

Assessment Report 104

Assessment by supplementary environmental report

Department of Infrastructure, Planning and Logistics

Mandorah Marine Facilities

August 2023

This assessment report has been prepared by the Northern Territory Environment Protection Authority (NT EPA) pursuant to section 64 of the *Environment Protection Act 2019* (NT) (EP Act). It describes the outcomes of the NT EPA's assessment of the Mandorah Marine Facilities proposed action.

The proposed action is to develop a safer and weather-resistant ferry berthing facility near the existing Mandorah ferry facility to improve transport connectivity between the Cox Peninsula and Darwin. The proposed action includes the construction of two rock armoured breakwaters, a floating pontoon, a gangway, a jetty, and a ferry terminal building, as well as the carrying out of initial (capital) and ongoing dredging activities for the creation of an access channel and berthing areas. Dredging activities, spaced every 5-7 years over the project's 50 year lifespan, involve the offshore disposal of unconsolidated sediments in Darwin Harbour. The NT EPA's method for assessment of the proposed action is by supplementary environmental report (SER).

The assessment report documents potential environmental impacts and risks identified during the environmental impact assessment process, focusing on those that could be significant, and the measures and recommended conditions required to address potentially significant impacts.

In accordance with section 65 of the EP Act, the assessment report is for the Northern Territory Minister for Environment, Climate Change and Water Security to consider when making a decision about whether to approve the action under the EP Act.



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28 August 2023

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Summary

This assessment report has been prepared by the Northern Territory Environment Protection Authority (NT EPA) pursuant to section 64 of the *Environment Protection Act 2019* (EP Act). This assessment report and the draft environmental approval are provided to the Minister for Environment, Climate Change and Water Security (Minister) for consideration in deciding whether to grant an environmental approval for the Mandorah Marine Facilities (proposed action).

The proposed action is located at Mandorah on the eastern tip of Cox Peninsula close to the existing Mandorah jetty and ferry service, about 5 km northwest of the Darwin central business district. The Northern Territory Department of Infrastructure, Planning and Logistics (proponent) proposes to develop new safer, weather resistant ferry berthing facilities to address access and/or safety issues experienced by the existing Mandorah ferry facility and boat ramp infrastructure.

The proposed action includes the construction of two rock armoured breakwaters, a floating pontoon, a gangway, a jetty, and a ferry terminal building. Dredging activities will be conducted to remove unconsolidated marine sediments and rock material for the creation of an access channel and berthing areas. The unconsolidated sediments amounting to 30,000 m³ will be disposed of offshore, while the rock material totalling up to 70,000 m³ will be repurposed for construction of the breakwaters. Ongoing maintenance dredging is expected to be required once every five to seven years after capital dredging works are complete.

The NT EPA assessed the proposed action by supplementary environmental report in accordance with the EP Act. The environmental impact assessment examined the potential for significant direct, indirect and cumulative environmental impacts on the environment.

The NT EPA identified and examined potential significant impacts on six key environmental factors:

1. Terrestrial environmental quality
2. Terrestrial ecosystems
3. Coastal processes
4. Marine environmental quality
5. Marine ecosystems
6. Culture and heritage.

To address potential significant impacts of the proposed action on the key environmental factors, the NT EPA has recommended conditions for the Minister to consider in deciding whether to grant or refuse environmental approval for the proposed action. The proponent and statutory decision-makers were consulted on the draft environmental approval as required by regulation 160 of Environment Protection Regulations 2020.

The NT EPA's assessment concludes that the proposed action can be implemented and managed in a manner that is environmentally acceptable and therefore recommends that environmental approval be granted, subject to the conditions in the draft environmental approval (Appendix 1).

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1. Introduction

This assessment report has been prepared by the Northern Territory Environment Protection Authority (NT EPA) pursuant to section 64 of the *Environmental Protection Act 2019* (EP Act). It provides an evaluation of the potential significant environmental impacts of the Mandorah Marine Facilities (proposed action).

The proponent for this development is the Northern Territory Department of Infrastructure, Planning and Logistics. The NT EPA carried out an environmental impact assessment of the proposed action by supplementary environmental report (SER) in accordance with the EP Act and Environment Protection Regulations 2020 (EP Regulations).

On completion of its assessment, the NT EPA provides this assessment report (including the draft Environmental Approval at Appendix 1) to the Minister for Environment (Minister) for consideration in deciding whether to grant environmental approval to the proponent.

1.1. Purpose

The purpose of this assessment report is:

- to assess whether the proposed action is likely to meet the environmental objectives
- to assess the potential significant environmental impacts of the proposed action
- to make recommendations for avoiding, mitigating and managing those impacts
- to advise the Minister as to the environmental acceptability of the proposed action.

The assessment report must assess the potential environmental impacts and risks of the proposed action and whether there are any significant residual impacts remaining after all reasonable measures to avoid and then mitigate and manage the risks have been taken.

2. Proposed action

2.1. Overview

The Northern Territory Department of Infrastructure, Planning and Logistics (proponent) proposes to develop the proposed action at Mandorah adjacent to the existing ferry facility on the eastern tip of Cox Peninsula, about 5 km northwest of the Darwin central business district (**Figure 1**). The proposed action is to develop new, weather resistant ferry berthing facilities at Mandorah, to address access and/or safety issues experienced by the existing Mandorah ferry facility and boat ramp infrastructure. The development of the proposed action will improve Cox Peninsula's ferry service for passengers, especially for those requiring mobility assistance.

The new facilities will be delivered in stages to maintain users' access to the existing Mandorah ferry service. The key components of the proposed action are summarised in **Table 1**. A detailed description of the proposed action is provided in section 3 of the [referral](#) (Cardno 2022).

Table 1 Proposed action key components

Aspect	Description
Action commencement	2023 - 2024
Disturbance footprint (land and water)	Approximately 7 hectares
Design life	25 - 50 years
Construction duration	Approximately 6 to 8 months

Aspect	Description
Capital dredging	<ul style="list-style-type: none"> • Duration up to 4 months (daylight hours, 7 days per week); • Approximately 2 hectares of dredge area (access channel, turning basin and berthing areas); • Dredge volume up to 100,000 m³, comprising approximately 30,000 m³ unconsolidated sediments and 70,000 m³ hard rock. • Dredge depth up to -6.8 m Australian Height Datum (AHD)
Dredging method (capital)	<ul style="list-style-type: none"> • Cutter-section dredger for soft sediments; • Back-hoe dredger and/or long-reach excavator for hard rocks.
Dredge material (reuse/disposal)	<ul style="list-style-type: none"> • Offshore disposal of excavated unconsolidated sediments in the Darwin Harbour (approximately 1.2 km to the northeast) via a hydraulic pipeline; • Reuse of excavated hard rock in breakwater cores.
Marine Infrastructure	<p>Development of approximately 1.7 hectares of beach and nearshore area comprising:</p> <ul style="list-style-type: none"> • two breakwaters creating a safe harbour; • boat ramp; • floating pontoon; • gangway; • causeway; • piles (up to 10); • jetty and mechanical lift (to be confirmed during final design stage).
Landside infrastructure (onshore)	<p>Minor modifications to the existing carpark in the Charles Point Road Reserve, and additional development of approximately 0.3 hectares of the onshore area on land parcels 50 and 116 comprising:</p> <ul style="list-style-type: none"> • a ferry terminal (50-people capacity building); • a new carpark; • toilet block and onsite disposal facility; • rainwater tanks; • paths and roads; • stormwater management system.
Temporary laydown and transit areas	<ul style="list-style-type: none"> • Approximately 2.7 hectares • Progressive rehabilitation to occur when these areas are no longer in use
Water supply and demand	<ul style="list-style-type: none"> • Construction water to be sourced offsite from existing Power and Water owned road bores or private bores; • Rainwater tanks to supply water during operations.
Power supply	To be confirmed during final design stage
Maintenance dredging (operational)	Every 5 to 7 years
Workforce	<ul style="list-style-type: none"> • 25-50 people for the construction stage • 1-2 people for operation stage
Capital investment	Estimated capital expenditure of \$50 million, with ongoing operational expenditure.

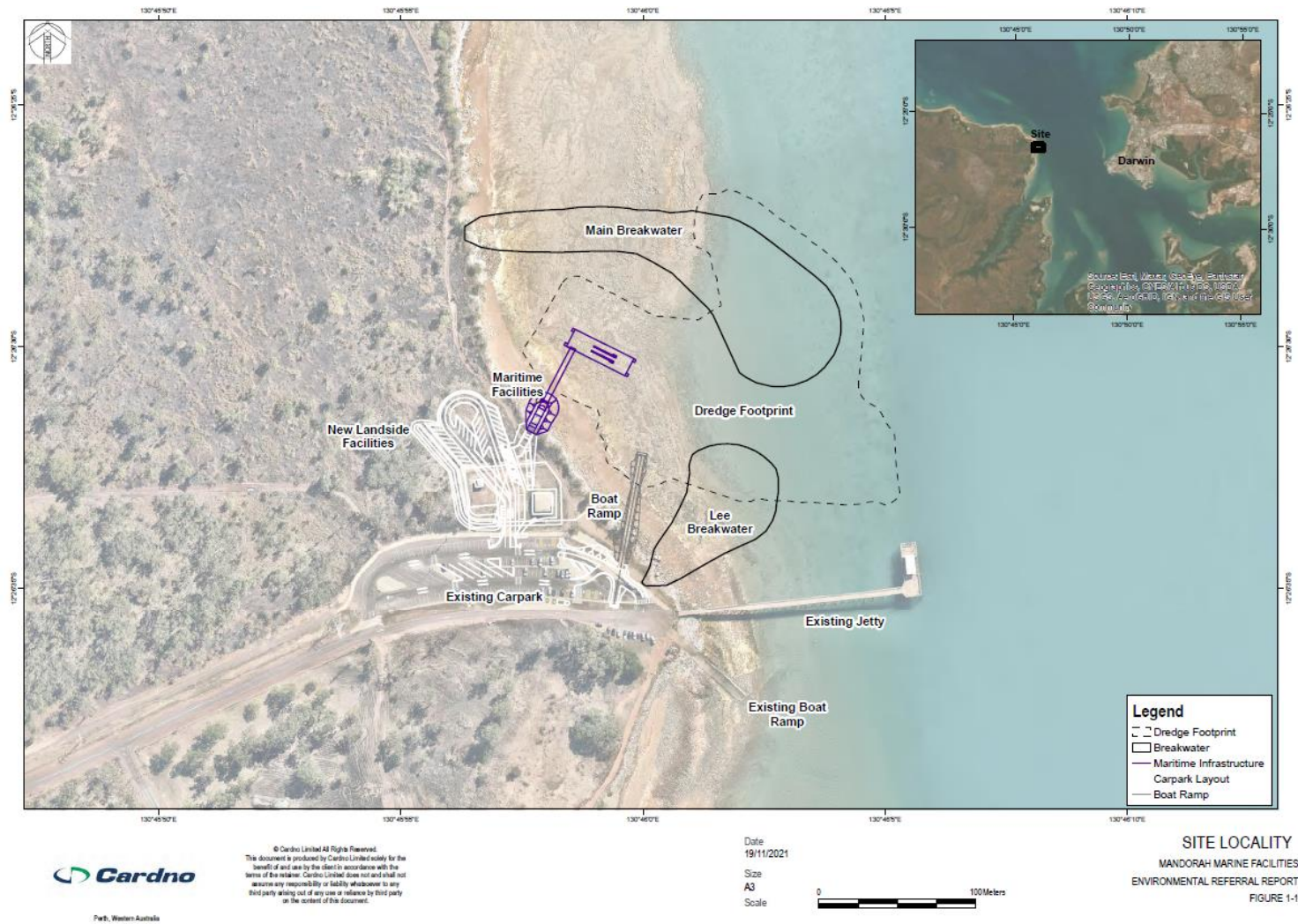


Figure 1 Location of the Mandorah Marine Facilities Project (Referral, Figure 1-1)

2.2. Local context

The existing Mandorah jetty was built in the 1960s. It serves the Wagait Beach (465 people) and Belyuen communities (164 people), as well as the ferry passengers travelling to and from Mandorah. The referral indicates that the existing jetty is unsafe for ferry users and does not meet accessibility requirements for people with mobility impairments. The nearby boat ramp to the south of the current ferry facility, which opens into the western Darwin Harbour, is also indicated to have usability issues due to safety and siltation concerns.

The proposed action is close to the existing jetty and boat ramp (shallow and intertidal zone of the western Darwin Harbour), and is accessible by Charles Point Road and Cox Peninsula Road. The referral indicates that the new facility will provide a safer environment for ferry users, improve accessibility for people with disabilities and unlock the area's potential for development and tourism.

Darwin Harbour is a working harbour with ongoing development, and is recognised as playing an important role in the economy of the Territory. Darwin Harbour also has significant environmental, cultural, social and economic values that require protection. The main marine uses of Darwin Harbour in the vicinity of the proposed action include commercial shipping, recreational boating, fishing and military activities. The land surrounding the proposed action is currently zoned as rural and rural living.

3. Strategic context

The proponent's primary role is to invest in the infrastructure and transport planning that enables growth of the Territory economy and supports the wellbeing and quality of life for all Territorians. The strategic justification for the proposed action is established in the Northern Territory Government's NT Infrastructure Plan and Pipeline 2022.

The proposed action is also consistent with other NT Government strategic plans and initiatives including the Darwin Regional Plan, NT Infrastructure Strategy, The Territory's Economic Reconstruction and Darwin Harbour Strategy.

3.1. Proposed action benefits

The referral indicates that the proposed action represents long-term social and economic benefits to residents and visitors of the Cox Peninsula region, with a \$50 million investment to improve safety and access for ferry users, and unlocking the area's potential for development and tourism.

The referral indicates that the proposed action will create job opportunities for approximately 25-50 people during construction and approximately 2 people during operation, with locals prioritised for employment.

4. Statutory context

The proposed action required assessment by the NT EPA under the EP Act due to the potential for significant environmental impact. The Northern Territory Minister for Environment, Climate Change and Water Security is the approval authority.

If an environmental approval under the EP Act is granted, it will prevail over other NT statutory authorisations that the proponent is required to obtain. It is the responsibility of the proponent to obtain all relevant statutory authorisations and approvals which may include, but not be limited to:

- an Authority Certificate from Aboriginal Areas Protection Authority (AAPA) under the *Northern Territory Aboriginal Sacred Sites Act 1989*;

- consent for the proposed action under the *Planning Act 1999*.

4.1. Mandatory matters for consideration

In preparing this assessment report, the NT EPA considered the following information in accordance with regulation 157 of the EP Regulations:

- referral information
- SER
- submissions made within the relevant submission period

In carrying out its assessment, the NT EPA took into account the purpose of the environmental impact assessment process under section 42 of the EP Act including consideration of:

- the objects (EP Act, section 3)
- the principles of ecologically sustainable development (EP Act, Part 2 Division 1)
- the environmental decision-making hierarchy (EP Act section 26)
- the waste management hierarchy (EP Act section 27)
- ecosystem-based management
- impacts of a changing climate.

Refer to section 9 of this report for further detail about matters that the NT EPA has taken into account during its assessment.

5. Consultation

The NT EPA invited public and government authority comments on the proponent's referral information during the consultation period from 24 March to 22 April 2022. Submissions from seven government authorities were received as well as one public submission.

The NT EPA considered the accepted referral information and submissions received, and on 8 June 2022 decided that the proposed action would require an assessment by SER under the EP Act.

The NT EPA invited public and government authority comments on the proponent's SER during the consultation period from 9 March to 14 April 2023. Submissions from three government authorities were received. No public submissions were made.

The proponent was directed by the NT EPA delegate on 16 May 2023 to provide additional information in relation to the SER to address issues raised in the submissions relating to the assessment of potentially significant environmental impacts.

The NT EPA invited two government authorities to make submissions on the additional information to the SER from 20 June to 27 June 2023.

On 28 June 2023, the NT EPA delegate invited the proponent to provide a response addressing the submission from one government authority (Aboriginal Areas Protection Authority) that related to cultural matters.

In preparing this assessment report, matters raised in the submissions were considered in relation to the potential significant environmental impacts of the proposed action. The issues raised in submissions are discussed in section 6.

The NT EPA invited the proponent to make a submission on the draft environmental approval and sought to obtain the views of a statutory decision-maker (Development Consent Authority) and the government authority for cultural matters (Aboriginal Areas Protection Authority), in line with EP Regulation 160. Submissions were received from the proponent and delegates under the *Planning Act 1999* and the *Northern Territory Aboriginal Sacred Sites Act 1989*. The NT EPA considered these submissions in finalising its advice and recommendations to the Minister.

The proponent conducted its own consultation in relation to the proposed action as detailed in section 7 of the referral report and delivered a presentation about the proposal to NT government authorities on 23 March 2023.

The consultation process has been appropriate, and reasonable steps have been taken to inform and consult with the community and stakeholders about the potential impacts and benefits of the proposed action. Relevant significant environmental issues identified from this process were taken into account by the NT EPA during its assessment of the proposed action.

6. Assessment of key environmental factors

6.1. Overview

The NT EPA identified that the proposed action has the potential to have a significant impact on environmental values associated with six key environmental factors¹ (**Table 2**).

Table 2 Key environmental factors

THEME	FACTOR	ENVIRONMENTAL OBJECTIVE
LAND	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
SEA	Coastal processes	Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.
	Marine environmental quality	Protect the quality and productivity of water, sediment and biota so that environmental values are maintained.
	Marine ecosystems	Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
PEOPLE	Culture and heritage	Protect culture and heritage.

The NT EPA considered other environmental factors during its environmental impact assessment; however, the impact on those factors was not considered to be significant.

In considering the key environmental factors and the recommended conditions in Appendix 1, the NT EPA took into account other statutory decision-making processes relevant to the proposed action with requirements for avoiding or mitigating potential impacts on the environment.

¹ [NT EPA Environmental factors and objectives](#)

6.2. Terrestrial environmental quality

6.2.1. Environmental values

The proposed action is located in the Darwin Coastal bioregion which is typically flat, low-lying and drained by several large rivers. Associated vegetation communities are eucalypt forest and woodland with tussock and hummock grass understorey.

There are no significant surface water bodies at the site and it is understood that rainfall runoff mainly flows directly to Darwin Harbour as the land is relatively flat and slopes gently towards the shoreline.

The soils within the onshore area have been previously disturbed through land clearing and the existing civil infrastructure development. However, the physical and chemical composition of the soils remain poorly understood as limited investigations have been conducted in this area. The limited data from a nearby location indicate that the site is likely to comprise gravelly silty sand or sand overlying shallow bedrock.

The area is likely to be free from other contamination since it has not been used for industrial purposes, though asbestos associated with an existing Radio Australia building has been detected. Generally, disturbed subsoils are encapsulated with bitumen.

Previous studies (Department of Environment and Natural Resources 2009; Hill and Edmeades 2008) show there is a low probability of acid sulfate soils occurring in the terrestrial environment of the proposed action.

Approach for identifying potential impacts to environmental values

The proponent undertook a hazardous material investigation of the existing Radio Australia building and its surroundings in 2021 to confirm the location, condition and risk presented by asbestos containing materials (ACMs). The investigation found ACMs in building materials and identified the possibility of ACM occurrence in soils in the vicinity of the building.

6.2.2. Consultation

The submissions on the SER raised the following key issues in relation to terrestrial environmental quality:

- avoid disturbance of acid sulfate soils and the requirement to follow appropriate guidelines when carrying out works
- potential impact of runoff and saline water intrusions into soils from the temporary stockpiling of dredge spoil within the onshore area, and the requirement to develop monitoring and mitigation actions to address such risks.

6.2.3. Factor assessment and recommended regulation

In assessing whether the residual impacts of the proposed action will meet the NT EPA environmental factor and objective, and whether reasonable and appropriate regulatory conditions can be imposed, the assessment findings and recommended conditions of approval are presented below in **Table 3**.

Table 3 Assessment for terrestrial environmental quality, and recommendations for conditions of approval

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
<p>Terrestrial environmental quality has the potential to be impacted through:</p> <ul style="list-style-type: none"> • direct land clearing (1.1 hectare) leading to potential soil erosion and degradation of both land and water quality through sedimentation • temporary stockpiling of up to 70,000 m³ of dredged hard rock within the onshore area (Lot 116) • earthworks that may disturb acid sulfate soils (ASS) and potential acid sulfate soils (PASS) 	<p>The proponent's construction environmental management plan (CEMP) includes the commitment to implement:</p> <ul style="list-style-type: none"> • rehabilitation and post construction monitoring in disturbed areas when these areas are no longer in use • monitoring and mitigation actions including the use of appropriate stockpiling techniques to prevent erosion issues and manage runoff • removal of ACM by trained personnel prior to earthworks • adaptive management actions if ASS or 	<p>Localised effects on land and soil quality.</p> <p>Potential land and marine water contamination in the event of poor land-based dredge spoil handling and site rehabilitation practices.</p>	<p>The NT EPA's assessment found:</p> <ul style="list-style-type: none"> • A detailed erosion and sediment control plan is required to avoid adverse effects beyond the proposed extent of the action. • The probability of encountering ASS or PASS within the onshore areas is low. • Asbestos removal will be regulated under the <i>Work Health and Safety Act 2011</i>, and this would need to be carried out by a licensed contractor. • The CEMP will be updated prior to construction, to address a number of relatively minor potential sources of 	<p>Regulated through recommended conditions:</p> <ul style="list-style-type: none"> • Condition 1: Limitation and extent – limit the extent of construction disturbance • Condition 2: <ul style="list-style-type: none"> ○ implementation of the action to achieve environmental objectives including no material environmental harm to land and soils beyond the proposed extent ○ develop an erosion and sediment control plan (ESCP) in accordance with the International Erosion Control Association Australasia 2008, Best Practice Erosion and Sediment Control.

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
<ul style="list-style-type: none"> disturbance of asbestos containing materials (ACM) associated with an old building 	asbestos are encountered		<p>impact, such as weeds, spills and dust.</p> <ul style="list-style-type: none"> If subject to the recommended conditions in Appendix 1, the impacts are considered to be insignificant. 	<p>Regulation by other regulatory processes:</p> <ul style="list-style-type: none"> <i>NT Planning Act 1999</i> <i>Soil Conservation and Land Utilisation Act 1969</i> <i>Weeds Management Act 2001</i> <i>Waste Management and Pollution Control Act 1998</i> (general duty) <i>Work Health and Safety Act (2011)</i>

6.2.4. Conclusion against the NT EPA objective

With the implementation of the proponent's proposed management measures, commitments and conditions for avoidance, monitoring, and mitigation of impacts identified in the draft environmental approval (Appendix 1), the NT EPA considers that the proposed action can be conducted in such a manner that its objective for terrestrial environmental quality is likely to be met.

6.3. Terrestrial ecosystems

6.3.1. Environmental values

The proposed action is located within the Darwin Coastal bioregion.

Vegetation mapping for the onshore area (Department of Environment and Natural Resources 2013) identifies native vegetation and habitat associated with the proposed action area as *Eucalyptus* open forest. The proponent's survey determined this vegetation classification to be inaccurate and identified *Terminalia* spp. open woodland as the dominant vegetation type across the construction footprint. This vegetation community is considered regionally widespread on the Cox Peninsula.

The area to be directly modified is relatively small, covering about 1.1 hectares. The portions of the area to be modified are already cleared or in a degraded condition, making it unlikely to support high biodiversity and habitat values. The area has a relatively low coverage of trees and substantial coverage of *Cenchrus* spp. (mission grass, Class B weed) compared to surrounding areas of Cox Peninsula which host similar but better quality habitat.

The relatively sparse *Terminalia* open woodland does not provide suitable habitat for native fauna and any listed species. The proponent's survey found that habitat values in the footprint were severely degraded by frequent fires and no occurrence of tree hollows, consistent leaf litter or debris that would provide habitat for fauna species such as reptiles, birds, bats and arboreal mammals.

Approach for identifying potential impacts to environmental values

The proponent undertook a desktop review of flora and fauna databases and conducted a self-assessment of matters of national environmental significance to determine whether the proposed action would have a significant impact on the matters protected under the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This included an assessment of the likelihood of occurrence for species with conservation significance.

Terrestrial habitat surveys were undertaken by the proponent in March 2020 to ground truth existing vegetation mapping applicable to construction work areas and assess habitat conditions. Opportunistic flora and fauna records, including any presence of threatened and introduced species, were also recorded.

6.3.2. Consultation

The submissions on the SER raised the following key issues in relation to terrestrial ecosystems:

- uncertainty regarding the terrestrial biodiversity and environmental values for temporary work areas
- concern regarding the invasion and spread of weeds, such as mission and gamba grass, in the areas directly impacted by the proposed action and its surroundings, and the recommendation to consider relevant threat abatement plans to manage such risks.

6.3.3. Factor assessment and recommended regulation

In assessing whether the residual impacts of the proposed action will meet the NT EPA environmental factor and objective, and whether reasonable and appropriate regulatory conditions can be imposed, the assessment findings and recommended conditions of approval are presented below in **Table 4**.

Table 4 Assessment for terrestrial ecosystems, and recommendations for conditions of approval

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
<p>Terrestrial ecosystem values have the potential to be impacted through:</p> <ul style="list-style-type: none"> land clearing (1.1 ha) to the extent that it would result in the incursion or spread of weeds, habitat fragmentation, disruption of foraging and breeding behaviours, and potential impacts on fauna populations in the area. construction activities that generate dust, noise, vibration, artificial light and 	<p>The proponent's CEMP includes the commitment to implement:</p> <ul style="list-style-type: none"> clearing activities in line with the NT Planning Scheme Land Clearing Guidelines (DEPWS 2021) to minimise disturbance to local vegetation communities lighting in the work areas in accordance with the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds 2020 rehabilitation and post construction monitoring in disturbed areas when these areas are no longer in use mitigation and management actions related to noise, dust, weeds and fire in construction work areas. 	<p>Residual low impact on terrestrial biodiversity and environmental values due to the short duration of construction works and permanent clearing of a relatively small area.</p>	<p>The NT EPA's assessment found:</p> <ul style="list-style-type: none"> The proposed action would result in irreversible loss of 0.3 hectares of <i>Terminalia</i> spp. open woodland habitat, subject to successful rehabilitation of temporary work areas. The portion of area to be developed is already cleared or in a degraded condition from frequent fires, and is unlikely to support habitat values. The vegetation community to be cleared represents a small proportion of similar, but relatively undisturbed, habitats in the Cox Peninsula region. The construction impacts on local fauna would be temporary and short-term (about 6 to 8 months). If the proponent's proposed management measures and commitments are implemented, the impacts are considered to be insignificant. 	<p>Regulated through recommended conditions.</p> <ul style="list-style-type: none"> Condition 1: Limitation and extent – limit the extent of construction disturbance Condition 9: Environmental performance and compliance reporting - upon completion of construction activities, the proponent must report to the Minister detailing the environmental performance of the action including rehabilitation of temporarily disturbed areas. <p>Regulation by other regulatory processes:</p> <ul style="list-style-type: none"> <i>Territory Parks and Wildlife Conservation Act 1976</i> <i>Bushfires Management Act 2016</i> <i>Fire and Emergency Act 1996</i> <i>Weeds Management Act 2001</i>

possible ignition sources for bushfires.				
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6.3.4. Conclusion against the NT EPA objective

With the implementation of the proponent's proposed management measures, commitments, and conditions for avoidance, monitoring, and mitigation of impacts identified in the draft environmental approval (Appendix 1), the NT EPA considers that the proposed action can be conducted in such a manner that its objective for terrestrial ecosystems is likely to be met.

6.4. Coastal Processes

6.4.1. Environmental values

The Mandorah shoreline is flat, shallow and open. Notably, it lacks mangroves and coastal wetlands which are usually found in the Darwin Harbour's fringes. The nearest coastal wetlands are located about 500 m to the northwest, which are connected to the outer Darwin Harbour via a tidal creek at Wagait Beach.

The shoreline consists of coastal sandflats, saline claypans, and claystone cliffs at its edge. A thin layer of porcelanite shelf (a type of sedimentary rock) is visible at the surface and extends offshore to about -3 mAHD. The rock varies in weathering and strength, and is overlain by fine to coarse grained sand. The claystone cliffs along the shoreline appear to be formed naturally through a complex geological process involving tectonic movements and rock weathering over an extensive period, typically millions of years.

Near the proposed action area, the tidal range is generally high and the waves are relatively small. The proponent's oceanographic survey for a limited time has recorded a tidal range of about 7 m and maximum wave height of over 1 m in deeper water. The water levels and currents in this region are primarily influenced by tidal patterns, with minor contributions from waves, wind, and tropical storms.

Tidal current velocities are generally stronger (1m/s) in deeper water, about 250 m offshore, as compared to the Mandorah shoreline where typical tidal current velocity is 0.4 m/s. The prevailing currents flow in both directions, to the north during ebb tide and to the south during flood tide. Ebb tidal currents are generally stronger than flood currents, reaching up to 1.1 m/s during a spring tide.

The seabed levels are at and above -4 mAHD within the footprint of marine infrastructure (about 150m offshore) and -7 mAHD within the dredge access channel.

Approach for identifying potential impacts to environmental values

The proponent undertook a short duration baseline oceanographic monitoring program during the wet season to understand metocean conditions directly adjacent to the proposed action. The survey analysed waves, currents and water levels for about 4 months (December 2019 – April 2020) at a location about 250 m offshore from the shoreline.

Geotechnical investigation and sediment quality sampling was undertaken by the proponent in 2019 in beach areas and areas to be dredged to inform a sediment transport assessment. The investigation did not account for surface sediment characterisation in the area immediately north of the proposed action; however, additional field investigations undertaken in 2023, coupled with bathymetric data (surveyed in 2017), provided evidence that available surface sediment volume within and around the proposed action area is limited, and there are broad areas of exposed weathering-resistant rocky substrate (porcelanite shelf).

Baseline data collected by the proponent and during previous dredging campaigns was considered in the modelling of hydrodynamic conditions and the proposed action's potential impacts on the shoreline and sediment transport processes.

Hydrodynamic modelling (depth-averaged two dimensional) was undertaken using the Delft 3D model system to predict the extent and magnitude of changes in metocean conditions with proposed marine structures installed. Tidal currents modelling was undertaken for the wet season and spring tide conditions under ebb and flood flow scenarios, and wave climate modelling was undertaken for dry season and wet season conditions. The modelling predicted that the harbour and the nearby areas would experience a reduction in current speeds and wave conditions. It was

predicted that peak ebb and flow velocities would decrease up to approximately 80% within the harbour and would create a sheltered environment suitable for vessel berthing.

The proponent also undertook sediment transport modelling using the LITPACK model system to predict shoreline change with and without marine infrastructure. Modelling was undertaken for a period of 10 years (2000-2010) and considered available data from the hydrodynamic model and bathymetric survey. Modelling assumed that there is an unlimited supply of sand for sediment transport.

The shoreline evolution modelling predicted that the construction of breakwaters would disrupt the natural southerly sediment transport pattern and lead to sediment accretion to the north and erosion about 350 m south of the lee breakwater (**Figure 2**). Erosion was predicted on the beach for both scenarios, with and without the marina construction, which contradicted the historical aerial views that showed that the shoreline has been relatively stable over the last 10 years. Based on available bathymetric data as well as geological information for the area (i.e., limited sand), the predicted sediment movement and rates are likely conservative and uncertain.

The NT EPA recognises a number of inadequacies and inherent uncertainties in the modelling approach. These uncertainties broadly relate to the model design and calibration. The NT EPA has considered these inadequacies and uncertainties, and the implications these have on predicting potential impacts on coastal processes in its assessment of the proposed action.



Figure 2 Extent of predicted shoreline change; sediment accretion to the north and erosion to the south

6.4.2. Consultation

The submissions on the SER raised the following key issues in relation to coastal processes:

- modification to the existing open shoreline environment and inherent physical, ecological and cultural values, with substantial changes to currents and sediment characteristics and transport from marina construction
- uncertainties in assumptions, parameterisation, calibration and predictive ability of shoreline evolution modelling to assess construction impacts, and the requirement to revise the site conceptual model to include all potential processes (e.g. modified

bathymetry; bedload movement; representative grainsizes, combined currents, waves and cyclonic conditions) impacting the sediment transport

- recommendation to consider a peer review of the models
- recommendation to optimise the facility design to minimise environmental impacts including coastal erosion
- concern about the design of the monitoring and management program including proposed monitoring frequency, trigger criteria and ongoing sand management effort, and the recommendation to develop a sustainable solution to the predicted shoreline change.

6.4.3. Factor assessment and recommended regulation

In assessing whether the residual impacts of the proposed action will meet the NT EPA environmental factor objectives, and whether reasonable and appropriate regulatory conditions can be imposed, the assessment findings and recommended conditions of approval are presented in **Table 5**.

Table 5 Assessment for coastal processes, and recommendations for conditions of approval

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment findings	Recommended conditions and regulation by other statutory decision-makers
<p>Coastal processes have the potential to be impacted through indirect construction and dredging impacts due to modified local hydrodynamics, sediment characteristics and transport processes.</p> <p>There is potential for significant localised consequential impacts on marine ecosystems, marine environmental quality and sites of cultural significance due to alterations in coastal conditions.</p>	<p>The proponent undertook the following actions:</p> <ul style="list-style-type: none"> characterised sediments, bathymetry and geological conditions in the areas likely to be directly impacted and adjacent areas applied the modelling approach to determine the extent and magnitude of impacts on the coastal environment and its intrinsic values prepared a Coastal Processes Monitoring and Management Plan (CPMMP) for implementation to 	<p>Irreversible impacts on near-shore environments, including substantial changes to sediment transport patterns and morphology.</p>	<p>The NT EPA's assessment found:</p> <ul style="list-style-type: none"> The tidal currents are the dominant mechanism for sediment resuspension and transport in the local environment. The construction of the marina would interrupt nearshore hydrodynamics and sediment transport patterns leading to ongoing physical impacts on the shoreline that would be localised for about 1,000 m. Predicted erosion effects are likely to be limited to within 400 m south of the lee breakwater due to coastal structures (groyne) and a sharp change in the coastline orientation. The modelling predictions are highly uncertain, and are confounded by the presence of rock (shallow and weathering- 	<p>Regulated through recommended conditions:</p> <ul style="list-style-type: none"> Condition 3: <ul style="list-style-type: none"> implementation of the action to achieve the environmental objective of maintaining the Mandorah beach within its natural extent implement the CPMMP monitor coastal conditions prior to (baseline) and after construction application of adaptive management framework to maintain Mandorah beach. <p>Condition 9 – Environmental performance and compliance reporting</p> <p>Upon completion of construction and any shoreline</p>

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment findings	Recommended conditions and regulation by other statutory decision-makers
	<p>address uncertainties in the modelling approach</p> <p>Proponent's CPMMP includes :</p> <ul style="list-style-type: none"> periodic routine monitoring (quarterly or annually) for at least the first five years to ensure adverse effects related to the shoreline modification are minimised. Additional monitoring will be conducted in case a tropical cyclone traverses the area within a 50 km distance. triggers and adaptive management actions (such as, installation of sand bypassing system) to restore the shoreline position the commitment for a periodic review of the plan to ensure its relevance 		<p>resistant) to the north of the main breakwater.</p> <ul style="list-style-type: none"> Given the uncertainty in modelling predictions, monitoring and management of the coastal area will be required in line with the CPMMP. The shoreline area and intrinsic values would likely be protected from significant impact through implementation of the adaptive CPMMP. Ongoing shoreline monitoring including baseline data collection will be required to detect impacts and verify modelled predictions. If subject to the recommended conditions in Appendix 1, the impacts can be minimised. 	<p>erosion mitigation activities, the proponent must report to the Minister detailing the environmental performance of the action and the compliance status of the CPMMP.</p>

6.4.4. Conclusion against the NT EPA objective

Implementation of monitoring and adaptive management required by the CPMMP will ensure that significant impacts from construction and dredging are avoided and mitigated.

With the implementation of the proponent's proposed management measures, commitments and conditions for avoidance, monitoring, and mitigation of impacts identified in the draft environmental approval (Appendix 1), the NT EPA considers that the proposed action can be conducted in such a manner that its objective for coastal processes is likely to be met.

6.5. Marine ecosystems and marine environmental quality

The proposed action has the potential to impact a range of marine environmental values including water quality values, sensitive receptors such as benthic communities and marine megafauna in Darwin Harbour. This section evaluates the potential impacts associated with predicted changes to marine water quality and benthic habitats, and the mitigation and management measures proposed in the SER.

6.5.1. Environmental values

The proposed action is located on the eastern tip of Cox Peninsula and on the western shore of Darwin Harbour. The Elizabeth, Blackmore and Darwin River catchments, and the minor catchments of West Arm and Woods Inlet, discharge to Darwin Harbour which is a naturally turbid deep water port. During wet season storm events, these and other smaller river systems deliver sediments, dissolved metals and nutrients to Darwin Harbour and its nearshore waters.

In addition to freshwater flows, the turbidity and levels of total suspended solids (TSS) within Darwin Harbour are directly influenced by tides and wind, generating strong semi-diurnal currents that mobilise and transport sediments in the water column as well as stirring up sediments from the seabed. Water quality within the harbour is also heavily influenced by extreme weather events such as cyclones and flooding, which typically increase the occurrence of nutrients and contaminants in the water.

Despite significant changes to Darwin coastal areas as a result of urban, industrial and port development, Darwin Harbour supports a broad range of significant marine ecological values and functions and is recognised as a site of conservation significance for the Territory. Particularly notable marine ecological values supported by Darwin Harbour include:

- a wide diversity of marine habitat types including intertidal beaches, mangrove forests, salt marshes, intertidal shoals, subtidal soft sediment habitats, rocky reefs and coral reefs
- local seagrass meadows at Casuarina Coastal Reserve, Mindil Beach, Fannie Bay and West Arm
- well-developed hard coral communities of significant biodiversity value at Channel Island, Wickham Point, Weed Reef and South Shell Island
- habitats for a range of fish and shellfish species of direct economic significance
- significant feeding areas for marine turtles, dugongs and dolphins, which are listed as threatened or migratory under Commonwealth and/or Territory legislation
- habitats for a range of other listed marine megafauna species, including whales and sharks protected under Commonwealth and/or Territory legislation.

Marine water quality is an important environmental asset in Darwin Harbour and its surrounds due to the presence of a number of ecological receptors that are sensitive to variations in water quality conditions. Past water quality monitoring programs undertaken in Darwin Harbour (2001-2021) have found the overall water quality in Darwin Harbour is very good to excellent. However, the urban expansion in the Darwin region over the last 10 years has resulted in elevated levels of nutrients and other contaminants in some places, particularly from wastewater discharge into creek estuaries.

Marine sediments in Darwin Harbour, particularly in the vicinity of port infrastructure and shipping channels, have a history of regular disturbance from dredging and dredged material management activities. Naturally high suspended sediment occurs at times in Darwin Harbour, varying widely with tides, season and location.

In the vicinity of the proposed action, a moderate to dense cover (typically <75%) of diverse coral species, predominately hard corals consisting of *Echinogorgia* and *Turbinaria* species, occurs on low relief hard and rubble substrate. The coral coverage tends to be denser in deeper water (>5 m depth) and becomes more patchy as the water depth decreases. The proponent's benthic surveys provided no evidence of soft corals occurring within the survey area, which is consistent with previous studies which have shown that Darwin Harbour has a relatively low diversity and distribution of soft corals. The poor representation of soft corals is attributed to natural influences such as turbidity, sedimentation, light availability, wave and flow exposure and steepness of reef that control the abundance of soft corals (Mckinnon et al. 2006; Galaiduk et al. 2019).

Low to moderate densities (<25%) of seagrass communities were identified by the proponent within the predicted zone of impact and zone of influence, occurring on the low relief reef and sandy habitats. The western side of Darwin Harbour (between Weed Reef and Stokes Point, the mouth of Woods Inlet, Mandorah, and some small patches between West Point and Charles Point) has historically been known to support low density and coverage of seagrass communities compared to the eastern side. Nonetheless, the seagrass communities in this area are considered critical for dugong movement between Darwin Harbour and Bynoe Harbour. Previous studies have indicated that peak seagrass coverage is more likely to be present in June and July before a decline moving into the tropical monsoon season.

Mixed filter feeder communities comprising sponge and coral species, such as those within the proponent's survey area, are widespread and well represented within the harbour, occurring in areas where sandy and hard substrate are available. These habitats can occur at any depth in the lower intertidal and subtidal areas and are typically patchy by nature, often forming a transition zone between hard substrates and the subtidal mud-dominated substrates.

The proponent's survey identified that the complexity of benthic communities increases in deeper waters to the northeast of proposed marine infrastructure and immediately adjacent to the disposal location. The deeper water with varying slopes in this area provide suitable habitats for mixed filter feeder and coral communities, which is consistent with previous studies.

Approach for identifying potential impacts to environmental values

The proponent undertook benthic habitat survey and mapping in October 2022 (**Figure 3**), considering available data from bathymetric surveys (2017, 2022) and previous dredging campaigns to identify impacts to sensitive receptors that would potentially be affected by the proposed action. The survey did not account for seasonal variation of seagrass distribution.

Water quality monitoring was undertaken by the proponent for the SER in October 2022. The assessment analysed water quality conditions at a number of locations (15 sites) within and surrounding the proposed action to both understand the current condition of marine water quality within the Harbour and establish site-specific relationships for total suspended solids, turbidity and photosynthetically active radiation (PAR). This will be used to monitor when and how the proposed action is influencing marine water quality and to determine appropriate management and/or mitigation strategies in response.

Sediment sampling and analysis was carried out in accordance with the National Assessment Guidelines for Dredging (NAGD) within and around the dredge area to determine the physical and chemical characteristics of the sediment and confirm suitability for the dredging design and marine disposal. Sediment samples were analysed for a range of parameters including particle size analysis, absolute and bulk density, pH_{field}/pH_{fox}, sulfate, metals, total organic carbon (TOC), nutrients (nitrogen and phosphorus) total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethyl benzene and xylenes, naphthalene (BTEXN), organochlorine (OC) pesticides and tributyltin (TBT).

Traces of TBT were detected in one of the 19 samples analysed. A sample collected at location BH2016 showed normalised TBT concentrations (corrected for 1% TOC) above the NAGD

screening level of 9 µg/kg. Further analysis and assessment around this site (at 12 locations) demonstrated that the marginal TBT exceedance at BH2016 was an isolated occurrence, not representative of a contamination hotspot.

Assessment of sediment samples against National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual registered inconclusive results or no occurrence of potential acid sulfate soils (PASS). Further analysis of three samples using the SPOCAS (Suspension Peroxide Oxidation Combined Acidity and Sulfate) method confirmed that PASS is likely to be present across the dredge area in surface-level soft sediments. However, this is unlikely to be an issue as this material would be pumped directly to the offshore disposal ground.

Available historical baseline water quality monitoring data (December 2012 – January 2015) from previous dredging campaigns, coupled with monitored sediment data in the littoral zone, was used by the proponent to undertake modelling of the proposed action's potential impacts during construction and dredging works. Hydrodynamic and suspended sediment transport modelling (Delft 3D) was undertaken for the dry season and wet season under neap and spring tidal conditions to quantify the extent, magnitude and dispersion of predicted sediment plumes that would be generated during the proposed action (dredging and construction).

The proponent adopted an impact zonation approach, including zones of high and moderate impact (where impacts are noticeable) and a zone of influence (where impacts are undetectable), to predict and map the extent of sediment plume impacts on sensitive receptors. The SER predicted that construction and dredging works would result in a large zone of influence, and smaller zones of high and moderate impacts with noticeable effects (SER Appendix B, Figures 4-3 to 4-6). The SER indicates that the zone of high impact would occur within the areas directly impacted by and immediately adjacent to the proposed action. The extent of these zones of impact would be minimised if the maritime activities are undertaken over the wet season.

The zone of influence is predicted to extend beyond the direct impact area for about 10 km to the north and to the south when soft sediments are dredged and disposed. During the removal of hard rock and the construction of the marine facility, the zone of influence would cover a smaller area, extending about 2 km to the north and about 1 km to the south.

Impacted water quality within the zones of impact and influence is predicted to return to baseline levels within approximately 4 weeks following the completion of staged construction activities, due to natural flushing caused by tidal currents. Similarly, the deposition of fine sediments on the shoreline beyond the footprint of marine infrastructure (up to 80 mm thick; **Figure 4**) is predicted to be temporary.

The NT EPA recognises a number of inadequacies and inherent uncertainties in the modelling approach. The predictive sediment transport model focussed solely on fine sediments to depict a worst case scenario for sediment plume dispersion and omitted coarse sediments from the assessment that are less likely to disperse but can change the benthic habitat considerably. Additionally, other processes like sediment transport patterns at the shoreline and in the nearshore area, which could impact sediment suspension and deposition, were assessed in isolation. The NT EPA has considered these inadequacies and uncertainties, and the implications these have on predicting potential impacts on coastal processes in its assessment of the proposed action.

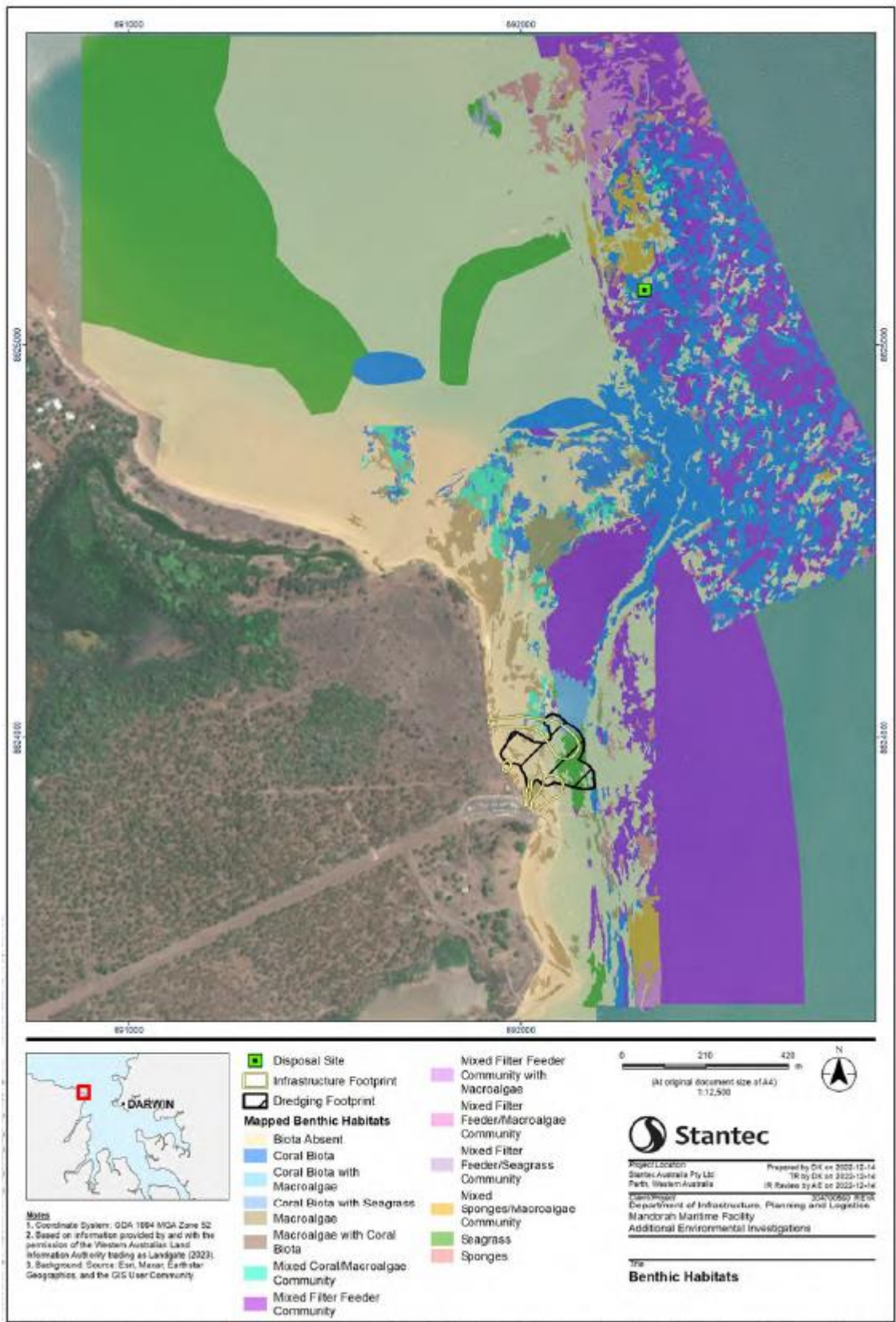


Figure 3 Predicted extent and type of benthic communities and habitats in the proposed action area and surroundings (SER, Figure 8-23)

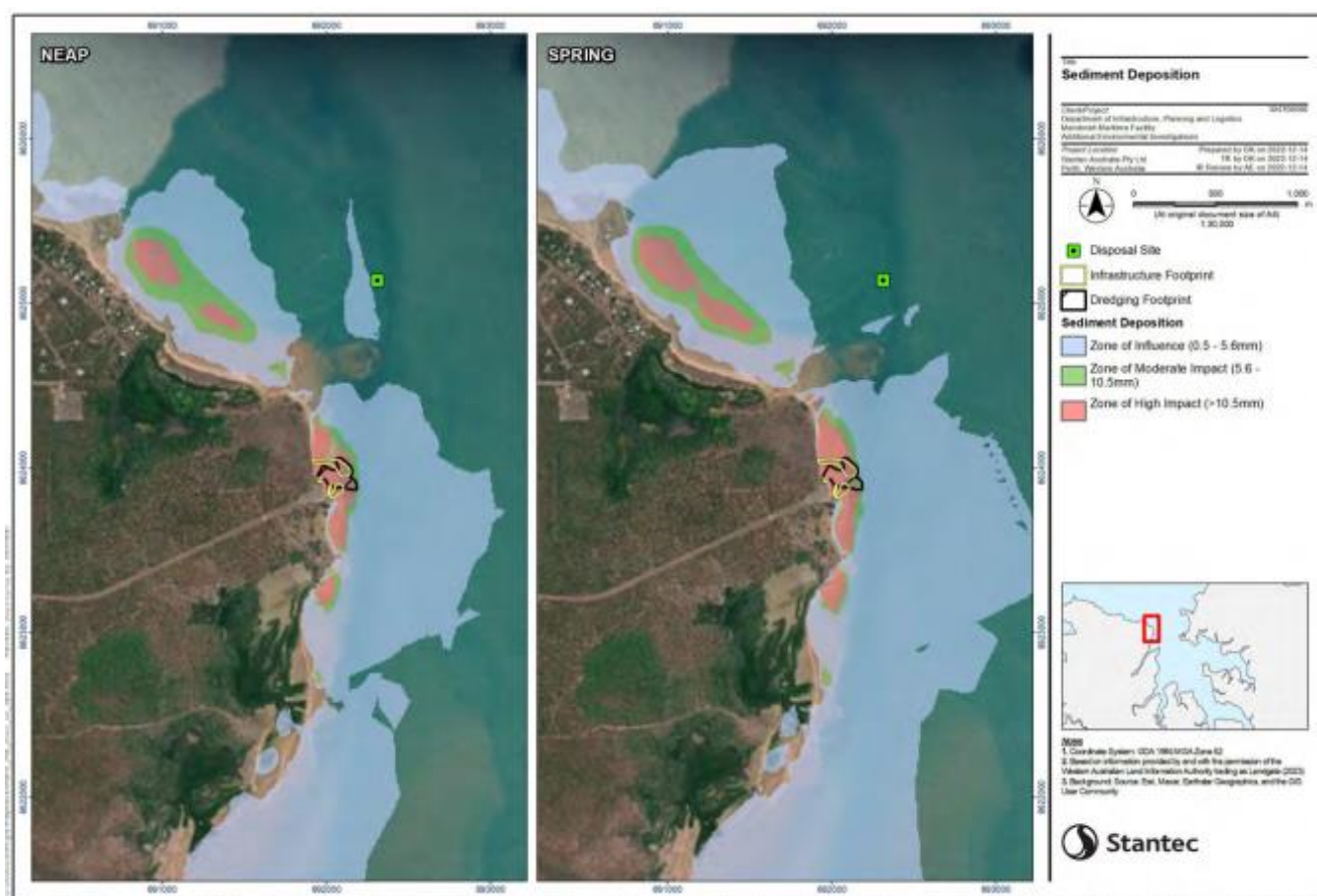


Figure 4 Cumulative sedimentation related to zones of impact and influence under neap and spring tides during cutter section dredging, backhoe dredging and breakwaters construction (SER, draft DMP, Figure 4-7)

6.5.2. Consultation

The submissions on the SER raised the following key issues in relation to marine ecosystems and marine environmental quality:

- uncertainties in assumptions, parameterisation, calibration and predictive ability of the sediment plume model to assess dredging impacts, and the requirement to revise the site conceptual model to include all potential contamination sources and pathways in modelling
- concern about the location of the spoil disposal site which is in close proximity to subtidal rocky reefs that are generally high diversity areas, and the recommendation to move the disposal site slightly to the west of the proposed location
- concern about the adequacy of the proponent's survey for benthic communities and habitat mapping, and the proponent's method for calculating benthic community habitat loss
- the need for improved understanding of baseline conditions (water quality and tolerances of benthic communities), particularly between Woods Inlet and Charles Point, to inform management and mitigation actions that would be implemented during dredging
- the need to establish the relationships between TSS, turbidity (nephelometric turbidity units/NTU) and PAR to monitor dredging impacts
- concern about the accuracy and reliability of thresholds, and the proponent's methods for delineating predicted zones of influence and impact

- concerns about the application of proposed trigger criteria without considering the health, resilience and resistance of all sensitive environmental receptors
- concern about the design of the proponent's individual monitoring programs, and the recommendation to develop a single integrated monitoring program for marine water quality, benthic habitat monitoring and megafauna monitoring using a holistic approach
- concern about the loss of turtle and dugong habitats through sediment transport, sedimentation and declining PAR conditions, and the recommendation to develop a seagrass health monitoring program to monitor dredging and construction impacts.

The NT EPA considered the submissions and the responses to the submissions provided by the proponent in its assessment of the proposed action.

6.5.3. Factor assessment and recommended regulation

In assessing whether the residual impacts of the proposed action will meet the NT EPA environmental factor objectives, and whether reasonable and appropriate regulatory conditions can be imposed, the assessment findings and recommended conditions of approval are presented in **Table 6**.

Table 6 Assessment for Marine ecosystems and Marine environmental quality, and recommendations for conditions of approval

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment findings	Recommended conditions and regulation by other statutory decision-makers
<p>Marine ecosystems and marine environmental quality</p> <p>Benthic communities (including corals, macro algae and seagrass) have the potential to be impacted through:</p> <ul style="list-style-type: none"> direct dredging, dredge material disposal and construction impacts (habitat removal or alteration) indirect dredging and construction impacts due to increased turbidity, suspended sediment, deposited sediment, shoreline erosion; reduced light availability for photosynthetic 	<p>The proponent undertook the following actions:</p> <ul style="list-style-type: none"> survey and mapping of benthic communities in the zones of impact and influence applied the environmental decision-making hierarchy to determine the location for dredged material disposal characterised the dredge area to understand the existing contamination levels and potential pathways categorised the predicted impact area into zones of impact (high and moderate impacts) and influence, utilising site-specific baseline data and scientific research data 	<p>Direct irreversible impacts to the structure, composition and distribution of benthic communities within the areas directly affected by dredging and maritime infrastructure.</p> <p>Temporary impacts to benthic habitats (sponge and coral colonies) in the vicinity of the dredged material discharge location and adjacent zones of impact and influence.</p>	<p>The NT EPA's assessment found:</p> <ul style="list-style-type: none"> Soft sediments in the dredge area are low in contaminants and appropriate for marine disposal, to reduce any opportunity for material oxidation and acid generation. The proposed action would result in a permanent loss of about 2 hectares of benthic communities, comprising low density (<25%) coral biota, seagrass, macroalgae, and sponge dominated filter feeders. The potentially affected benthic communities within and immediately adjacent to the footprint of marine infrastructure and the disposal area represent a relatively small proportion of similar habitats in Darwin Harbour. Relative reductions in the effects of dredging on water quality, in particular from cutter section 	<p>Regulated through recommended conditions:</p> <ul style="list-style-type: none"> Condition 1: Limitations and extent - limit the extent of dredging, construction disturbance and disposal of dredged material. Condition 4: <ul style="list-style-type: none"> implementation of the action to achieve environmental objectives including no material environmental harm to benthic habitats and communities beyond the zones of impact prepare and implement a DMP monitor water quality prior to and during dredging apply triggers and management actions during dredging.

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment findings	Recommended conditions and regulation by other statutory decision-makers
<p>activity and release of contaminants of concern (such as, sulphuric acid, iron and various other metals)</p> <ul style="list-style-type: none"> cumulative impacts of dredging over time and/or in combination with other actions in Darwin Harbour. The appropriate approach to addressing cumulative impacts is discussed in section 8. 	<ul style="list-style-type: none"> prepared a Dredging and Spoil Disposal Management Plan (referred to hereon as a dredge management plan (DMP) for implementation, drawing upon scientific literature and specific data obtained from the site. <p>The proponent's DMP includes:</p> <ul style="list-style-type: none"> triggers and management actions to protect sensitive receptors, including a phased and intermittent approach to construction and dredging operations management actions to minimise sedimentation at the spoil disposal location a reactive water quality monitoring program to ensure water quality is maintained below levels (80th and 95th percentiles of reference data) at which adverse effects on sensitive receptors may occur. <p>The proponent's CEMP includes:</p>		<p>dredging, are likely during spring tides and in the wet season.</p> <ul style="list-style-type: none"> The effects of predicted fine sediment deposition on the shoreline would be temporary due to strong ebb tides prevailing in the coastal environment. The effects of modifications to the coastal morphology on sensitive receptors would not be significant and are likely to be manageable through implementation of the adaptive CPMMP. The 2022 benthic survey conducted by the proponent did not account for temporal/seasonal variation in the distribution of sensitive receptors. However, potential impacts to benthic communities within the predicted zone of influence would likely be minimised if the proposed triggers and management response actions are implemented. Water quality and sediment deposition monitoring is required before and during implementation of the action to detect impacts and verify modelled predictions. Monitoring data would also contribute to the detection of 	<p>Condition 9 – Environmental performance and compliance reporting - upon completion of initial construction works and maintenance dredging, the proponent must report to the Minister detailing the environmental performance of the action and the compliance status of the DMP.</p> <p>Regulation by other regulatory processes:</p> <ul style="list-style-type: none"> Pollution regulation under the <i>Waste Management and Pollution Control Act 1998</i>

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment findings	Recommended conditions and regulation by other statutory decision-makers
	<ul style="list-style-type: none"> reporting and response protocols to address spill incidents installation of erosion and sediment control measures, such as bunding, to manage sediment runoff resulting from land disturbance 		<p>cumulative impacts and thereby improve understanding and management of Darwin Harbour, ideally applied through a harbour-wide dredging strategy (see section 8).</p> <ul style="list-style-type: none"> If subject to the recommended conditions in Appendix 1, the impacts are considered to be insignificant. 	
<p>Marine megafauna</p> <p>Marine megafauna individuals such as dugongs, turtles and dolphins have the potential to be impacted during dredging and construction through:</p> <ul style="list-style-type: none"> injury or death due to, collision or entrainment artificial light and underwater noise poor water quality and sedimentation impacts on benthic foraging habitat. 	<p>The proponent proposed the following measures to avoid and/or mitigate impacts:</p> <ul style="list-style-type: none"> marine megafauna observation within 2 km to avoid vessel strikes apply observation (≤ 2 km) and exclusion (≤ 1 km) distances from vessels and equipment during dredging and piling temporarily cease dredging or reduce vessel speed if response triggers activated employ soft start procedures to alert fauna and minimise potential collisions by encouraging them to leave the area scheduling work activities during daylight hours and 	<p>Potential impacts on individual marine megafauna from vessel strikes, and entrainment.</p> <p>Temporary changes in marine fauna behaviour from noise emissions and light attenuation</p>	<p>The NT EPA's assessment found:</p> <ul style="list-style-type: none"> Local marine megafauna may experience direct effects within the areas directly disturbed, however this would be managed through the proposed marine megafauna observation procedures. The proposed action area, Woods Inlet to the south and West point to the northwest, are known for seagrass meadows, which serve as suitable feeding grounds for dugongs. This presents a higher likelihood of dugongs being struck by vessels as they travel through this area while moving between Darwin Harbour and Bynoe Harbour. 	<p>Regulated through recommended conditions:</p> <ul style="list-style-type: none"> Condition 4: <ul style="list-style-type: none"> implementation of the action to achieve environmental objectives including minimising risks to marine megafauna implement DMP incorporating robust procedures for marine megafauna observation and reporting any injury or mortality apply noise attenuation and mitigation strategies.

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment findings	Recommended conditions and regulation by other statutory decision-makers
	adhering to lighting design principals outlined in the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds 2020, in order to minimise impacts from artificial lights.		<ul style="list-style-type: none"> Implementation of a comprehensive monitoring and action plan will minimise the impacts on marine megafauna. If subject to the recommended conditions in Appendix 1, the impacts are considered to be manageable and consistent with the NT EPA's objective for marine ecosystems. 	

6.5.4. Conclusion against the NT EPA objective

Implementation of the DMP prior to, during and after dredging in accordance with the recommended conditions will ensure that significant impacts from the proposed action are avoided and mitigated.

With the implementation of the proponent's proposed management measures, commitments and conditions for avoidance, monitoring, and mitigation of impacts identified in the draft environmental approval (Appendix 1), the NT EPA considers that the proposed action can be conducted in such a manner that its objective for marine ecosystems and marine environmental quality is likely to be met.

6.6. Culture and heritage

6.6.1. Environmental values

The nearest communities to the proposed action area are Wagait Beach and Belyuen. Wagait Beach with about 465 people is about 2 km to the northeast. Belyuen, an Aboriginal community of about 164 people, is located about 13 km to the southwest. There are small commercial operations in the area, such as Wagait Beach Supermarket and Cox Country Club.

An abandoned building of the Radio Australia station still exists on Lot 50. Native Title rights have been removed from the majority of Lot 50; however the western portion of the lot still retains its native title.

The nearby heritage sites in the area include the World War II Gun Emplacements and the Delissaville (Belyuen) Cemetery.

The surroundings of the proposed action are significant to the Wagait Beach and Belyuen people, and a number of sacred sites and heritage/archaeological objects are located in this area. The SER indicated that the cultural and heritage values of these sites and objects are intrinsically linked to the coastal environment. As such, maintenance of coastal processes and protection of the environment would protect these values from proposal impacts. The NT EPA has considered these strong connections in its assessment of the proposed action.

Approach for identifying potential impacts to environmental values

The proponent undertook a marine magnetic survey in June 2022 within the proposed construction and dredge area to detect underwater culture and heritage objects that could potentially be affected by the proposed action. The survey also involved further investigation of magnetic anomalies detected at a number of locations.

The proponent has obtained Authority Certificates from AAPA in relation to the proposed action.

6.6.2. Consultation

The submissions on the SER raised the following key issues in relation to culture and heritage:

- potential for direct disturbance of sacred sites, heritage items and objects (including underwater cultural sites), as well as indirect disturbance through altered coastal morphology
- a variation to an existing Authority Certificate should be obtained to cover all proposed activities including the construction of a boat ramp, repurposing of an old building, and mitigation activities to replenish sand within restricted work areas to ensure the protection of sacred sites within a wider potential impact area
- the dredge area and spoil heaps should be monitored to detect cultural and archaeological sites or objects that might be dredged
- a sustainable solution to littoral drift should be developed to avoid disturbance of sacred sites
- monitoring programs including those focussed on weeds, erosion and sediment controls, should be extended to the boundaries of restricted work areas to avoid construction impacts on sacred sites.

6.6.3. Factor assessment and recommended regulation

The NT EPA considers that potential significant impacts to cultural heritage can be appropriately avoided through statutory provisions under the *Northern Territory Aboriginal Sacred Sites Act 1989* and *Heritage Act 2011* (NT). In assessing whether the residual impacts of the proposed action are likely to meet the NT EPA environmental factor and objective, and whether reasonable and appropriate regulatory conditions can be imposed, the assessment findings and recommended conditions of approval are presented below in **Table 7**.

Table 7 Assessment for Culture and heritage, and recommendations for conditions of approval

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
Damage to known and unknown sacred sites and objects of heritage significance, such as burial remains and skeleton, directly from construction and dredging, and indirectly from alterations in coastal morphology.	<p>The proponent undertook the following actions:</p> <ul style="list-style-type: none"> magnetic survey to find underwater objects in the dredge area obtained Authority Certificates from the AAPA for the direct works prepared a management strategy including a CPMMP to avoid construction and dredging impacts. <p>The management strategy includes the following controls:</p> <ul style="list-style-type: none"> all works to adhere to the conditions of 	Indirect or inadvertent direct impacts to culture and heritage may occur.	<p>The NT EPA's assessment found:</p> <ul style="list-style-type: none"> The marine magnetic survey found no culturally or historically significant objects or items in the dredge area. Direct impacts to culture and heritage are likely to be avoided, subject to only undertaking works within the proposed action area. Indirect and temporary effects on cultural and heritage sites may occur from material deposition (predicted up to 80 mm in restricted work areas) during dredging and construction. Indirect and irreversible effects on cultural and heritage sites and objects may occur if long-term erosion of the Mandorah shoreline occurs as predicted (200 - 600 m³ per year to the south of the facility). There is high uncertainty in modelling predictions relating to sediment deposition and erosion. 	<p>Regulation through recommended conditions:</p> <ul style="list-style-type: none"> Condition 1: Limitations and extent - limit the extent of dredging, construction disturbance and disposal of dredged material. Condition 3 <ul style="list-style-type: none"> implementation of the action to achieve the environmental objective of maintaining the Mandorah beach within the limits of natural variation implement the CPMMP monitor coastal conditions prior to construction (baseline) and for the life of the action

Potentially significant impact	Avoidance and mitigation of impacts	Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
	<p>the authority certificate</p> <ul style="list-style-type: none"> cessation of works and reporting to relevant authorities in case a sacred site or heritage object is encountered. implementation of an adaptive monitoring and management program for the coastal area to ensure that the erosion of Mandorah shoreline is minimised to avoid adverse impacts on sacred and heritage sites provision of cultural and heritage training and induction for all site staff, sub-contractors and visitors. 		<ul style="list-style-type: none"> When the current Authority Certificates were issued, indirect impacts to sacred sites from altered coastal processes were not anticipated. AAPA cannot authorise damage to or interference with a sacred site without agreement from the custodians of the site obtained through an application for an Authority Certificate. The proponent has committed to implementing monitoring and management strategies under an adaptive management plan (the CPMMP). The proponent must meet its obligations under the <i>Northern Territory Aboriginal Sacred Sites 1989</i>. 	<ul style="list-style-type: none"> application of adaptive management framework to maintain Mandorah beach. <p>Regulation by other regulatory processes:</p> <ul style="list-style-type: none"> <i>Northern Territory Aboriginal Sacred Sites Act 1989</i> <i>Heritage Act 2011</i>

6.6.4. Conclusion against the NT EPA objective

If the proponent abides by its obligations under the *Northern Territory Aboriginal Sacred Sites Act 1989* and the *Heritage Act 2011*, and implements its CPMMP, the NT EPA considers that the proposed action can be conducted in such a manner that its objective for culture and heritage is likely to be met.

7. Whole of environment considerations

The NT EPA assessed the impacts of the proposed action against the key environmental factors and environmental values individually in the key factor assessments above. Given the relationships between coastal processes, marine ecosystems, marine environmental quality, and culture and heritage, the NT EPA also considered connections and interactions between them to inform a holistic view of impacts on the environment as a whole.

There is a high level of interaction and connectivity between the environmental factors of marine ecosystems and marine environmental quality. Avoiding and minimising any significant turbidity effects from dredging and therefore maintaining the quality of marine waters, is important for the protection of marine ecosystems that rely on good water quality. The NT EPA considers that by limiting the extent of dredging and implementing the DMP, the proponent would avoid significant environmental impacts on marine ecosystems and marine environmental quality beyond the disturbance footprint.

There is strong connectivity between cultural heritage and the physical aspects of the environment. Areas of cultural importance including a heritage place and a sacred site may be affected through impacts to coastal processes. The NT EPA considers that the proposed mitigation and management measures and recommended conditions for managing impacts to coastal processes (implementation of the CPMMP) will lead to outcomes for culturally important sites that are likely to be consistent with the NT EPA's environmental objectives.

When the environmental factors and values potentially affected by the proposed action are considered holistically, the NT EPA concludes that the impacts from the proposed action would not alter the NT EPA's views about the consistency of outcomes with the NT EPA's factor objectives, as assessed in section 6.

Due to the long-term life of the proposed design, the NT EPA is of the view that a changing climate characterised by rising sea level and intensified cyclones, may affect the proposed action and interconnected environmental values in the area. The NT EPA considers that implementing recommended conditions for impacts to coastal processes (implementation of an adaptive CPMMP) and the preparation of environmental performance reports (after maintenance dredging and shoreline mitigation activities) would allow the proponent and the Minister to assess the performance of the proposed action over the life of the action so that environmental management strategies can be adapted as required.

8. Other advice

The NT EPA provides the following advice for consideration by the proponent and the Minister.

8.1. Cumulative impacts

Darwin Harbour and its surrounding catchment are recognised as significant and valuable assets for Territorians due to the unique environmental, social and cultural values of the region. The residual impacts from this proposed action, combined with potential impacts from other capital and maintenance dredging projects proposed in Darwin Harbour in the near future, may result in significant cumulative impacts to the values of Darwin Harbour if not managed carefully.

As the cumulative impacts of development in Darwin Harbour cannot be attributed to a single proposal, it is critical that a strategic, harbour-wide approach is developed and implemented. The NT Government's proposed harbour-wide dredging strategy, comprising a long-term monitoring program supported by a management and decision-making framework, is appropriate for effective long term management of cumulative impacts on the values of Darwin Harbour.

The NT EPA strongly supports such an approach and expects that the relevant government agencies will finalise and implement the strategy as soon as possible so as to inform future NT EPA assessments of dredging campaigns in Darwin Harbour.

9. Matters taken into account during the assessment

Matters taken into account during the assessment	Consideration
<i>Objects of the EP Act</i>	
To protect the environment of the Territory	The proponent's referral information, SER and this assessment report, including the NT EPA's recommended conditions for an environmental approval, provide detail about how the environment of the Territory would be protected from potentially significant environmental impacts that could occur as a result of implementation of the proposed action.
To promote ecologically sustainable development so that the wellbeing of the people of the Territory is maintained or improved without adverse impact on the environment of the Territory	Consideration of the principles of ecologically sustainable development in relation to the proposed action is addressed below.
To recognise the role of environmental impact assessment and environmental approval in promoting the protection and management of the environment of the Territory	The NT EPA recognises the importance of environmental impact assessment and approval processes in the protection and management of the environment of the Territory. The NT EPA has assessed the potential environmental impacts of the proposed action to inform an environmental approval decision by the Minister that, in the NT EPA's view, promotes protection and management of the Territory. The proponent's commitment to implement the DMP and CPMMP, reinforced through recommended conditions for an environmental approval, promotes protection.
To provide for broad community involvement during the process of environmental impact assessment and environmental approval	The referral information indicates that the proponent undertook some community consultation during preparation of the referral information, and that feedback was considered in development of the proposed action. The NT EPA's public consultation undertaken during its assessment of the proposed action provides for community involvement during the environmental impact assessment process. Submissions received in relation to the proposed action have been taken into account in the NT EPA's assessment and the preparation of the recommended conditions for an environmental approval.
To recognise the role that Aboriginal people have as stewards of their country as conferred under their traditions	The NT EPA recognises the role of Aboriginal people as stewards of their country and the importance of participation by Aboriginal people and communities in environmental decision-making. The public consultation

Matters taken into account during the assessment	Consideration
and recognised in law, and the importance of participation by Aboriginal people and communities in environmental decision-making processes.	process provided an opportunity for interested persons to make a submission in relation to the proposed action. The proponent consulted with the AAPA and the Heritage Branch of the Department of Territory Families, Housing and Communities, in relation to Aboriginal sacred sites and cultural heritage. Traditional owners were also consulted during the community consultation.
Principles of ecologically sustainable development	
Decision-making principle <ol style="list-style-type: none"> 1. Decision-making processes should effectively integrate both long-term and short-term environmental and equitable considerations. 2. Decision-making processes should provide for community involvement in relation to decisions and actions that affect the community. 	<p>The NT EPA has considered the decision-making principle in its assessment and has had particular regard to this principle in its assessment of terrestrial environmental quality, terrestrial ecosystems, marine environmental quality, marine ecosystems, and culture and heritage.</p> <p>The NT EPA notes the interconnectedness between environmental factors and recognises that the mitigation measures to avoid and minimise impacts on the factors listed above may also reduce the significance of impacts on other environmental factors.</p> <p>The NT EPA has recommended conditions for environment protection outcomes to be achieved through design, construction, and ongoing management.</p> <p>The NT EPA notes that culture and heritage would also be regulated through the <i>Northern Territory Aboriginal Sacred Sites Act 1989</i> and the <i>Heritage Act 2011</i>.</p> <p>The NT EPA considers that its environmental impact assessment and recommended conditions have identified and mitigated environmental impacts.</p> <p>The community has been provided the opportunity to be involved in the environmental impact assessment process during public consultation on the proposed action. The submissions received have been taken into account in the preparation of this report and the recommended conditions to inform the Minister's decision on whether to grant an environmental approval.</p>
Precautionary principle <ol style="list-style-type: none"> 1. If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. 2. Decision-making should be guided by: <ol style="list-style-type: none"> (a) careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and 	<p>This principle was considered by the NT EPA when assessing the impacts of the proposed action on the key environmental factors.</p> <p>The proponent has identified measures to avoid or minimise impacts on the environment and included commitments to implement the DMP and CPMMP to address uncertainties regarding impacts on coastal processes and the marine environment (water quality and ecosystems) of Darwin Harbour.</p> <p>The NT EPA has considered these measures during its assessment, and has reinforced the proponent's commitments for the DMP and CPMMP implementation through recommended conditions to promote environmental protection. From its assessment of the proposed action the NT EPA has concluded that the environmental values will be protected provided its recommended conditions, and the proponent's commitments, are implemented.</p>

Matters taken into account during the assessment	Consideration
(b) an assessment of the risk-weighted consequences of various options.	The proposed action may result in some irreversible impacts associated with terrestrial and marine ecosystems due to the removal of habitat, however those residual impacts are not considered significant.
Principle of evidence-based decision-making Decisions should be based on the best available evidence in the circumstances that is relevant and reliable.	The NT EPA has considered the available evidence during the course of its assessment of the proposed action, and this scientific evidence provides the foundation for its decision making and recommended conditions. In its assessment of the proposed action, where the NT EPA considered that further evidence is required to inform the management of potentially significant impacts to terrestrial environmental quality, terrestrial ecosystems, coastal processes, marine environmental quality, marine ecosystems, and culture and heritage, the NT EPA has recommended conditions requiring the proponent to undertake additional work to provide further evidence about how the impact would be effectively avoided and/or mitigated.
Principle of intergenerational and intragenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of present and future generations.	It is important to protect marine ecosystems, marine environmental values and sensitive cultural values, for the benefit of future generations. The NT EPA considers that the recommended conditions for an environmental approval would provide an appropriate degree of protection for these values, while the proposal will benefit the community. The NT EPA has considered the principle of intergenerational equity and intragenerational equity in its assessment. From the assessment of this proposed action the NT EPA has concluded that the environmental values will be protected and that the health, diversity and productivity of the environment will be maintained for the benefit of future generations.
Principle of sustainable use Natural resources should be used in a manner that is sustainable, prudent, rational, wise and appropriate.	The NT EPA has considered the importance of sustainable use of resources and this principle during the environmental impact assessment process. The NT EPA considers that this principle is closely linked to the principles of intergenerational and intragenerational equity, and conservation of biological diversity and ecological integrity.
Principle of conservation of biological diversity and ecological integrity Biological diversity and ecological integrity should be conserved and maintained.	This principle was considered when assessing the impacts of the proposed action on the environmental values, particularly in relation to marine ecosystems. The assessment of these impacts is provided in this report. Biological diversity and ecological integrity are likely to be conserved due to the avoidance, minimisation and mitigation measures in the DMP that will be implemented by the proponent and the conditions recommended by the NT EPA.
Principle of improved valuation, pricing and incentive mechanisms 1. Environmental factors should be included in the valuation of assets and services.	This principle was considered by the NT EPA when assessing the impacts of the proposed action. The NT EPA notes that the proponent would bear the costs relating to the avoidance and management of potential dredging and construction impacts.

Matters taken into account during the assessment	Consideration
<ol style="list-style-type: none"> 2. Persons who generate pollution and waste should bear the cost of containment, avoidance and abatement. 3. Users of goods and services should pay prices based on the full life cycle costs of providing the goods and services, including costs relating to the use of natural resources and the ultimate disposal of wastes. 4. Established environmental goals should be pursued in the most cost-effective way by establishing incentive structures, including market mechanisms, which enable persons best placed to maximise benefits or minimise costs to develop solutions and responses to environmental problems. 	
Environmental decision-making hierarchy	
<ol style="list-style-type: none"> 1. In making decisions in relation to actions that affect the environment, decision-makers, proponents and approval holders must apply the following hierarchy of approaches in order of priority: <ol style="list-style-type: none"> (a) ensure that actions are designed to avoid adverse impacts on the environment; (b) identify management options to mitigate adverse impacts on the environment to the greatest extent practicable; (c) if appropriate, provide for environmental offsets in accordance with this Act for residual adverse impacts on the environment that 	<p>The extent to which the proponent has applied the environmental decision-making hierarchy in its design of the proposed action and the proposed measures to avoid and then mitigate significant impacts has been considered.</p> <p>Where the NT EPA was not satisfied that this hierarchy had been applied, it has recommended conditions requiring that the proponent take reasonable measures to avoid and/or mitigate impacts.</p> <p>The NT EPA has had regard to this hierarchy during the assessment of the proposed action and did not identify any residual impacts that would require offsetting.</p>

Matters taken into account during the assessment	Consideration
cannot be avoided or mitigated.	
<p>2. In making decisions in relation to actions that affect the environment, decision-makers, proponents and approval holders must ensure that the potential for actions to enhance or restore environmental quality is identified and provided for to the extent practicable.</p>	<p>The proposed action is located on the land parcels that are subject to historical natural and human-induced disturbance. The proponent has committed to implement a CEMP to manage impacts.</p> <p>In the marine environment, zones of moderate impact and the zone of influence temporarily affected by dredging are expected to recover over time which is likely to restore marine environmental quality and marine ecosystems in those areas outside of the disturbance footprint. The NT EPA has recommended conditions requiring the implementation of a DMP.</p>
Waste management hierarchy	
<p>1. In designing, implementing and managing an action, all reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</p> <p>2. For subsection (1), waste should be managed in accordance with the following hierarchy of approaches in order of priority:</p> <ul style="list-style-type: none"> (a) avoidance of the production of waste; (b) minimisation of the production of waste; (c) re-use of waste; (d) recycling of waste; (e) recovery of energy and other resources from waste; (f) treatment of waste to reduce potentially adverse impacts; (g) disposal of waste in an environmentally sound manner. 	<p>The referral considered options for management of dredged material in line with the waste management hierarchy. The strategy for management of dredged material includes reuse of suitable dredged material for civil and maritime construction (e.g. construction of breakwater cores). The fine sediments not suitable for reuse would be disposed of offshore for dispersal back into the marine environment.</p>

Matters taken into account during the assessment	Consideration
<i>Ecosystem-based management</i>	
Management that recognises all interactions in an ecosystem, including ecological and human interactions.	<p>The NT EPA considered the importance of ecosystem-based management for achieving both sustainable development and biodiversity protection goals.</p> <p>With consideration of the link between coastal processes, marine ecosystems, marine environmental quality and culture and heritage, the NT EPA also considered the connections and interactions between parts of the environment to inform a holistic view of impacts to the whole environment.</p> <p>The NT EPA formed the view that the impacts from this proposed action can be managed to be consistent with the NT EPA's environmental factors and objectives.</p>
<i>The impacts of a changing climate</i>	
The effects of a changing climate on the proposal and resilience of the proposal to a changing climate	<p>The NT EPA considered the working design life of the proposed action (25-50 years) in the context of resilience to climate change, and how climate change may impact the proposed action. The effects of a changing climate are also potentially relevant to long term maintenance dredging.</p> <p>The NT EPA had regard to measures and controls relating to extreme weather events such as flooding and high intensity rain events. The NT EPA recommended conditions requiring the implementation of CPMMP to manage impacts.</p>

10. Conclusion and recommendation

The NT EPA has considered the Mandorah Marine Facilities proposed action by the Department of Infrastructure, Planning and Logistics. The NT EPA's assessment of the proposed action identified potentially significant environmental impacts associated with the key environmental factors.

The NT EPA considers that the proposed action can be implemented and managed in a manner that is environmentally acceptable and therefore recommends that environmental approval be granted subject to the conditions recommended in Appendix 1.

11. References

Cardno 2022. Environmental Referral Report: New Marine Facilities to Service Mandorah and Cox Peninsula, ZMD01890. Report prepared for Department of Infrastructure, Planning and Logistics.

Department of Environment and Natural Resources 2009. Metadata: Acid Sulfate Soils of the Darwin Region, Survey DARAS_50, Northern Territory Government.

Department of Environment and Natural Resources 2013. Metadata: NVIS Version 3.1 National Vegetation Information System, NT Data Compilation, Northern Territory Government.

Department of Environment, Parks and Water Security 2021. Land clearing guidelines: Northern Territory Planning Scheme. Northern Territory Government.

Galaiduk, R., Radford, B., Harries, S., Case, M., Williams, D., Choy, D.L. and Smit, N., 2019. Technical Report: Darwin–Bynoe Harbours predictive mapping of benthic communities.

Hill J.V. and Eadmeades B.F.J. (2008). Acid Sulfate Soils of the Darwin Region. Technical Report Number 09/2008D, Land and Water Division, Department of Natural Resources, Environment, The Arts and Sport, Northern Territory.

McKinnon, A.D., Smit, N., Townsend, S. and Duggan, S., 2006. Darwin Harbour: water quality and ecosystem structure on a tropical Harbour in the early stages of urban development. In *The environment in Asia pacific harbours* (pp. 433-459). Dordrecht: Springer Netherlands.

Stantec 2023. Mandorah Marine Facilities: Supplementary Environmental Report. Report prepared for Department of Infrastructure, Planning and Logistics.

Appendix 1 – Draft Environmental Approval

Draft Environmental Approval

PURSUANT TO SECTION 69 OF THE *ENVIRONMENT PROTECTION ACT 2019*

Approval number	EP2022/014-001
Approval holder	Chief Executive Officer of the NT Department of Infrastructure, Planning and Logistics
Australian business number (ABN)	84 085 734 992
Registered business address	Level 3, Manunda Place 38 Cavenagh Street Darwin, Northern Territory 0800
Address for notices	Floor 5, Energy House, 18-20 Cavenagh Street, Darwin, Northern Territory 0800
Proposed Action	Mandorah Marine Facilities

Proposed Action description

Construct and operate a safer and weather-resistant ferry berthing facility near the existing Mandorah ferry facility to improve transport connectivity between the Cox Peninsula and Darwin, especially for passengers requiring mobility assistance. The proposed action includes:

- installation of maritime infrastructure components including rock armoured breakwaters, a floating pontoon, gangway, piles, a boat ramp and causeway
- establishment of landside infrastructure including a car park and a ferry terminal
- refurbishment of the current building to serve as the ferry terminal
- capital dredging to remove up to 30,000 m³ of unconsolidated sediments and up to 70,000 m³ of rock material
- unconsolidated marine sediments disposal about 1 km offshore within the Darwin Harbour
- maintenance dredging to occur every 5-7 years.

The proposed project life is approximately 50 years.

Advisory notes

- i. Approval is granted under section 69 of the *Environment Protection Act 2019* for the action to be undertaken in the manner described, including the implementation of the environmental management measures, commitments and safeguards documented in the Referral information (including the Referral Report and Appendices), Supplementary Environmental Report (**SER**) (including the **SER** and Appendices), additional information submission dated 3 July 2023 and response to a submission on the additional information dated 11 July 2023. If there is any inconsistency between the **SER** and this environmental approval, the requirements of this environmental approval prevail.
- ii. This approval does not authorise the approval holder to undertake an activity that would otherwise be an offence under the *Northern Territory Aboriginal Sacred Sites Act 1989*.
- iii. Submission of all notices, reports, documents or other correspondence required as a condition of this approval must be provided in electronic form by emailing environmentalregulation@nt.gov.au

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- iv. The approval holder has a duty to notify the **CEO** of incidents in accordance with Part 9 Division 8 of the **EP Act**.

Address of proposed action	Section 50, Hundred of Bray Section 116, Hundred of Bray Darwin Harbour
NT EPA Assessment Report number	104
Person authorised to make decision	Hon Lauren Jane Moss MLA, Minister for Environment, Climate Change and Water Security
Signature	NOT FOR SIGNING
Date of decision	NOT FOR APPROVING

Recommended Environmental approval conditions

1 Limitations and extent of action

- 1-1 When implementing the action, the approval holder must ensure the action does not exceed the following limitations and extent:

Action element	Figure	Limitation or maximum extent
Landside development envelope	Figure 1	No more than 3 hectare (ha) to be cleared within the approved extent .
Marine development envelope	Figure 1	No more than 3.7 ha to be developed within the approved extent .
Capital dredging	Figure 1	No more than 70,000 m ³ of rock and 30,000 m ³ of unconsolidated material to be dredged within the 2.02 ha dredge area of the approved extent .
Maintenance dredging	Figure 1	Maintenance dredging to occur within the 2.02 ha dredge area of the approved extent
Spoil disposal	Figure 2	Spoil disposal to occur over no more than 0.3 ha of the dredge spoil disposal area within the approved extent .

2 Terrestrial environmental quality

- 2-1 The approval holder must implement the action to achieve the following environmental objectives:

- (1) no **material environmental harm** to land and soils beyond the **approved extent**;
- (2) no **material environmental harm** to flora and fauna values including biodiversity and ecological functioning beyond the **approved extent**.

- 2-2 Prior to **substantial implementation**, to meet the environmental objectives at condition 2-1, the approval holder must implement an **Erosion and Sediment Control Plan (ESCP)** that:

- (1) has been developed by a Certified Professional in Erosion and Sediment Control (**CPESC**) in accordance with the International Erosion Control Association Australasia 2008, *Best Practice Erosion and Sediment Control*, and achieves the environmental objectives specified in condition 2-1;
- (2) provides details of the design, implementation, monitoring, maintenance and removal of erosion, sediment and drainage controls in all **construction** and temporary work areas; and

(3) is reviewed by a **CPESC** within 12 months of **substantial implementation** or at any time during the **life of the action** if:

- (a) ongoing monitoring identifies a failure of the **ESCP**; or
- (b) an accelerated or changed work program is required.

3 Coastal processes

3-1 The approval holder must implement the action to achieve the following environmental objective:

- (1) maintain the beach within its natural extent under non-cyclonic conditions for a distance up to 400 m south from the existing Mandorah jetty.

3-2 Prior to **substantial implementation**, to meet the objective at condition 3-1, the approval holder must implement a Coastal Processes Monitoring and Management Plan (**CPMMP**) for the **life of the action**.

3-3 The **CPMMP** required by condition 3-2 must:

- (1) be prepared as an adaptive management plan in consideration of the *Northern Territory Environment Protection Authority Guidance on Adaptive Management*;
- (2) be endorsed by an **independent qualified person**;
- (3) include a requirement for the action to achieve the environmental objective required by condition 3-1;
- (4) provide a field-validated assessment of the baseline conditions for the beach and adjacent areas;
- (5) provide mapping and a description of specific areas in the intertidal zone that require management and protection, and analysis of the risks to those areas from the action;
- (6) include monitoring methods, control/reference sites, and trigger criteria for management responses;
- (7) include methods and indicators for determining whether any exceedance of management **trigger values** is attributable to the action;
- (8) provide appropriate adaptive management responses and procedures that would be implemented to maintain the achievement of the environmental objective specified in condition 3-1;
- (9) provide the layout and cross sectional drawings of any permanent infrastructure (such as structures for shoreline impact mitigation) to be used to maintain the environmental objectives specified in conditions 3-1 and 4-1; and
- (10) include certification from a registered engineer confirming the stability and integrity of any permanent infrastructure to be used.

4 Marine environmental quality and marine ecosystems

4-1 The approval holder must implement the action to achieve the following environmental objectives:

- (1) no **material environmental harm** to the environmental values and declared **beneficial uses** of water in Darwin Harbour beyond the **approved extent**, including but not limited to ecosystem health, cultural, aesthetic, recreational, aquaculture;
- (2) no **material environmental harm** to **benthic habitats and communities** beyond the **zones of impact**; and
- (3) risks of physical injury, mortality, behavioural changes or health impacts on marine megafauna are minimised.

4-2 At least 10 business days prior to **substantial implementation**, the approval holder must submit to the **Minister** a **Dredge Management Plan (DMP)** to meet the requirements specified in condition 4-3.

4-3 The **DMP** required by condition 4-2 must:

- (1) be endorsed by an **independent qualified person**;
- (2) include a requirement for all **maritime activities** to achieve the environmental objectives required by 4-1;
- (3) include benthic mapping showing the field-validated extent, distribution and health of potentially affected **benthic habitats and communities**, as well as critical sensitive areas requiring protection;
- (4) clearly stated objectives, methods and outcomes including a conceptual model that defines stressors and potential impacts in the receiving environment and identifies the links between predicted responses and the monitoring indicators to be monitored;
- (5) include an integrated water quality and benthic habitat monitoring and management program based on **pressure-response pathways** associated with **maritime activities** including but not limited to:
 - (a) reference and impact monitoring site locations pertinent to sensitive benthic habitats and modelled **zones of impact** and **zones of influence**;
 - (b) management trigger criteria, including **trigger values** for key indicators such as turbidity (NTU) and **PAR** (benthic and surface) ($\text{mol}/\text{m}^2/\text{day}$ or DLI);
 - (c) defined relationships between monitoring indicators such as suspended solids and turbidity, and **PAR**;
 - (d) continuous logging with on-line near real-time monitoring capability for turbidity, **PAR** (benthic and surface) and water depth/pressure at reference and impact sites, with a baseline data collection phase;

- (e) periodic monitoring of suspended solids, nutrients, pH, conductivity, temperature, metals and metalloids, dissolved organic matter, spectrophotometric water colour, sediment deposition and condition of benthic communities (particularly seagrass meadows) at reference and impact monitoring sites, with a baseline data collection phase;
 - (f) procedures for determining whether any exceedance of management **trigger values** is attributable to the action;
 - (g) a trigger action response plan incorporating a tiered adaptive monitoring and management approach to achieve the environmental objectives required by condition 4-1(1) and 4-1(2);
 - (h) procedures for determining when the impacts of **maritime activities** beyond the **approved extent** return to baseline conditions after the cessation of these activities;
 - (i) quality assurance methods and reporting of results;
- (6) include monitoring and management measures to achieve the environmental objective required by condition 4-1(3) including but not limited to:
- (a) measures to avoid direct impacts of entrainment and vessel strikes on marine megafauna, such as imposing speed limits on vessels and specifying safe distance for marine megafauna encounters during the **maritime activities**;
 - (b) defined observation and exclusion zones, along with protocols for marine megafauna observation, and keeping a record of sightings and locations in the vessels' daily log book;
 - (c) trained marine megafauna observers to be present during **maritime activities**;
 - (d) procedures for observing marine megafauna during night time (if night operations are proposed) and low visibility conditions;
 - (e) procedures for reporting any incidents related to marine megafauna injury or mortality to the relevant regulators;
- (7) provide measures to prevent the introduction of marine pests; and
- (8) provide procedures to minimise the impacts on marine ecosystems from **construction** noise and artificial lighting.
- 4-4 Any maintenance dredging required must be conducted in accordance with a **DMP** to meet the environmental objectives at condition 4-1.
- 4-5 The **DMP** referred to in condition 4-2:
- (1) must be reviewed and revised as and when directed by the **Minister**; and
 - (2) may be reviewed and revised for the approval holder's own purposes.

- 4-6 The approval holder must provide a copy of any revised **DMP** to the **Minister** at least 10 business days prior to any amendment(s) being implemented, accompanied by:
- (a) a tabulated summary of the amendment(s) with references to supporting documents;
 - (b) reasons for the amendment(s);
 - (c) an assessment of environmental risks and potential impacts associated with the amendment(s); and
 - (d) a written review and endorsement from an **independent qualified person** stating that the amended plan appropriately identifies and mitigates environmental risks and complies with the conditions of this approval.
- 5 Commencement of action**
- 5-1 This approval expires 5 years after the date on which it is granted, unless **substantial implementation** has commenced on or before that date.
- 5-2 The approval holder must provide notification in writing to the **Minister**, at least 10 business days prior to the commencement of **substantial implementation**.
- 6 Completion of construction**
- 6-1 The approval holder must provide notification in writing to the Minister, within 10 business days after completion of **construction** of the action.
- 7 Change of contact details**
- 7-1 The approval holder must notify the **Minister** in writing of any change of its name, physical address or postal address for the serving of notices or other correspondence within 10 business days of such change.
- 8 Operation**
- 8-1 The approval holder must meet the environmental objectives specified in this approval at all times throughout the **life of the action**.
- 9 Environmental performance and compliance reporting**
- 9-1 The approval holder must:
- (1) within 12 months after completion of **construction** of the action and after closure of the action, and within 6 months after any maintenance dredging activities and/or implementation of shoreline mitigation activities, prepare a report to address conditions 9-2(1) to 9-2(7); and
 - (2) submit each report to the **CEO** within 30 days of the report's completion.
- 9-2 The reports required by condition 9-1 must:

- (1) provide all monitoring data (inclusive of any raw and processed data) and reportable incidents required by the conditions of this approval;
- (2) provide an analysis and interpretation of monitoring data to demonstrate whether compliance with the requirements of conditions 2-1, 3-1 and 4-1 has been achieved;
- (3) provide a comparison between the actual and predicted impacts;
- (4) include an assessment of the effectiveness of monitoring, management and contingency measures implemented to comply with conditions 2-1, 3-1 and 4-1 of this environmental approval;
- (5) identify all non-compliances and describe corrective actions taken;
- (6) include a statement as to whether the approval holder has complied with the conditions of this approval; and
- (7) include a written review and endorsement by an **independent qualified person**.

10 Provision of environmental data

- 10-1 All environmental monitoring data required to be collected or obtained under this environmental approval must be retained by the approval holder for a period of not less than 50 years commencing from the date that the data is collected or obtained.
- 10-2 The approval holder must, as and when directed by the **Minister**, provide any validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products such as maps) relevant to the assessment of the action and implementation of this environmental approval, to the **Minister** in the form and manner, and at the intervals, specified in the direction.

11 Rehabilitation and closure

- 11-1 The approval holder must submit to the **Minister** a rehabilitation plan 12 months before the end of the **life of the action**. The plan should include information related to:
- (1) rehabilitation objectives and criteria;
 - (2) consultation outcomes with relevant stakeholders, clearly identifying assets to be retained, decommissioned, remediated and rehabilitated, and associated costs;
 - (3) proposed tenure and management arrangements including the maintenance or handover of useable assets;
 - (4) program of works, including specific trials and monitoring to demonstrate progress towards meeting the rehabilitation objectives; and
 - (5) a contingency plan outlining corrective actions if monitoring indicates that the rehabilitation objectives are unlikely to be achieved.

Definitions

The terms used in this approval have the same meaning as the terms defined in the *Environment Protection Act 2019* and *Environment Protection Regulations 2020*.

Term	Definition
approved extent	The extent identified in Figure 1 and Figure 2 of this approval that is the area of land and water that will be directly disturbed by the construction of structures, dredging and dredge spoil disposal.
beneficial uses	The uses of water as defined in section 4 of the <i>Water Act 1992</i> .
benthic habitats and communities	The areas of seafloor that support functional ecological communities (e.g. high relief reef, platform reef, sand, silt and the depth they occur at). The communities may include light dependent taxa (e.g. algae, seagrass, corals, some sponges, mangroves) or animals that obtain their energy by consuming live or dead organisms (e.g. ascidians, sponges, soft corals).
CEO	The Chief Executive Officer of the Department of Environment, Parks and Water Security [or another name for that department, which may vary from time to time], or their delegate.
construction	Works and activities undertaken to establish the action including land clearing, earthworks, stockpiling, capital dredging and spoil disposal, and building of landside and marine infrastructure. Construction excludes periodic maintenance dredging and any Mandorah beach maintenance.
CPESC	Certified Professional in Erosion and Sediment Control
CPMMP	Coastal Processes Monitoring and Management Plan
DEPWS	Department of Environment, Parks and Water Security
DMP	Dredge Management Plan that includes management of dredge spoil disposal (referred to in the referral and SER as Dredging and Spoil Disposal Management Plan)
EP Act	Environment Protection Act 2019
ESCP	Erosion and Sediment Control Plan
independent qualified person	A qualified person as defined under section 4 of the EP Act; and who also meets the following requirements: a) was not involved in the preparation of the SER ; and b) is independent of the personnel involved in the design, construction and implementation of the action; and c) has obtained written approval from the CEO to be the qualified person to satisfy the independent qualified person reporting requirements under this approval.
life of the action	The period of time from substantial disturbance until the issue of a closure certificate under section 213 of the EP Act , or revocation of the environmental approval by the Minister at the request of the approval holder under section 114 of the EP Act .
maritime activities	The actions that occur in the intertidal and marine environment, as presented in Figures 1, 2 and 3
material environmental harm	The environmental harm as defined under section 8 of the EP Act

Term	Definition
PAR	Photosynthetically active radiation
pressure-response pathways	The pathways through which environmental or ecological systems respond to seasonal variations or changes in stressors. These pathways can encompass the sequence or chain of events that occur in response to external pressures or disturbances.
SER	Supplementary Environmental Report
substantial implementation	Any substantial disturbing activity relating to the action within the approved extent , including, but not limited to, land clearing, civil works, construction works or dredging works. Substantial implementation does not include preliminary works such as geotechnical, hydrographic and aerial investigations, as well as other pre-construction activities that do not involve land clearing or disturbance of intertidal/marine areas.
trigger value	The values of monitored environmental parameters that indicate when response actions are required to prevent or minimise impact.
Zones of impact	Defines the areas within which benthic habitats and communities are impacted by a particular event or action.
Zones of influence	Defines the areas within which environmental quality would be effected by a particular event or action but the effects would not result in detectable impacts to benthic habitats and communities .

Location and extent of action

Spatial data depicting information provided in Figures 1 and 2 are held by the Department of Environment, Parks and Water Security as follows:

- NTEPA2022/0040-013 – Spatial Files – Department of Infrastructure, Planning and Logistics – Mandorah Marine Facilities.

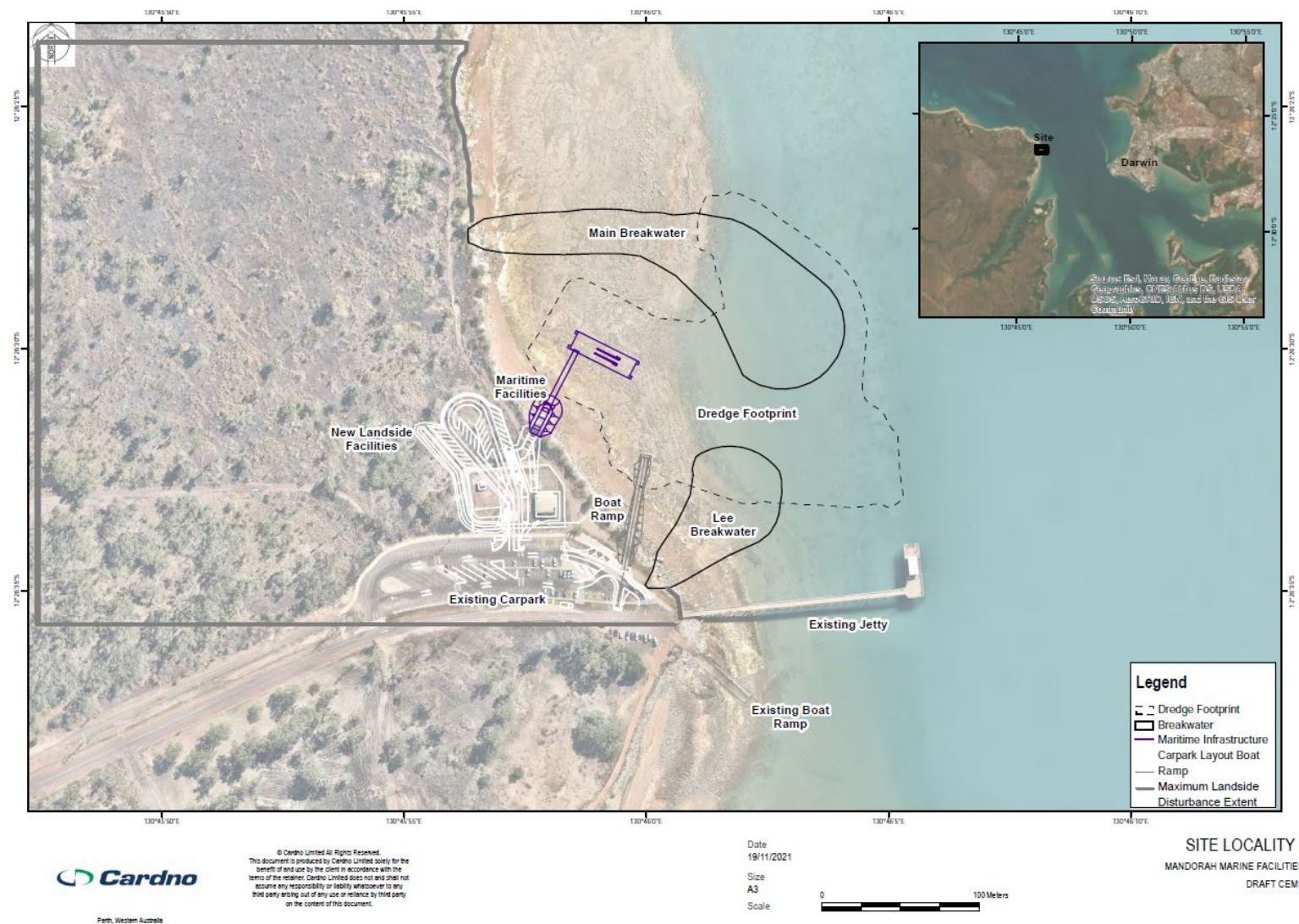


Figure 1. Location and approved extent of the proposed action (Source: adapted from Mandorah Marine Facilities Referral, p.18)

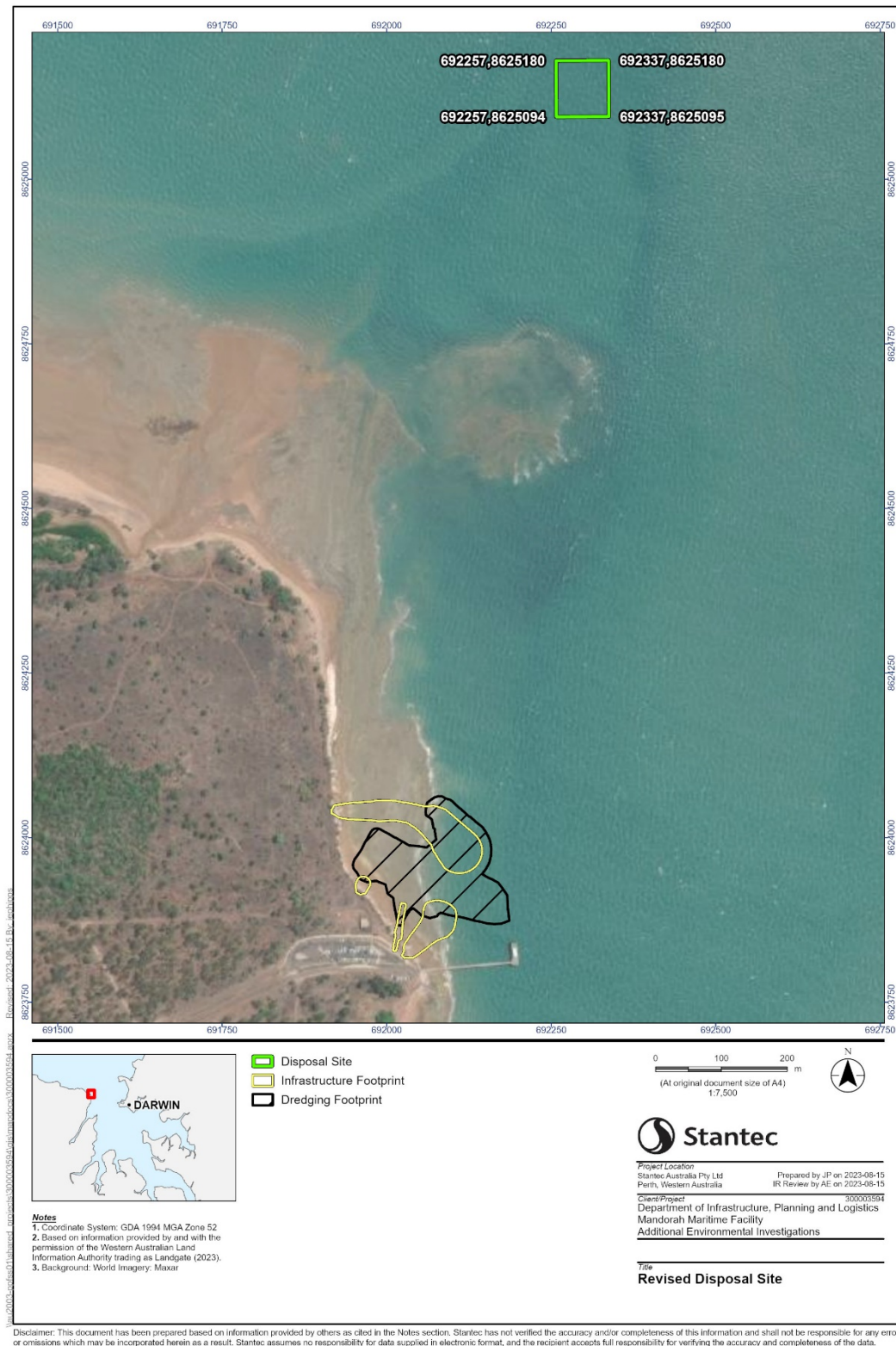


Figure 2. Location and approved extent of dredge spoil disposal area (Source: DIPL, 15 August 2023)

Appendix 2 – Environmental impact assessment timeline

Date	Assessment stages
23 March 2022	Referral accepted
24 March to 22 April, 2022	Referral consultation submission period
8 June 2022	NT EPA decided environmental impact assessment required by the supplementary environmental report (SER) method
13 July 2022	NT EPA directed the proponent to provide additional information in the SER
9 March to 14 April, 2023	SER consultation submission period
16 May 2023	NT EPA directed the proponent to provide additional information in relation to the SER
20 June to 27 June 2023	Additional information consultation period
28 June 2023	NT EPA directed the proponent to provide response to a government submission
20 July to 11 August 2023	Consultation with proponent and statutory decision-maker on draft environmental approval
31 August 2023	Statutory timeframe for the NT EPA's assessment report to be provided to the Minister for Environment, Climate Change and Water Security
30 business days after receiving the NT EPA's assessment report	Minister's decision on environmental approval due (If the Minister does not make a decision within 30 business days after receiving the assessment report the Minister is taken to have accepted the NT EPA's recommendation for approval).