The Sustainable Sediment Management story at the Port of Mackay

What is sustainable sediment management (SSM)

From 2015 to 2017, North Queensland Bulk Ports Corporation (NQBP) pioneered an extensive research project to investigate the most sustainable way to manage accumulated sediment in and around the Port of Hay Point, on the eastern coast of Queensland. The result was a robust and transparent method to define sediment placement options that can be used across our ports.

Why is sustainable sediment management important?

Left unmanaged, natural sediment fills up port navigational infrastructure, impacting the depth necessary for safe loading, manoeuvring and transit of ships. A reduced ability to effectively load ships can have a substantial economic impact on the region that the Port supports.

How our approach is different

A lot of previous sediment management research has focused on whether the sediment is clean of contaminants and where it can be safely placed. Our sustainable sediment management study looked at this too, but also examined how and why sediment accumulates, and explored ways to reduce the build-up in navigational areas in the first place.

Additionally, we took steps to evaluate potential reuse of marine sediments. For each potential reuse or relocation option, we sought to demonstrate how environmental risks, human health, economics, and future challenges have been considered.

SSM at the Port of Mackay

In 2018-19, NQBP replicated its SSM research methodology at the Port of Weipa and now we have undertaken the research for the Port of Mackay.

We worked with environmental scientists, consultants and technical experts to produce a series of reports that investigate conditions at and around the Port of Mackay in North Queensland.

NOTE: As the Port of Mackay is located in close proximity to the Port of Hay Point (approximately 20km apart) many of the detailed studies undertaken for the Port of Hay Point SSM are relevant and were used for the Port of Mackay Assessment.

Some technical reports and management plans required for the Port of Mackay SSM study had been previously prepared (in 2018) and have been reviewed and updated, where relevant.

This document presents key findings from these reports.

Download via www.nqbp.com.au →

How we do it

Our methodology in action

Avoid or **reduce**

1. Where do sediments come from in the Port of Mackay?
2. Where do sediments accumulate in the Port of Mackay?
3. What effect will this have on the Port ?
4. Can sedimentation be managed without dredging?

Reuse or **recycle**

1. What are the engineering qualities of the material?
2. Can the material be used beneficially?

Alternative to **at sea**

1. What are the environmental values to consider, on land and at sea?
2. What are the at sea, onshore containment or reuse alternatives?
3. How do all the placement alternatives compare?

First, we ask, can sedimentation be managed at the Port to **avoid or reduce** the need for maintenance dredging?

If maintenance dredging must occur, we undertake a comprehensive assessment of whether material can be beneficially **reused or recycled.**

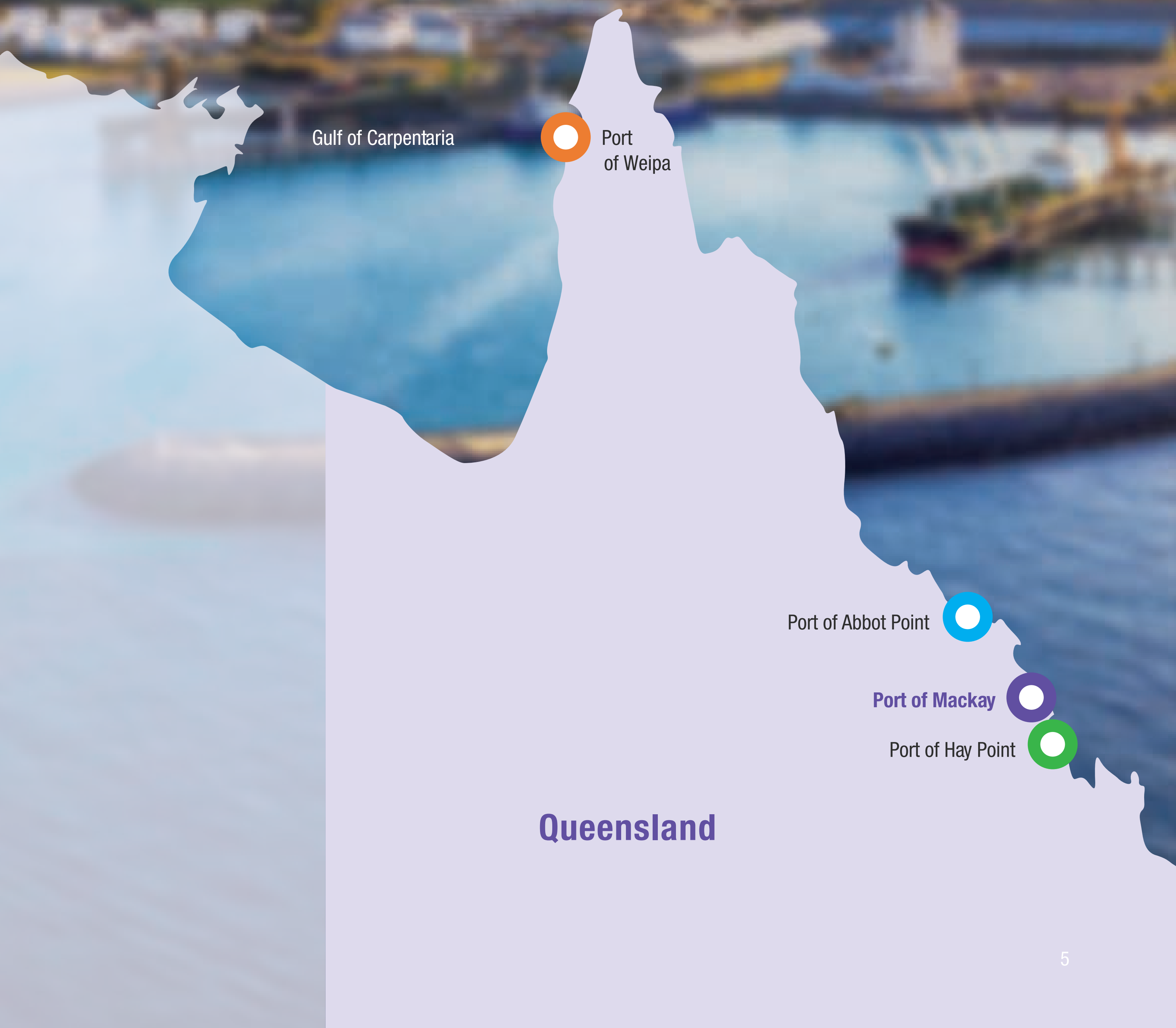
If no beneficial reuse options are available we determine the most suitable and feasible placement option including **alternatives to at sea** placement.

About the Port of Mackay

North Queensland Bulk Ports manages the Port of Mackay on the east coast of Queensland. Established in 1939, the Port operates 24 hours a day, seven days a week and extends over 800 hectares of land and water under the direct control of North Queensland Bulk Ports.

The Mackay region is one of the largest sugar producing areas in Australia, and the Port hosts one of the world's largest bulk sugar terminals. The region also supports the nearby Bowen Basin and Galilee Basin coalfields, which produce most of Queensland's coal. The dominant trades through the Port are sugar, fuel and breakbulk cargo.

The Port of Mackay is enclosed by breakwaters (also referred to as Mackay Harbour), has four main berthing areas and a slipway. The neighbouring Mackay Marina (owned privately) features a residential and tourist precinct, major marina amenities, over 450 marina berths and lift out shipyard.



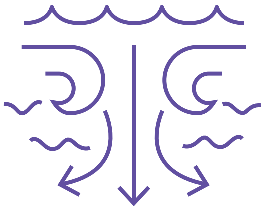
Avoid or **reduce**

1. Where do sediments come from in the Port of Mackay?
2. Where do sediments accumulate in the Port of Mackay?
3. What effect will this have on the Port ?
4. Can sedimentation be managed without dredging?

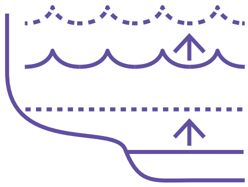
Where do sediments come from?

Resuspension of sediment in the Mackay region is dominated by wave action and tidal currents. Wave energy results in much higher resuspension, while the tidal currents (and wind-generated currents) will transport the suspended sediment along the coast, predominately in a south to north direction.

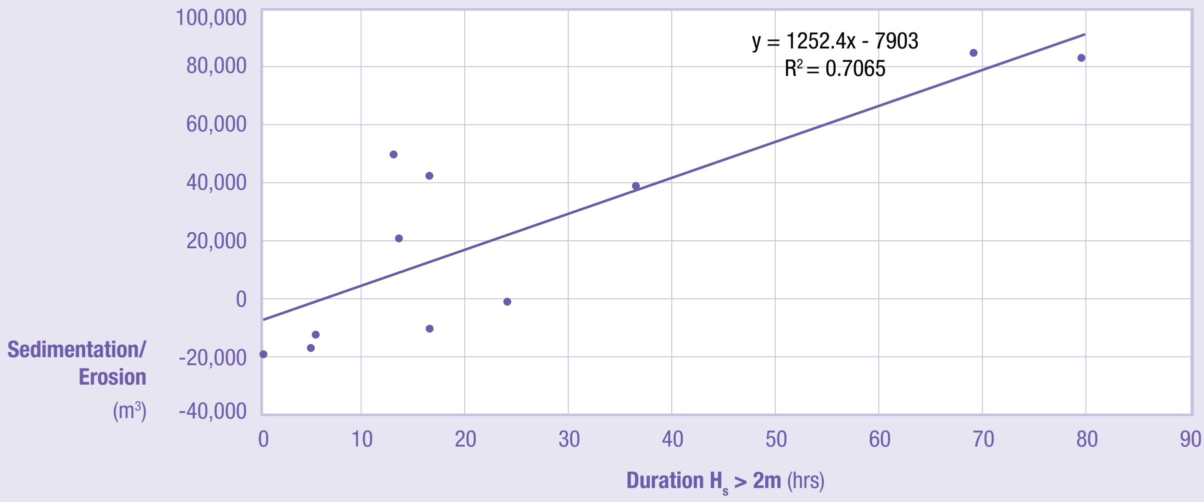
The local currents around the Port of Mackay, specifically within the enclosed breakwaters of Mackay Harbour, result in a net import of sediment, and the low current speed within the Harbour means that it retains much of this sediment and acts as a sediment sink.



The majority of the sedimentation which occurs within the Port of Mackay is due to fine grained sediment being imported into the Harbour as suspended load during the flood tide. This is natural sediment which has been resuspended from the seabed within the adjacent nearshore coastal region around Mackay due to wave action and tidal currents.



Sedimentation rates within the Mackay Harbour demonstrate an approximate linear relationship between the volume of sedimentation and duration of time the significant wave height (Hs) is above 2 m (i.e. the duration of large wave events).



Port and Coastal Solutions Pty Ltd, July 2021

The spatial distribution of the sedimentation within the Harbour is controlled by a combination of the local bathymetry (i.e. more sedimentation in areas with high trapping efficiency such as berth pockets and constructed sediment trench), the vessel routes (e.g. high traffic routes will have more propeller wash which will limit sedimentation) and the local metocean conditions (e.g. the higher current speeds and larger waves at the entrance to the Harbour will limit the deposition of fine-grained sediment).

The majority of the sedimentation at the Port of Mackay occurs during the wet season, due to both the increased wave activity and associated increased coastal suspended solids concentration (SSC), relative to the dry season. Based on the sediment budget developed for the Mackay / Hay Point region (AECOM, 2016) direct deposition during wet season flood events from local catchments accounted for less than 1% of the observed sedimentation in the area. Furthermore, the input of sediment from the rivers represents a small amount (2%) of the total sediment transport occurring in the region. Based on this, the direct input of sediment from rivers in the Port of Mackay can be considered negligible in terms of ongoing sedimentation within the Mackay Harbour.

For those years with typical wave conditions, the annual sedimentation is in the order of 20,000 m^3/yr to 40,000 m^3/yr, while for years with high wave energy the annual sedimentation could increase up to 90,000 m^3/yr. Based on the sedimentation rates a realistic upper value for sedimentation was used to estimate future maintenance dredging volumes for the Port. It was predicted that over 10 years the maintenance dredging volume for the Port of Mackay would be 500,000 m^3. Allowing for limited over-dredging an upper estimate of 575,000 m^3 over a ten year period is expected.

Summary volumes

Maintenance dredging has occurred periodically at the Port of Mackay since establishment in 1939. Historic records of dredging and material relocation show approximately 40,000 m^3 annually. In 2004, maintenance dredging using a larger trailing suction hopper dredge (TSHD) reduced the frequency to approximately every 3-5 years. Dredge planning is based on a need to accommodate the anticipated volumes over a 10 year period as outlined in the table below.

NUMBER OF YEARS	ANTICIPATED VOLUME	TOTAL (INCLUDING +15% OVERDREDGE ALLOWANCE)
8 years in 10-year period	40,000 m^3 (typical year) totalling 320,000 m^3	368,000 m^3
2 years in 10-year period	90,000 m^3 (cyclonic year) totalling 180,000 m^3	207,000 m^3
TOTAL: 10 years	**500,000 m^3**	**575,000 m^3**

Avoid or **reduce**

1. Where do sediments come from in the Port of Mackay?
2. Where do sediments accumulate in the Port of Mackay?
3. What effect will this have on the Port ?
4. Can sedimentation be managed without dredging?

Where do sediments accumulate in the Port?

AND AT WHAT VOLUMES AND RATES?

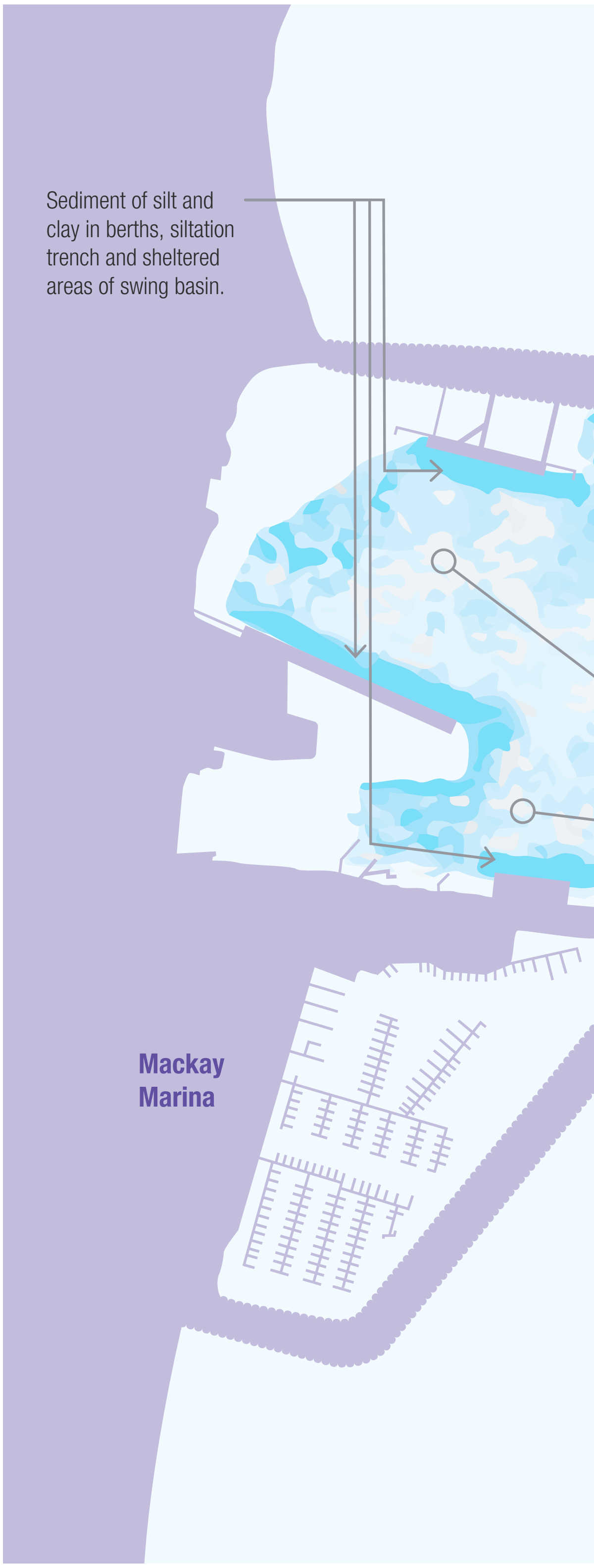
Sediment sampling has shown that the majority of the sediment within the Port of Mackay is silt and clay.

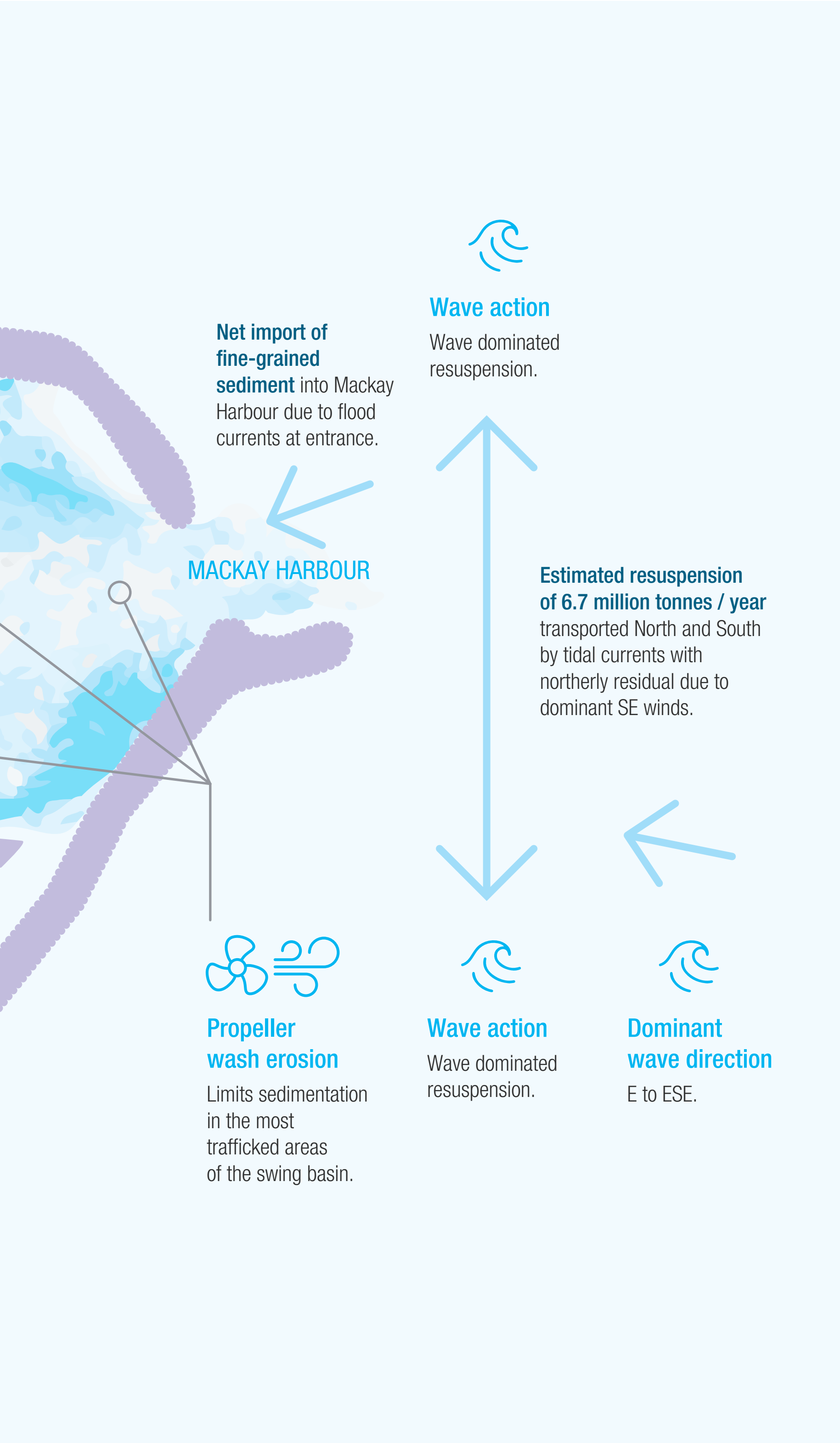
The larger volume of historical sedimentation at the Port of Mackay occurs in the broader swing basin, but that the majority of the sedimentation above design depths is seen in the berth pockets. It is likely that vessel movements and propeller wash transport accumulated sediments into these deeper areas.

In 1996/1997 a sediment trench was constructed for the sole purpose of trapping sediments in a non-navigable area of the Port. The trench has been very effective and in recent years has significantly contributed to a lesser frequency of maintenance dredging (no maintenance dredging occurred between 2013 and 2020).

There is no correlation between regional rainfall data and sedimentation at the Port. Sedimentation volumes are directly correlated to the number of hours the significant wave height exceeds 2 metres. Tropical cyclones have the potential to increase sedimentation in the Port due to the large waves and wind-induced currents which they can generate.

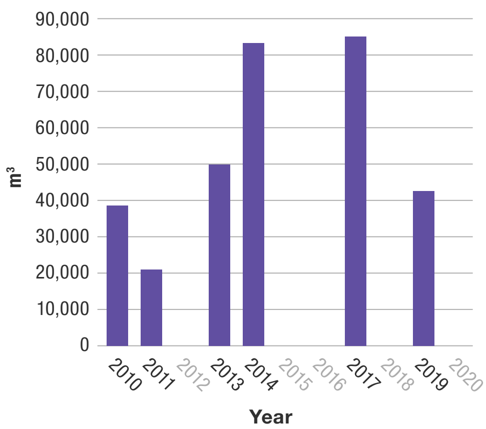
Tropical cyclones have the potential to result in increased sedimentation in the Port of Mackay. The highest sedimentation occurred in 2017 following TC Debbie and in 2014 following three tropical cyclones over the 2013/14 wet season, with TC Dylan resulting in the largest waves. In the 2019 wet season two tropical cyclones passed within 200 km of Mackay, one in December 2018 (TC Owen) and one in January 2019 (TC Penny).





Cyclone related sedimentation

YEAR	SEDIMENTATION (M³)	TROPICAL CYCLONE
2010	39,011	Ului
2011	21,135	Anthony
2013	50,313	Oswald, Tim
2014	83,658	Dylan, Edna, Ita
2017	85,256	Debbie
2019	42,669	Owen, Penny



Avoid or **reduce**

1. Where do sediments come from in the Port of Mackay?
2. Where do sediments accumulate in the Port of Mackay?
3. What effect will this have on the Port ?
4. Can sedimentation be managed without dredging?

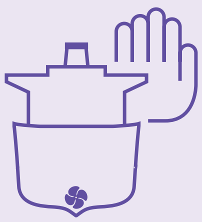
What effect will this have on the Port?

ECONOMIC AND SOCIAL IMPACTS

The maintenance of navigational depths at ports is essential for an economy like Australia to trade goods efficiently. As part of the Sustainable Sediment Management process, and to assist in evaluating various options, NQBP sought an independent analysis of the economic impacts if maintenance dredging were not to occur at the Port of Mackay (Synergies Economic Consulting, 2021).

Based on shipping and trade characteristics of the Port of Mackay, the analysis showed that Port's primary trades begin to be totally constrained within 8-10 years if maintenance dredging were not undertaken.

Three key impacts were identified as occurring as a result of sedimentation build up resulting from a 'no maintenance dredging' scenario.



Increased vessel delays

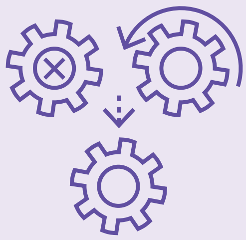
Sedimentation impacts the window of accessibility for vessels to access berths.

This constraint creates vessel delays, which has impacts on vessel and crew holding costs, manifesting in increased demurrage costs that are passed on to customers.

Trade diversion

Where vessels are no longer able to be accepted at Port of Mackay due to depth constraints, the trades will be diverted to alternative supply chains, resulting in additional economic costs being incurred.

These additional costs include land transport costs, port and port terminal costs, and externality costs (e.g. increased greenhouse gas emissions) resulting from the alternate supply chain movement.



Loss of economic output

Arises where the production and trade of a commodity ceases due to constraints at the Port of Mackay and diverting to an alternative supply chain is not commercially viable.

The figure below presents total economic costs (present value) and annual economic regional impacts attributable to the 'no maintenance dredging' scenario for the Port of Mackay.

Increased economic costs

20,465 total hours of vessel delays

- $11.6 million increased demurrage costs

~155 million total additional kms of road transport

- $169.7 million vehicle and road costs
- $48.6 million in increase externalities

Increased economic costs of $224.0 million in NPV terms (incl. shipping cost savings)

Regional economic impacts (Annual)

Loss of 380,000 tonnes of refined sugar annually

- $47.3 million lost regional value add output
- $10.6 lost GRP
- $4.5 million lost labour income
- 61 FTEs lost

Loss of 60 million litres of ethanol production annually

- $52.8 million lost regional output
- $13.8 million lost GRP
- $5.7 million lost labour income
- 58 FTEs lost

Loss of $100.1 million in regional annual output and 119 FTEs

Total economic costs under the 'no maintenance dredging' scenario are estimated to be $224.0 million in Net Present Value (NPV) terms over the 20-year analysis period.

Community cost increases would largely be attributable to road costs, as well as increased heavy vehicle environmental impacts and road maintenance. This signifies that the impact of 'no maintenance dredging' at the Port of Mackay leads to not only increased costs for shippers but also unfavourable outcomes for the community in terms of increased heavy vehicle traffic and associated environmental maintenance cost impacts.

The wider regional economic impact of the 'no maintenance dredging' scenario, is a loss of trade and production of ethanol and refined sugar. It was identified through industry consultation that the production of these products would no longer be commercially viable without the capacity to export the commodities through the Port of Mackay. The annual regional economic impacts from loss of production of these commodities totalled $100.1 million in regional output, $24.4 million in gross regional product, and 119 jobs.

$24.4 million in gross regional product, and 119 jobs.

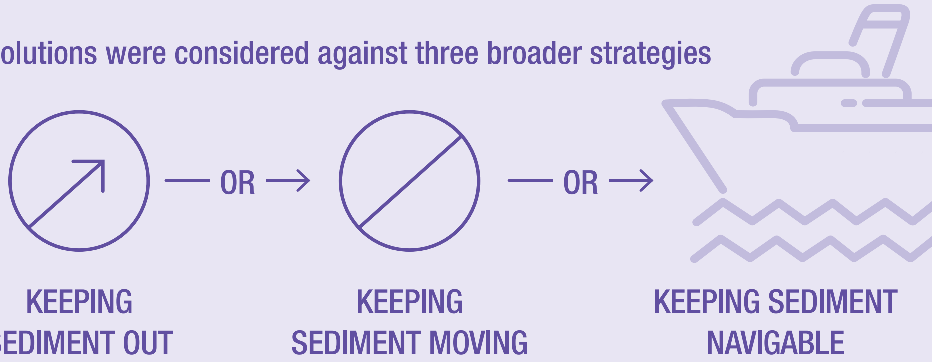
Avoid or **reduce**

1. Where do sediments come from in the Port of Mackay?
2. Where do sediments accumulate in the Port of Mackay?
3. What effect will this have on the Port ?
4. Can sedimentation be managed without dredging?

Can sedimentation be managed without dredging?

An analysis was undertaken to understand if there were any realistic sediment reduction alternatives to traditional maintenance dredging and offshore placement at the Port of Mackay. This work leveraged the information already analysed for the Port of Mackay in 2018.

Solutions were considered against three broader strategies



Both engineered and technological solutions were identified to possibly avoid or reduce future maintenance dredging and their feasibility considered based on the Mackay environment, port layouts and infrastructure design.

- ENVIRONMENTAL IMPACTS
- OPERATIONAL IMPACTS
- ONGOING MAINTENANCE
- EFFECTIVENESS OF SOLUTION
- LEGISLATIVE REQUIREMENTS
- COST
- GREENHOUSE GAS EMISSIONS

Category	Reduction strategy	Example
KEEPING SEDIMENT OUT	Stabilise sediment sources	Reduce sediment input through better catchment management
	Diverting sediment-laden flows	Diverting river sediment inputs away from port
	Trapping sediment before it enters port	Sediment traps, insurance trenches and sediment bypass systems management
	Blocking sediment entry	Pneumatic barrier, silt screen, barrier curtain management
	Habitat creation	Seagrass, saltmarsh, mangroves to stabilse sediment/ promote accretion management
KEEPING SEDIMENT MOVING	Structural solutions to train natural flows	Training walls/dikes to divert flow and prevent local deposition of sediment
	Devices to increase bed shear stresses	Hydraulic jets, vortex foil arrays, mechanical agitators
	Methods to reduce sediment flocculation	Adopting designs that reduce turbulence and therefore flocculation
KEEPING SEDIMENT NAVIGABLE	Adopt a 'nautical depth' navigation approach which includes fluid mud	Nautical depth is the distance from the water surface to a given wet density, typically in the range of 1100 to 1300 kg/m^3

Here's what we found

						$	Co2e
Maintenance dredging	Low	Low	No*	High	Low	$8.0M	7,950
Sediment trap	Low	Low	No*	High	Low	$7.3M	9,380
Drag barring/bed levelling	Low	Moderate	No*	Medium	No	$9.2M	30,530
Propeller was agitation	Low	Moderate	No*	Low	No	$12.4M	26,160

FINDING

Due to the processes that control the sedimentation and the configuration of the dredged areas at the Port of Mackay, the assessment was not able to identify any feasible engineered or technical solutions that could significantly reduce the natural sedimentation at the Port. Continued utilisation of the existing constructed siltation trench was found to be the best mechanism to reduce maintenance dredging needs at the Port of Mackay, assisted by utilising devices to increase bed shear stresses, specifically periodic bed levelling.

FOOTNOTE

*No ongoing 'NQBP' maintenance would be required as dredging and bed levelling vessel would be contracted from external parties

1

Following the sediment analysis, maintenance dredging was deemed necessary to maintain effective port operations.

2

With the sediment analysis complete, we explored alternative options for the use or placement of sediment material.

Reuse or **recycle**

1. What are the engineering qualities of the material?
2. Can the material be used beneficially?

What are the engineering qualities of the material and can it be used beneficially?

At the Port of Mackay sediment to be dredged consists mainly of fine grained (silt/clay) and some coarser material (sand) that has naturally settled in the Port area.

On average 74% fine grained (silt and clay), but ranging from 44% to 98% in some areas. There is very little coarse material in the sediment matrix within the Port of Mackay, and furthermore it isn't found in isolation to the fine silts and clays. For this reason, finding uses for coarse sandy material would also require significant onshore processing.

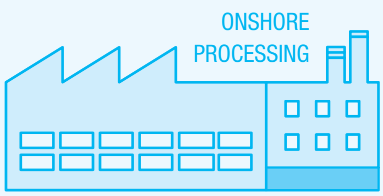
FINE GRAINED
74%
silt + clay

COARSE
26%
sand + gravel

ASSESSMENT

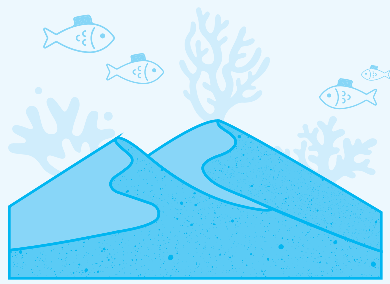
FINE GRAINED

The **strength, plasticity, density and consolidation of fine grained sediment** means it's generally unsuitable for engineering applications.



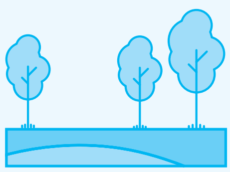
Significant onshore processing and treatment would be required to improve its suitability, although would likely still not be suitable for high load-bearing uses.

For this reason, fine grained sediments are more suitable to habitat creation options and potentially for reuse in shoreline protection if placed in geotextile bags, where such opportunities exist.



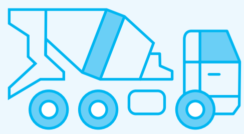
COARSE

Coarse sediment, such as sand, is typically **more suitable for reuse in medium to high-load:**



LAND RECLAMATION

BEACH NOURISHMENT



CONCRETE MANUFACTURE

Once sediment properties are known, we identify potential beneficial reuse options.

? WHAT ARE THE BENEFICIAL REUSE OPTIONS FOR THE **2** MATERIALS

HOW WE ASSESS

All beneficial reuse opportunities are analysed by a multidisciplinary team using the below criteria.

10 beneficial reuse options were identified by the team across three categories.

CRITERIA

- Sediment suitability (Sed Suit.)
- **Demand for the opportunity (Opp.)**
- Conceptual cost estimate (Cost)
- **Confidence in reuse process (Process)**
- Duration from construction use (Dur.)
- **Greenhouse gas emissions (GHGs)**
- Environmental implications (Enviro.)
- **Socio-economic implications (Social)**
- Indigenous community implications (Indig.)
- **Economic implications (Econ.)**
- Environmental approvals and permits (Approv.)
- **Constraints (Constr.)**
- Knowledge gaps requiring research (KGaps.)
- **Longevity and future considerations (Future)**

RECYCLE

ENGINEERING MATERIAL

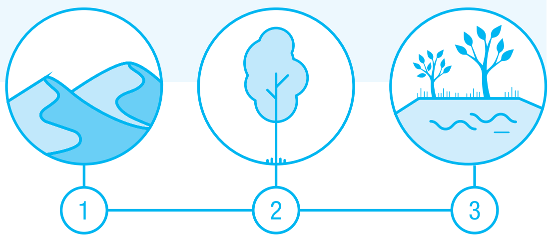
Land reclamation
Construction
Road base
Lining material
Concrete products
Aquaculture
Topsoil

REUSE

ENVIRONMENTAL ENHANCEMENT

Habitat creation (deepwater and coastal/tidal) including uses for shoreline protection and beach nourishment

Whilst no beneficial reuse options are considered feasible at this stage, reusing material for shoreline protection or deepwater habitat creation ranked higher than other options.



RANKING PERFORMANCE

Shoreline protection and deep water habitat creation were ranked the top two most beneficial opportunities.

3. SHORELINE PROTECTION

Process	Dur	GHGs	Opp	Sed Suit	Cost	Env	Social	Econ	Approv	Constr	KGaps	Future

2. DEEP WATER HABITAT CREATION

Cost	Dur	GHGs	Opp	Env	Social	Econ	Approv	Const	Future	Sed Suit	Process	KGaps

HIGH ← MODERATE — LOW

ALTERNATIVES TO AT SEA

3

A comparative analysis explored alternative options for the use or placement of sediment material. The analysis draws on existing research and independent technical reports.

1

UNDERSTAND THE DECISION

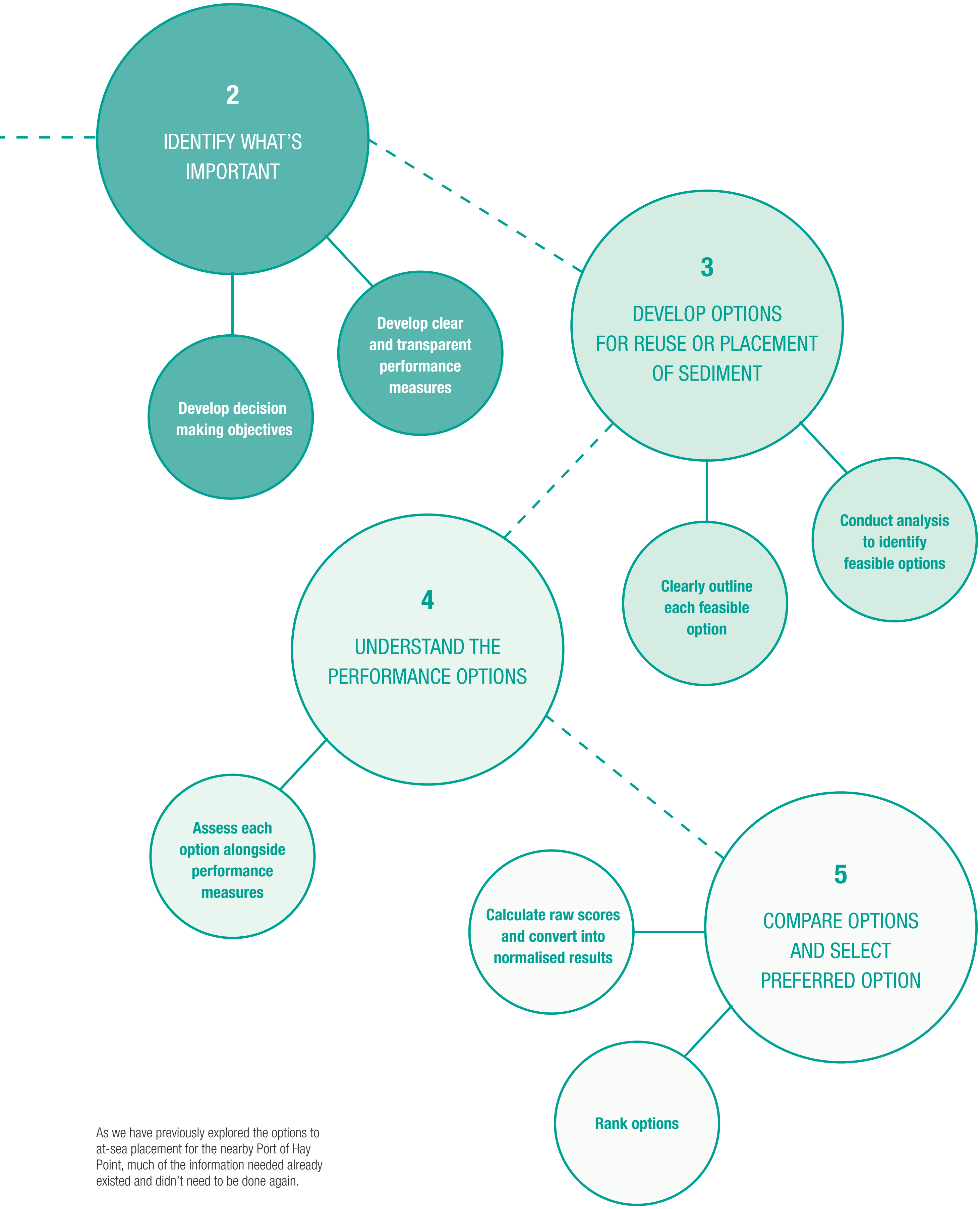
Frame the decision

Initial analysis of decisions

We adopted the principles of **structured decision making** to ensure an organised and transparent approach.

First, we took the time to identify and understand those **environmental values** of local, regional and national importance.

Then, we conducted a **comparative analysis** of feasible sediment use or placement options.



As we have previously explored the options to at-sea placement for the nearby Port of Hay Point, much of the information needed already existed and didn't need to be done again.

Alternative to **at sea**

1. What are the environmental values to consider, on land and at sea?
2. What are the at sea, onshore containment or reuse alternatives?
3. How do all the placement alternatives compare?

What are the environmental values to consider

ON LAND OR AT SEA?

The environmental values assessment evaluated what was considered to be important for the Mackay / Hay Point region across **four headline categories.**

Headline Categories
Social
Aquatic ecosystems
Landform and biota
Air quality

Using robust methodologies, the assessment explored how each value was considered important at a national, regional and local level. Data from field investigations and online portals, including government databases, were used to determine the specific values for the project. Importantly the study also assessed the attributes in the region that contribute to Outstanding Universal Value (OUV) for the Great Barrier Reef World Heritage Area (GBRWHA). The original 2016 Environmental Values Assessment was reviewed in 2021 (2021 Addendum) confirming the values and assessment remain relevant.

TRAFFIC MANAGEMENT

SEAGRASS

FISHERIES

MANGROVES

WASTE MANAGEMENT

CATCHMENTS & STREAMS

INDIGENOUS CULTURAL HERITAGE

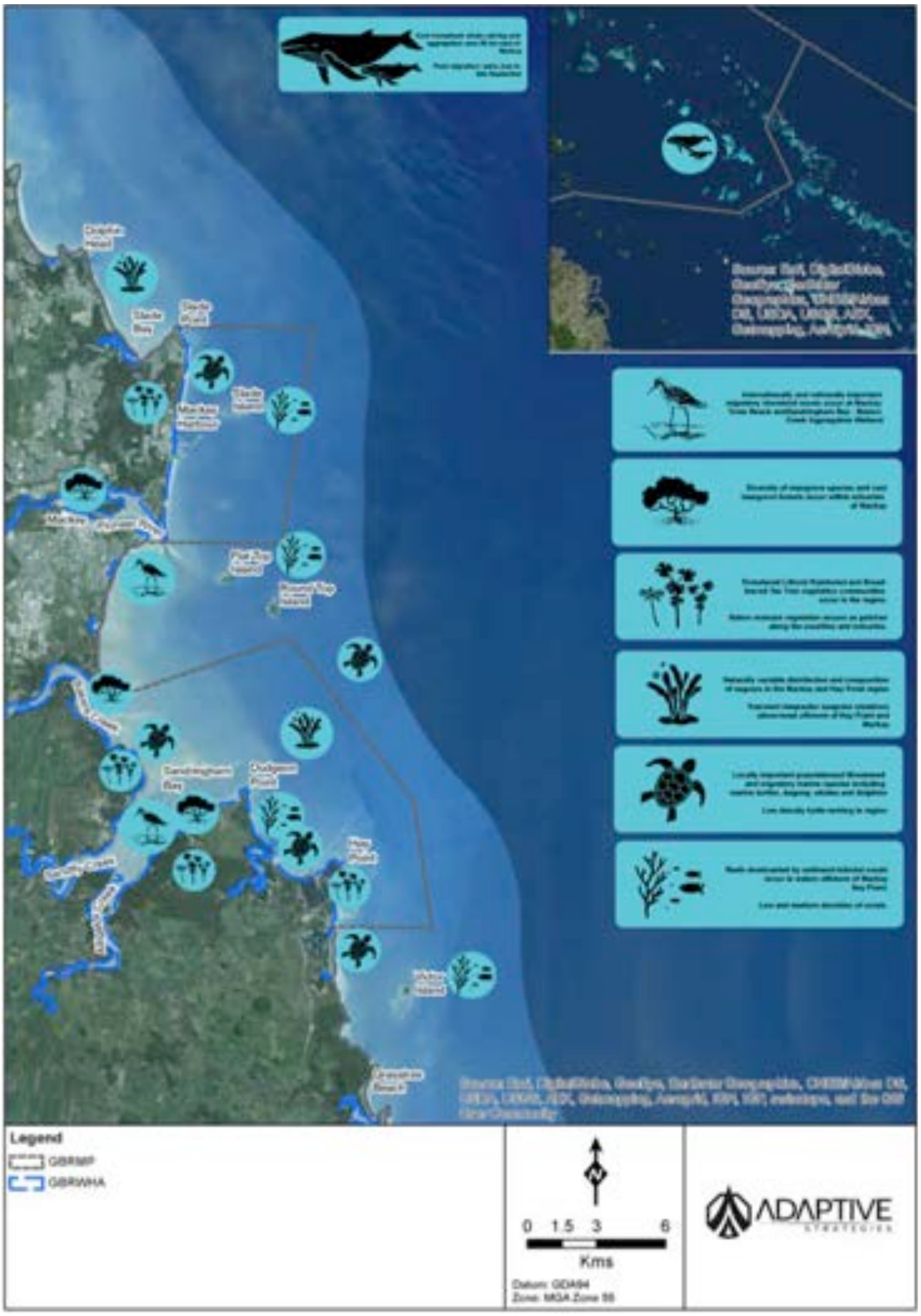


FIGURE 1. REGIONAL ENVIRONMENTAL VALUES

- Internationally and nationally important migratory shorebird species occur at Mackay Town Beach and Sandringham Bay – Bakers Creek Aggregation Wetland.
- Diversity of mangrove species and vast mangrove forests occur within estuaries of Mackay.
- Threatened littoral rainforest and broad-leafed tea tree vegetation communities occur in the region. Native remnant vegetation occurs as patches along the coastline and estuaries.
- Naturally important populations of threatened and migratory marine species including marine turtles, dugong, whales and dolphins. Low density turtle nesting in the region.
- Reefs dominated by sediment tolerant corals occur in waters offshore of Mackay and Hay Point. Low to medium densities of corals.

Some values were recognised to be important for the region, however, were not found to be unique to the project area when compared with surrounding regions

Alternative to **at sea**

1. What are the environmental values to consider, on land and at sea?
2. What are the at sea, onshore containment or reuse alternatives?
3. How do all the placement alternatives compare?

ENVIRONMENT

CULTURAL HERITAGE

PORT OPERATIONS

HEALTH AND SAFETY

SOCIAL

INNOVATION

WORLD HERITAGE

What are the at sea, onshore containment or reuse alternatives?

AND HOW DO THEY COMPARE?

Meetings were held with the Port of Mackay Technical Advisory and Consultative Committee (TACC). From this, 11 objectives and 14 performance measures were established. The objectives and performance measures developed as part of the Port of Hay Point SSM assessment were considered appropriate to adopt for the Port of Mackay SSM assessment. The TACC considered that the objectives and performance measures continued to be of relevance and importance to the Mackay region. The TACC did not identify any new values or measures specific to the Port of Mackay assessment.

THEME	OBJECTIVE	MEASURE
	Avoid and minimise impacts to coastal ecosystems	Predicted performance in relation to avoidance and minimisation of impacts to coastal ecosystems
	Minimise carbon emissions	Predicted risk on dredge material placement plumes and/or tailwater discharge exceeding ambient variation (percentile above median ambient TSS)
		Forecast Greenhouse gas emissions
	Minimise impact on cultural heritage	Nature and scale of any impact on cultural heritage
	Maintain effective and efficient port operations	Number of days disruption to terminal loading operations
		Predicted lead time to dredge material placement
		Capacity to provide a long term solution for the Port
	Avoid significant loss of future port expansion opportunities	Predicted performance in terms of facilitating or constraining future port expansion
	Ensure solution is cost effective	Assessment of costs
	Avoid or mitigate health and safety risks	Relative risk
	Minimise interference to social activities	Scale and duration of any impacts on social activities
	Provide increased economic and social opportunities	Predicted number of FTE jobs created
	Promote innovation in port management	Ability of a solution to advance current dredging practice information, technology and techniques
	Avoid and minimise impacts to the Great Barrier Reef World Heritage Area	Scale and duration of activity within the Great Barrier Reef World Heritage Area

6 discrete alternative options for reuse and placement were identified across four categories (at-sea, onshore, land reclamation and habitat creation) and an analysis of the performance of these options found:

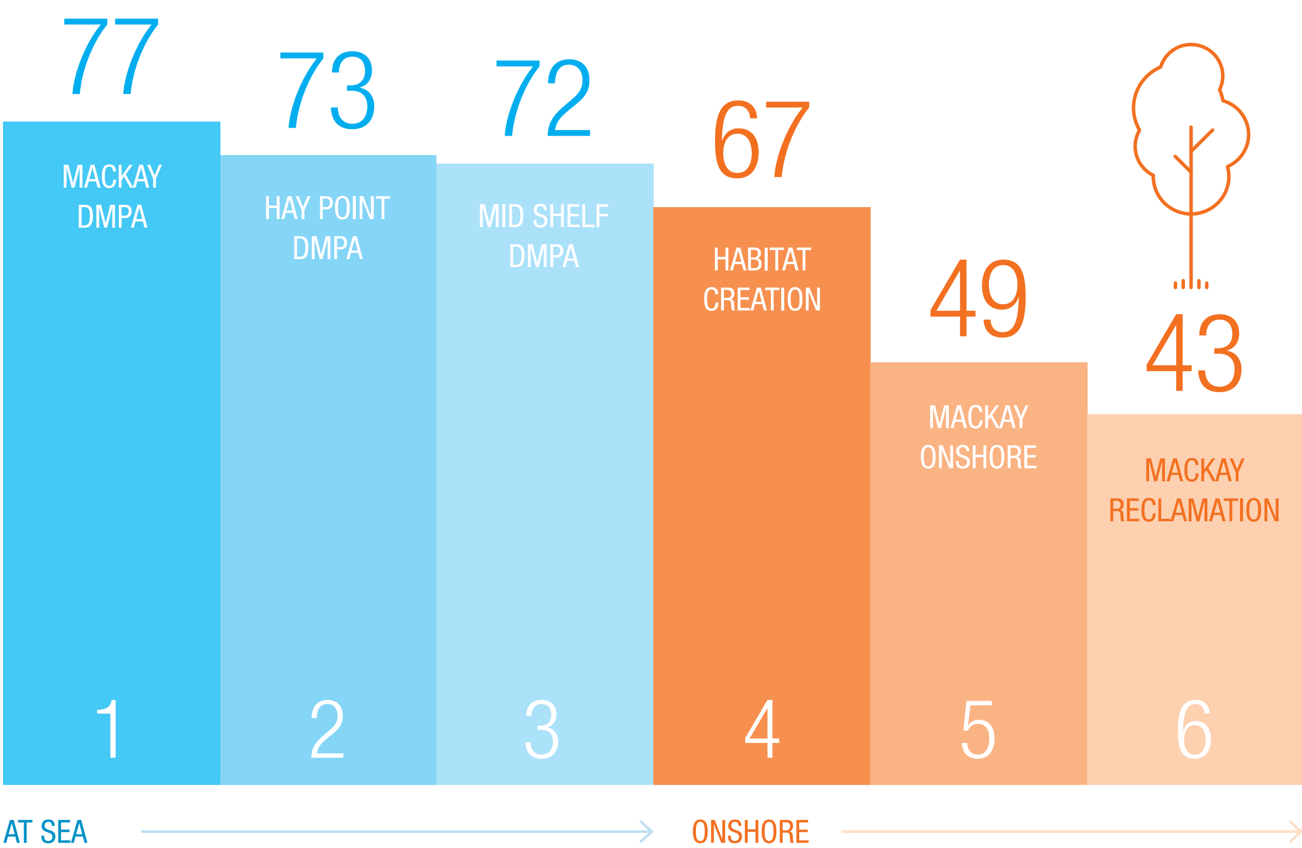
READING THE DATA

This table summarises the weighted scores (max 100) for each option across the six weighting scenarios. For the 'Equal' weighting column all performance measures were compared on an equal weighting. For the five other weighting columns, a 75% weighting was given to performance measures in a particular theme/value, i.e. the 'Environment' weighting gave a 75% weighting for the environment performance measures (coastal ecosystems, dredge plumes/tailwater discharge and greenhouse gas emissions).

	EQUAL					
At sea Mackay DMPA	77	72	90	58	94	76
At sea Hay Point DMPA	73	66	86	57	93	65
At sea Mid-shelf DMPA	72	74	77	58	92	56
Mackay Onshore	49	60	48	43	62	59
Mackay Reclamation	43	36	43	60	72	30
Habitat creation	67	89	52	64	91	82

Comparing overall performance scores

Offshore placement at the existing Dredged Material Placement Area (DMPA) consistently performed the best. It was the strongest of the three best performers and on balance, is considered to be the preferred solution. It provides both a short and long-term solution, is well understood, and performs strongly in a range of scenarios.



Alternative to **at sea**

1 What are the environmental values to consider, on land and at sea?

2 What are the at sea, onshore containment or reuse alternatives?

3 How do all the placement alternatives compare?

A closer look at the preferred solution

AT SEA

The three offshore options all perform relatively well across a range of measures. The existing offshore alternative generally out performs both the Hay Point DMPA and the mid-shelf alternative.

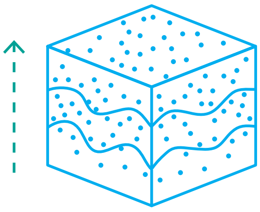
The existing dredged material placement area (DMPA) for the Port of Mackay is located approximated 2km of Slade Islet (or 3km North-East of Mackay Harbour) and has been used by the Port since the early 1960s.

Continued environmental monitoring and assessment through NQBP's long-standing partnership with James Cook University has shown that maintenance dredging has had no detectable or lasting impacts on water quality, seagrass or other benthic habitat in the area.

10 year volume may be in the order of 575,000m^3

Sediment volumes in context

Performance measures were calculated to accommodate the following dredge volumes over a 10 year period (based on historic data and taking into account cyclonic weather events).



Typical sedimentation

40,000m^3 /year – expected 8 out of every 10 years

Large sedimentation

90,000m^3 / year – expected 2 out of every 10 years

It is expected to be removed approximately every 3-5 years. Including 15% contingency, the 10 year volume may be in the order of 575,000m^3.

Port of Mackay

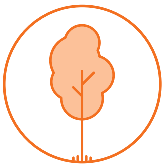
50,000 scenarios were run through the model

9 scenarios with positive NPV

0 scenarios viable without coastal protection benefits

A closer look at the alternatives

Habitat restoration and creation



Habitat restoration and creation was identified during the Port of Hay Point SSM assessment and a scientific advisory group was established to help steer research in this area. Investigations since have suggested only very small regional areas of coastal habitat lend themselves to restoration (all of which could be achieved with simple fences and other access controls). None lend themselves to large volumes of dredged maintenance material.

Habitat creation – specifically using dredged maintenance material to create new intertidal flats for mangroves and saltgrass where currently another habitat exists was also considered. An approach to model the circumstances in which a habitat creation project might be positive (with respect to the 'value of the newly created habitat'). This approach avoided unintentionally limiting the analysis by selecting options that were intrinsically unfeasible in their design or by being constrained by specific location/site parameters. Instead, the analysis could identify in what circumstances a habitat creation project might be successful.

A total of 50,000 scenarios were run through the model to understand the circumstances where benefits exceeded costs of habitat creation (i.e. where net benefits are realised). From the model it was concluded that:

- Only 9 scenarios resulted in net positive outcomes (Net Present Value = NPV greater than zero).
- None of the 9 scenarios are viable at all without the inclusion of the coastal protection benefits. That is, most of the potential value comes from a scenario which protects coastal assets at risk.
- No single scenario stands out as being feasible.

Reclamation or onshore pond containment

The fine nature of the dredged material doesn't lend itself to beneficial reuse or in constructing reclaimed land for load bearing uses. Non-load bearing uses such as parkland could be achieved over time, or the material could simply be contained onshore with no future use. Available land suitable for such uses is limited and both these onshore options were consistently the worst performing and as such do not warrant future consideration.

Mackay Office
Level 1, Waterfront Place,
Mulherin Drive
Mackay Harbour, QLD 4740
PO Box 3340,
North Mackay, QLD 4740
Phone: 07 4969 0700

Brisbane Office
Level 4, 175 Eagle St
Brisbane QLD 4000
GPO Box 409, Brisbane, QLD 4001
Phone: 07 3011 7900

Phone: 1300 129 255
Email: info@nqbp.com.au
Website: nqbp.com.au