (impact site north of spoil ground) off Earl Hill.
  - Site 10 (impact site south of spoil ground, between outer channel and spoil ground); and
  - Site 11 (background site off Yorkeys Knob).
- The turbidity plume distance is measured.

Method Notes: Water quality testing is in accordance with the Queensland water quality Monitoring and Sampling Manual 2009 (Department of Environment and Heritage Protection, 2009). In-situ testing undertaken by a calibrated multifunction probe water quality meter. Multiple samples are collected at each site at different levels in the water column. This is at 0.5m, 1.0m and 1.5m (EcoSustainAbility, 2018).

8.2.1.1 Monitoring Limits

Sampling results are recorded by the contractor on a daily data sheet and sent to Council for analysis against permit conditions and for record keeping.

The carrying out of the activity must not result in the exceedance of any of the **contaminant limits** in Table 24.

Table 24: Receiving water contaminant limits.

Parameter	Units	Limit	Limit Type
Turbidity	Visible	No visible plume to entre intertidal zone of coastline north of Half Moon Creek entrance for all sites except HMB beach replenishment area. No visible plume to be present greater than 200m from the HMB beach replenishment area.	Maximum
pH	pH units	6.0 – 8.5	Range
Total Petroleum Hydrocarbons	Visible	No visible film on water not detectable for odour	Maximum

The exceedance of contaminant limits is notifiable. Any breach must be reported to the Department of Environment and Science as soon as practicable, or at most, within 24 hours of it becoming aware. Records must be kept including full detail of the breach and any subsequent actions undertaken.

Water Quality data is reviewed against set **trigger limits** if the turbidity plume is greater than 200m, this occurrence is referred to as an "event". During an "event" the following contaminant trigger levels must not be exceeded.

Table 25: Receiving water trigger limits.

Parameter	Unit	Limit	Limit Type
Turbidity	NTU	95th percentile of reference site or 20 NTU, whichever is higher.	Median
pH	pH units	20th percentile of reference site or 8, whichever is lower. 95th percentile of reference site or 8.4, whichever is higher.	Median

If a trigger limit is exceeded, Council will undertake the following actions:

a. Complete an investigation in accordance with the ANZECC (2000) methodology, into the potential for environmental harm; and
b. Provide a written report to the administering authority within three (3) months of the date of the original exceedance, outlining:

- details of the investigations carried out; and
- actions taken to prevent environmental harm.

8.2.2 Turbidity Plume Extent Monitoring

The extent of the turbidity plume is visually monitored daily, but the extent of the plume is also modelled once annually in an intensive program. This involves measuring turbidity levels at a depth of 0.5m below the sea surface in a series of transects across the plume (approximately) 25m, 50m, 75m, 100m, 150m, 200m, 250m, 300m, 350m, and 400m, down current of the spoil pipe outlet.

Each transect to be 200m in width, with sites out from the centreline of the plume at 0m, 25m, 50m, 75m and 100m on each side. To avoid any doubt the distances above are from the spoil pipe outlet (the beginning of the plume), and the location of monitoring points are dictated by the pipe outlet location and current on the day of monitoring. A graphical representation of the plume will be prepared and used for future reference/comparison (EcoSustainAbility, 2018).

Method Notes: To be undertaken in wave conditions less than 0.3m and wind conditions less than 12 knots (i.e., when background turbidity is relatively lower, and the plume can be more readily detected). The direction of plume travel (and hence the centreline, which may not be straight) will be determined by following small, floating but mostly submerged objects representative of suspended sediments in the plume. These will be subject to wave and current action (but not wind) and released at the dredge spoil pipe outlet (EcoSustainAbility, 2018).

8.2.3 Sediment Movement Monitoring

To provide greater clarity on sediment movement from the spoil ground and into the nearby seabed, after at least one month of dredging to the spoil ground, five sediment samples are collected at fixed sites to the northwest of the HMBSG and into the predicted zone of influence, and analysed for particle (grain) size. Commencing on the spoil ground boundary, samples are collected at 0m, 100m, 200m, 300m and 400m intervals to the northwest at locations with depth ~1.8m – 2.0m below LAT. The depth of the sampling will change over time. Refer to Figure 32 for an indication of sediment sampling locations (EcoSustainAbility, 2018).

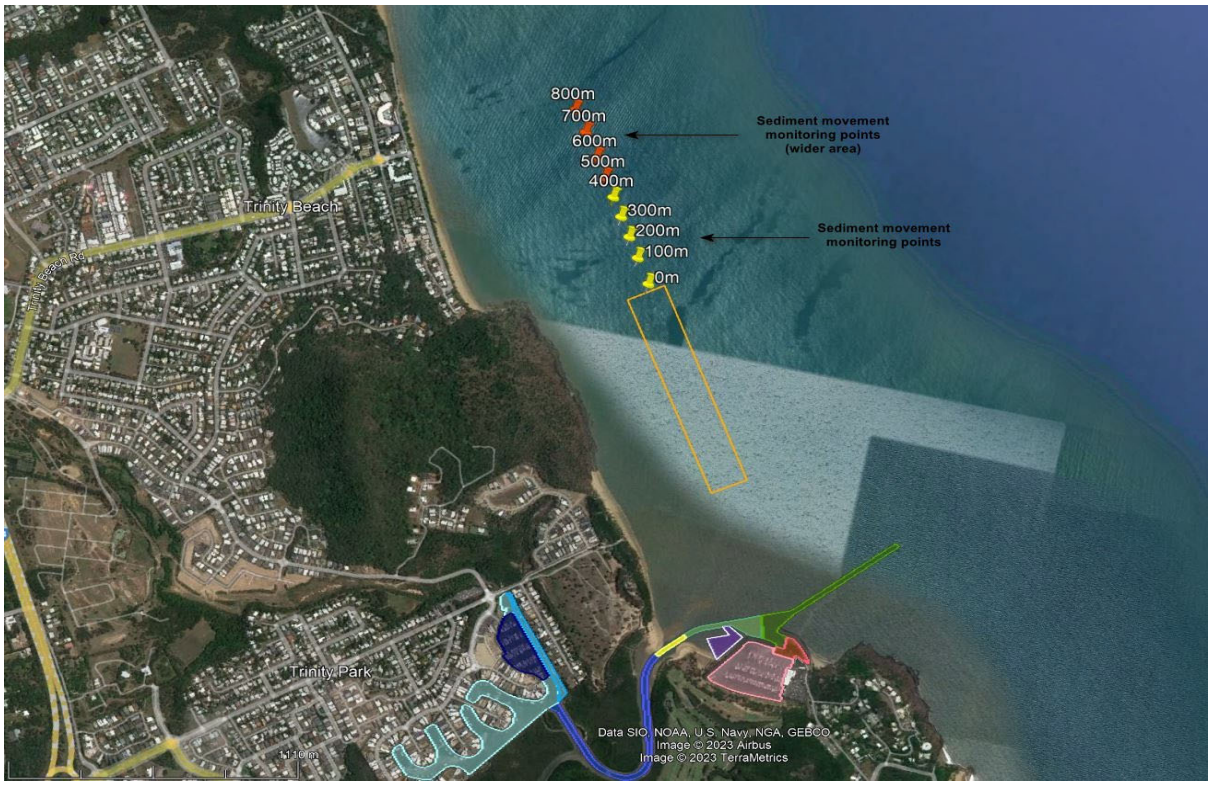


Figure 32: Example of Sediment Movement Monitoring Points

8.2.4 Benthic Fauna and Flora Investigations

Benthic flora and fauna sampling and analysis is to be undertaken if there is a dredging event greater than 10,000m^3 in Half Moon Creek and/or Bluewater canal (Dredge Area 1). Sampling will be undertaken within 30 days prior to commencing dredging and within 60 days of concluding dredging. Sediment particle size analysis to be undertaken and the benthic macro flora and fauna to be sampled. Sampling is to be undertaken at the sites detailed in Table 26 and in Figure 33 (EcoSustainAbility, 2018).

Table 26: Benthic Fauna and Flora Monitoring Sites

Monitoring Site	Coordinates
Benthic 10 Inshore: B#10(1)	-16.796700° / 145.714352°
Benthic 10 Offshore: B#10(2)	-16.795921° / 145.715413°
Spoil Ground Inshore: B#SG(1)	-16.792087° / 145.711053°
Spoil Ground Offshore: B#SG(2)	-16.791640° / 145.711969°
Earl Hill Inshore: B#9(1)	-16.788364° / 145.707876°
Earl Hill Offshore: (B#9(2)	-16.787732° / 145.709068°

Figure 33: Benthic Fauna and Flora Monitoring Sites

Method Notes: Samples to be collected at the specified locations by Ekman Grab. Collected sediments will be decanted to a tray and then placed into a re-sealable plastic bag (without preservation). Samples are then delivered to laboratory(ies) for particle size analysis and benthic flors/fauna identification. Each sediment sample to be stained in rose Bengal and fixed in 4% formalin seawater. Samples to be allowed to stain for 48 hrs and then sieved through 200µm mesh. Any fauna or flora

smaller than 200um may be discarded. All retained fauna and flora to be identified and photographed and stored in 100% alcohol (EcoSustainAbility, 2018).

The benthic flora and fauna identification is to record species diversity and is not intended to include quantitative/comparable abundance. Owing to the wave and current conditions and the fact that at some locations the Ekman grab needs to be deployed numerous times to collect a sample of sufficient quantity, the actual sample location is +/- 25m from the GPS position (EcoSustainAbility, 2018).

The methods ability to detect change before and after dredging should be reviewed and the timing and sample sites may be amended over the life of this plan in an effort to ensure the sampling protocol has the best probability of detecting change. Any change in method will build on the sites/methods previously used such that a longitudinal review of the benthos in the spoil ground and control sites can be developed over successive sampling programs (EcoSustainAbility, 2018).

8.2.5 Disposal Site Bathymetry

A hydrographic survey of the HMBSG is to be undertaken each year. This survey should include the site and at least a ~300m buffer. Typically, the survey will be taken from the entrance channel to at least 300m north of the spoil ground and from offshore at LAT (as close inshore as the survey vessel can get safely) to at least 200m to seaward of the spoil ground. An example is provided in Figure 34.

Do this annually relative sediment volumes can be compared, which over time provides an understanding of sediment movement in the bay and beyond.

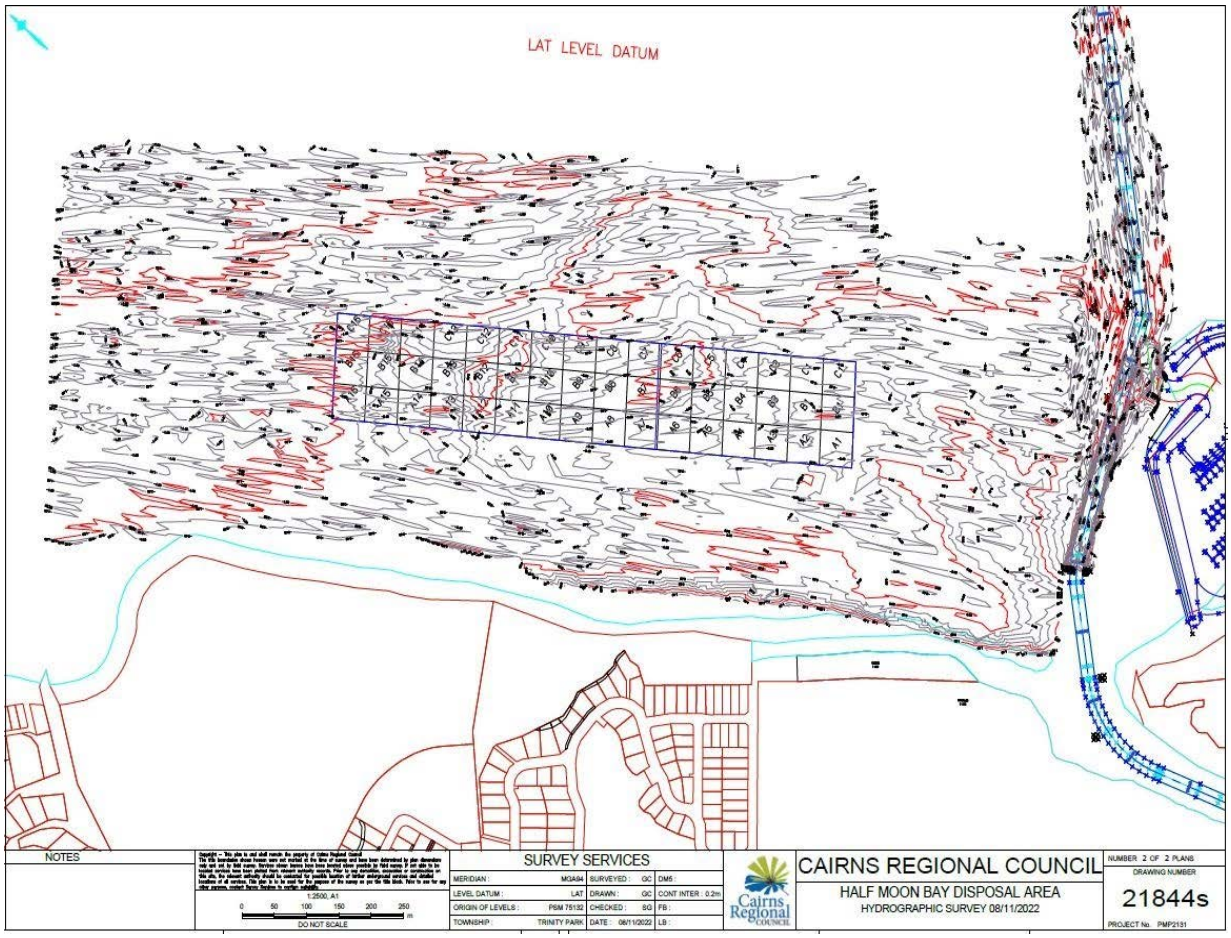


Figure 34: Predicted Zone of Influence Hydrographic Survey (2022)

8.3 Wider Area Monitoring

Wider area monitoring should be conducted to allow comparison of the predicted zone of influence and wider area sites. The wider area extends to the northwest of the predicted zone of influence, commencing ~250m from the HMBSG and extending 800m, refer to Figure 35. The wider area monitoring proposed is detailed in the section below.

Figure 35: Wider Area Monitoring Zone

8.3.1 Turbidity Plume Extent (wider area)

When undertaking the annual turbidity plume extent survey within the predicted zone of influence, monitoring will continue to follow the plume path for up to an additional 400m to measure the extent of any measurable plume (e.g., Turbidity, as NTU, 20% more than background).

Sites to be 450m, 500m, 550m, 600m, 650m etc. down current of the spoil pipe outlet, until no discernible turbidity plume. If detectable the plume is likely to have dispersed such that transects are not meaningful and just detecting the highest turbidity along the flow path and comparing this to adjacent background (usually 100m - 200m seaward) is the best (EcoSustainAbility, 2018).

To avoid any doubt the distances above are from the spoil pipe outlet (the beginning of the plume), and hence the location of monitoring points is dictated by the pipe outlet location and current on the day of monitoring. If the spoil pipe is towards the south-eastern area of the HMBSG the initial monitoring points of 450m, 500m etc. down current may indeed still be within the predicted zone of influence, in this case monitoring must continue down current until well into the wider area (this could be ~800m down current of the spoil pipe outlet) (EcoSustainAbility, 2018).

8.3.2 Sediment Movement (wider area)

The annual sediment particle size analysis in the predicted zone of influence extends to 400m from the HMBSG. Additional samples for particle size analysis will be taken in the wider area every two years. Sites will be at 100m intervals. The wider area monitoring points will be 500m, 600m, 700m, and 800m to the northwest of the spoil ground, refer to Figure 32 (EcoSustainAbility, 2018).

This will provide a better understanding of the movement of sediment to the north. It should be adaptive monitoring with sites moved or added to try to "track" sediments from the Spoil Ground (however most sites, once initially chosen should be sampled annually at the same GPS position to build a history).

8.3.3 Extended Bathymetry

Every five years an extended hydrographic survey will be undertaken, moving 400m to the northwest of the predicted zone of influence into the wider area zone. The survey will extend a total of 800m northwest of the HMBSG (EcoSustainAbility, 2018). In 2023 and 2028 a volume comparison (cut/fill) on the 2018 bathymetry surface will be undertaken. This data may be correlated with the sediment data collected from the other sediment movement monitoring activities detailed above (EcoSustainAbility, 2018).

8.4 Investigations

Should any water quality limits conditioned in the State or Commonwealth permits be exceeded, an investigation will be carried out in accordance with ANZECC 2000 guidelines. The results of the investigation will be reported to the relevant authority and the BMDTACC and set out the details and conclusions of the investigation and actions taken to prevent environmental harm.

If the exceedance is an isolated result and owing to a defined event (unusual weather/wave/tide) and subsequent monitoring results return to within the limits dredging may continue. Should the contaminant or trigger limits be exceeded with ongoing results, dredging will cease until the investigation is completed.

9.0 PERFORMANCE INDICATORS

Several key performance indicators have been identified to verify the effectiveness of the monitoring and management practices incorporated into the activity. These include:

- No reported incidents of physical harm to marine fauna.
- Compliance with all State and Commonwealth permit conditions.
- No seagrass found in the benthic fauna and flora surveys.
- No marine pests identified in the benthic fauna and flora surveys.
- No long-term changes in water quality parameters.
- Zero incidents involving the release of contaminants into the marine environment.
- No reportable incidents of environmental harm during the maintenance dredging.
- No items of cultural significance damaged or disturbed by the activity.
- No community-based complaints about noise or vibration.

10. CORRECTIVE ACTIONS

Incidents, breaches of conditions, exceedances of limits, and complaints will be detailed in a Corrective Action Report (CAR) and investigated.

A CAR will describe the incident or problem, investigate the root cause, identify corrective actions to deal with the issue, identify preventive actions to prevent or reduce the potential for it to occur again, then act on the corrective and preventative actions identified.

This process is important for identifying and addressing issues that have the potential to create environmental harm and forms an important part of Councils commitment to continuous improvement.

11. BLUEWATER MAINTENANCE DREDGING TECHNICAL ADVISORY CONSULTATIVE COMMITTEE (BMDTACC)

In accordance with the NAGD a Technical Advisory Consultative Committee was established in 2017. The Cairns Regional Council formally constituted the Bluewater Maintenance Dredging Technical Advisory Consultative Committee (BMDTACC) at its meeting of 16 August 2017.

Council noted the National Assessment Guidelines for Dredging which set out the framework for the environmental impact assessment and permitting of the ocean disposal of dredged material. Council established the BMDTACC with the purposes of:

- Provide continuity of direction and effort in protecting the local environment
- Aid communication between stakeholders and provide a forum where points of view can be discussed, and conflicts resolved.
- Assist in the establishment, as appropriate, of longer-term permitting arrangements, including reviewing the development and implementation of Sampling and Analysis Plans, Long Term Management Plans and research and monitoring programs.
- Review ongoing management of dredging and dumping activities in accordance with the NAGD Guidelines and permitting arrangements, and
- Make recommendations to the Council and the determining authority as necessary or appropriate.

The following stakeholder organisations/individuals have been appointed to the BMDTACC:

- Manager Bluewater Marina
- Yorkeys Knob Boating Club
- Maritime Safety Queensland
- James Cook University
- Ports North
- Residents representative
- Department of Agriculture and Fisheries
- Department of Environment and Science
- CRC Associate Director Service Delivery - Cairns Infrastructure & Assets
- CRC Executive Manager Strategic Asset Management and Planning
- Division 8 Councillor
- Division 9 Councillor

Since the establishment of the BMDTACC the committee meets annually to review the year and discuss the future schedule of works. It is an opportunity for members to voice any concerns, be updated on the works program and gain an understanding of the monitoring and management actions

that were implemented throughout the year. Outside of the annual meeting, the BMDTACC are given the opportunity to review any changes proposed to the operation or management initiatives.

12. CONTINUOUS IMPROVEMENT

Cairns Regional Council commits to the continuous improvement of the activity. Council has undertaken numerous studies and investigations to better understand the natural environment and the potential impacts associated with the activity. From the knowledge gained over the years, adjustments have been made to minimise or mitigate potential environmental impacts.

Council will continue to collaborate with other Agencies, local interest groups, the contractor and the BMDTACC, to build on this understanding and to ensure that there is an opportunity for stakeholders to contribute to the improvement of practices.

It is anticipated that the BMDTACC will review the ongoing dredging program, compliance with the LTMMP and ongoing relevance of the LTMMP annually. Should minor operational changes be required these can be implemented by Council and/or the dredging contractor. Should a major change to the LTMMP be proposed, the LTMMP will need to be revised, reviewed by the BMDTACC, and submitted to the DCCEEW for approval.

13. AUDITING AND REPORTING

Council will undertake an annual internal audit of compliance with the LTMMP. This may take the form of, or be informed by, a compliance report by the dredging contractor.

Throughout this LTMMP there are reporting strategies to be implemented for key events, e.g., breaches of permit conditions will be reported to the relevant authority within the specified timeframes.

Council also provides an Annual Report to the BMDTACC in December each year. This communicates to stakeholders' the details of the maintenance dredging activity over the year, including volumes dredged from each area, the results of the ongoing monitoring, updates on any incidents that occurred or investigations that were undertaken, the details of any changes to permit conditions, and provide an overview of outstanding tasks (the schedule of works). It ensures stakeholders remain informed and are provided an opportunity to review the ongoing dredging program.

Annually, Council submits a Sea Dumping Permitting International Report to DCCEEW to provide the information required for Australia's international reporting obligations under the London Protocol. This report outlines:

- Permit number, permit start and expiry dates
- Locations and type of material dredged
- Volume dredged at each location
- Placement locations used
- Placement method used.

This is submitted by 31 January each year.

14. PUBLICATION OF LTMMP & MONITORING DATA

The *Environmental Code of Practice for Dredging and Dredging Material Relocation* (Ports Australia, 2016) identifies that 'transparent and open information sharing is important to improve knowledge and to understand community values, client needs and government expectations. Communication and reporting are an important component of this, to demonstrate performance and provide for community accountability'.

Council commits to providing transparency and information sharing through the publication of the LTMMP on the CRC website. The Annual Report, provided to the BMDTACC each year, will also be made public on the website. This contains details of volumes dredged from each area, the results of the ongoing monitoring, updates on any incidents or investigations that occurred, and provides an overview of the future schedule of work.

15. ATTACHMENTS

The attachments listed in the table below accompany the LTMMP. Due to the size of each they have not been included in the document but can be provided to people outside the organisation upon request. All Council staff can access the documents through Council data management system. The reference number for each is provided in the table.

Table 27: Supporting documentation

Attachment	Document	DM Reference
1	Half Moon Bay Sediment Source Analysis 2018, prepared by EcoSustainAbility.	#5776481
2	Half Moon Bay Sediment Sampling and Analysis Plan (SAP) 2023-2033, prepared by CRC.	#7176039
3	Half Moon Bay Maintenance Dredging – 2023 Sediment Analysis Report, prepared by EcoSustainAbility.	#7258527
4	Bluewater Canal – Management of the Environment Plan (EMP), prepared by the Contractor.	#7257781
5	BMDTACC Terms of Reference (ToR).	#5485389
6	Sea Dumping Permit SD2018/3842 (five-year permit)	#6788428
7	Royal Harbour Master (RHM) letter of support for HMB Maintenance Dredging.	#7258609
8	Protected Matters Search Results August 2023.	#7258662

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