

Assessment Report 100

Assessment by Referral Information

Ichthys LNG Maintenance Dredging Program 2023-2027

INPEX Operations Australia Pty Ltd

April 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 Ichthys LNG Maintenance Dredging Program 2023-2027 proposed by INPEX Operations Australia Pty Ltd (proponent) in Darwin Harbour.

This 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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18 April 2023

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Summary

This assessment report has been prepared by the Northern Territory (NT) Environment Protection Authority (NT EPA) pursuant to section 64 of the *Environment Protection Act 2019* (NT) (EP Act) for the Ichthys LNG Maintenance Dredging Program 2023-2027 (proposal).

INPEX Operations Australia Pty Ltd (proponent) proposes to undertake maintenance dredging activities of the shipping channel and turning basin used for its onshore liquefied natural gas (LNG) processing facility at Bladin Point in Darwin Harbour. Dredging would be carried out within the footprint of the capital works undertaken between 2012 and 2014. A maximum of 1.5 million cubic metres (Mm³) of material would be removed using a single trailing suction hopper dredge (TSHD) over the nominal five-years, and no single campaign would exceed 0.75 Mm³. Dredged material would be loaded directly into the dredge hopper and transported to the previously used dredge spoil disposal area (DSDA), for disposal within NT waters of the Beagle Gulf, approximately 45 km north of East Arm.

The NT EPA assessed the proposal by the referral information method in accordance with the requirements of the EP Act and Environment Protection Regulations 2020 (regulations). The NT EPA examined the potential for significant direct, indirect and cumulative impacts on the environment in accordance with the principles of ecologically sustainable development.

The NT EPA has examined potential significant impacts on the values of three key environmental factors:

1. Marine environmental quality
2. Marine ecosystems
3. Culture and heritage.

The proposal has the potential to have significant impact on marine water quality, benthic habitats and communities, marine megafauna, and cultural and heritage values within the zones of impact and influence in Darwin Harbour and the dredge spoil disposal area. The environmental risks associated with the proposal are minimised through implementation of the proponent's maintenance dredging and dredge spoil management plan (DMP).

The NT EPA's assessment concludes that the proposal can be implemented and managed in a manner that is environmentally acceptable and recommends that environmental approval be granted subject to the conditions recommended in Appendix 1. This assessment report and the draft environmental approval (Appendix 1) are provided to the Minister for Environment, Climate Change and Water Security (Minister) for consideration in deciding whether to grant the environmental approval.

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1. Introduction

This assessment report provides advice and recommendations of the Northern Territory Environment Protection Authority (NT EPA) to the Minister for Environment, Climate Change and Water Security (Minister) on completion of the NT EPA's environmental impact assessment of the Ichthys LNG Maintenance Dredging Program 2023-2027 (proposal).

The proponent is INPEX Operations Australia Pty Ltd (Australian business number 48 150 217 262). The proposal is to undertake maintenance dredging activities within the previously dredged footprint of the shipping channel and turning basin for its onshore liquefied natural gas (LNG) processing facility at Bladin Point in Darwin Harbour. Dredged material would be loaded directly into the dredge hopper of a single trailing suction hopper dredge (TSHD) and transported to the previously used dredge spoil disposal area (DSDA), for disposal within NT coastal waters of the Beagle Gulf, approximately 45 km north of East Arm (Figure 1).

The NT EPA has prepared this report in accordance with section 64 of the *Environment Protection Act 2019* (EP Act). As prescribed by regulation 156 of the Environment Protection Regulations 2020 (EP Regulations), the purpose of this report is to:

- assess whether the proposal is likely to meet the environmental objectives
- assess the potential significant environmental impacts of the proposal
- make recommendations to avoid, mitigate and manage those impacts
- advise the Minister as to the environmental acceptability of the proposal.

This report must assess the potential significant environmental impacts and risks of the proposal and whether there are any significant residual impacts remaining after all reasonable measures to avoid, minimise and (where applicable) offset the impacts and risks have been taken.

This assessment report and the draft environmental approval (Appendix 1) are provided to the Minister for consideration in deciding whether to grant an environmental approval for the proposal. Matters taken into account during the assessment are tabulated in section 8. An environmental impact assessment timeline is provided at Appendix 2.

1.1. Location and context

The proposal is located within Darwin Harbour and the Beagle Gulf in NT coastal waters (Figure 1) on unzoned land in NT Portions 7168 and 7634 respectively. The nearest residential areas are the Darwin Waterfront Precinct and Darwin's central business district to the north-west (~3.5km) and Marlow Lagoon, Palmerston to the east (~6.5km).

Dredging is proposed within East Arm, adjacent to the onshore Ichthys LNG facility and East Arm Wharf and in the Litchfield Local Government Area (LGA). Spoil disposal is proposed within a designated DSDA in the Beagle Gulf approximately 12 km north-west of Lee Point, outside Darwin Harbour and LGA boundaries. All proposal activities lie within the Darwin Harbour regional management area¹.

The Darwin Harbour region is the NT's most densely populated area, supporting the largest concentration of commerce and industry in the NT. Darwin Harbour is a working harbour with ongoing development recognised as economically important to the NT.

¹ Darwin Harbour Advisory Committee, 2023. Available at: <https://nt.gov.au/darwinharbour/background>

Darwin Harbour is a recognised site of international conservation significance² supporting a range of marine, estuarine, freshwater and terrestrial environments including extensive areas of tidal mudflats and one of the largest and most diverse areas of mangroves in the NT. The land and seas of and surrounding Darwin Harbour are culturally significant to Aboriginal peoples. The rich heritage value of Darwin Harbour includes, but is not limited to, sacred sites, shipwrecks, sunken aircraft and the heritage listed coral reef at Channel Island. The values of Darwin Harbour are recognised through declared beneficial uses including protection of environment, culture (aesthetic, recreational and cultural) and aquaculture.

Darwin has a tropical monsoonal climate with a distinct dry season (May to September) and wet season (October to April). The onset and duration of the wet season varies between years; however, most rainfall is associated with monsoonal troughs and/or from isolated convective storms. On average, two to three cyclones form in the NT each season, with one to two crossing the coast.

The water quality of Darwin Harbour is considered good with generally excellent water quality despite its natural turbidity. Natural turbidity is generally higher in the wet season months with stormwater inflows, and during the spring tides when current speeds are higher. Despite its highly turbid waters, Darwin Harbour supports diverse and important primary producing marine ecosystems. These include benthic habitats comprising hard corals, soft corals and sponges, macroalgae, seagrasses, soft sediment biota, and those associated with mangrove communities. In turn, these habitats provide resources for conservation listed fauna species including dolphins, dugong, sea turtles, sawfish and migratory shorebirds.

The current level of knowledge about values of Darwin Harbour is limited despite the high level of survey and research effort focused on the marine and nearshore environment. For example, a reasonably high level of uncertainty remains about the spatial distribution of sensitive benthic habitats and communities and their tolerance thresholds to dredging pressures.

2. Proposal

The proposal is to undertake maintenance dredging within the proponent's previously dredged footprint at East Arm, Darwin Harbour (NT Portion 7168), and spoil disposal at the DSDA in the Beagle Gulf (NT Portion 7634). The total footprint of marine works is approximately 373 ha.

Table 1 quantifies the key components of the proposal and Figure 1 shows the location and extent of proposed dredging and spoil disposal. A detailed description of the proposal is presented in section 2 of the proponent's referral³.

Table 1 Proposal description

Aspect	Description
Equipment	One trailing suction hopper dredge Overflow fitted with green valve Seabed leveller (auxiliary attachment to vessel) Telemetered data loggers
Dredge area	94.4 ha – turning basin (jetty pocket, berth area and turning area) 153.5 ha – shipping channel and approach area

² NRETAS, 2009. Darwin Harbour site of conservation significance. Available at:

<https://nt.gov.au/environment/environment-data-maps/important-biodiversity-conservation-sites>

³ Referral report (LO60-AH-REP-70028 9 August 2022) and appendices, available on the NT EPA website.

Aspect	Description
Area of DSDA	125 ha
Proposal life	5 years
Duration of dredging	24/7 for up to 39 days for any one of the dredge campaigns
Quantity of dredge material	1.5 Mm ³ maximum total for the five-year period 0.75 Mm ³ maximum for any one of the dredge campaigns
Remaining available capacity of DSDA	7 Mm ³

2.1. Justification for the proposal and alternatives

The footprint of dredging works is bound by previous capital dredging works. The same DSDA is proposed with remaining capacity verified through hydrographic survey as being 7 Mm³.

The proponent describes its equipment selection in section 2.3.1 of its maintenance Dredging and Spoil Disposal Management Plan (DMP). The proponent proposes to use seabed levelling as necessary, as an alternative to, or to delay dredging by levelling high spots such as sand waves or areas of sediment deposition.

The timing of works includes provisions for wet or dry season dredging with consideration of environmental and operational windows. The proponent has developed site-specific management triggers for each season to avoid and then minimise potentially significant impacts on the environment.



Figure 1 Location of dredge footprint and dredge spoil disposal area (source: Referral report)

3. Strategic context in which proposal is being considered

The proposal is consistent with and contributes to the NT Government's commitment to creating jobs and economic growth, and with strategic plans and initiatives including:

- Darwin Regional Plan - identifies high level characteristics and needs that will shape development, management of growth and regional infrastructure.
- NT Economic Development Framework - establishes the directions and actions needed to accelerate the Territory's economic development, informs long term decision making and aims to deliver policy and regulatory certainty for investors.
- The Territory's Economic Reconstruction – the Territory Economic Reconstruction Commission Report sets out a blueprint to diversify the NT's industry base and take advantage of global market trends to accelerate the growth of its economy and economic recovery.
- Indigenous Employment and Supplier-Use Infrastructure Framework – aims to increase Indigenous employment and supplier-use in the delivery of land transport infrastructure projects funded or co-funded by the Australian Government.
- [Darwin Harbour Strategy 2020-2025](#) (Darwin Harbour Advisory Committee 2020) – to guide sustainable management and planning.

4. Statutory context

4.1. Overview

The proposal required standard assessment by the NT EPA under the EP Act. The NT Minister for Environment, Climate Change and Water Security is the approval authority.

It is the responsibility of the proponent to obtain all approvals, which include, but may not be limited to development consent under the *Planning Act 1999* (Planning Act). The approval holder is responsible for implementing the commitments made in the referral.

The proponent holds three Aboriginal Areas Protection Authority (AAPA) certificates for the proposal area to protect sacred sites.

Commonwealth approval was granted (EPBC 2008/4208) in 2011 for both capital and maintenance dredging under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which includes nearshore and offshore matters of national environmental significance.

Pursuant to section 61 of the EP Act, the purpose of the environmental approval is to manage the potentially significant environmental impacts of a proposal during all phases. This includes planning, designing, construction, rehabilitation and completion of the proposal. If an environmental approval is granted, it would be the principal approval under NT legislation; however, the proposal also requires separate NT regulatory approvals that cannot be inconsistent with an approval under the EP Act.

4.2. 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
- submissions on the referral information

- any other information the NT EPA considers relevant under EP Regulation 157(2)(c).

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 8 for further detail about matters that the NT EPA has taken into account during its assessment.

5. Consultation

The NT EPA published the referral for comment between 21 September and 19 October, 2022. No public submissions were received, and seven government authority submissions were received and are published on the NT EPA website.

The NT EPA considered the submissions in making its decision to require a standard environmental impact assessment by the referral information method. The issues relating to potential significant impacts raised in submissions are discussed in more detail in section 6 below.

The NT EPA consulted with and invited submissions from the proponent and statutory decision-makers regarding dredging under the Planning Act and dredging under the EPBC Act, on the draft environmental approval. Submissions were received and considered by the NT EPA in finalising its recommendations to the Minister.

The proponent has committed to continued engagement with relevant stakeholders during implementation of the proposal, should approval be granted.

6. Assessment of key environmental factors

6.1. Overview

The NT EPA identified that the proposal has the potential to have a significant impact on environmental values associated with three environmental factors (Table 2).

Table 2 Key environmental factor⁴

THEME	FACTOR	ENVIRONMENTAL OBJECTIVE
SEA	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 consideration of the referral; however, the impact on those factors was not considered to be significant.

6.2. Marine environmental quality

6.2.1. Environmental values

Darwin Harbour is an international site of conservation significance⁵ and has declared beneficial uses including protection of environment, culture (aesthetic, recreational and cultural) and aquaculture. The proponent's referral describes the marine environmental values of Darwin Harbour and the DSDA in section 3 of the draft DMP.

6.2.2. Consultation

Matters raised during the NT EPA's consultation on the referral are published in the submissions available on its website. Relevant matters raised, relating to potentially significant impacts to marine environmental quality, include:

- the referral included a comprehensive and evidence-based draft DMP with modelling, site-specific triggers, monitoring and reactive and contingency response actions
- uncertainty about scheduling dredging operations in the dry season
- cumulative impacts from multiple dredging projects in Darwin Harbour
- communication, scheduling and monitoring requirements to manage cumulative impacts

⁴ [NT EPA Guide to Environmental Factors and Objectives](#).

⁵ Darwin Harbour – [Sites of conservation significance](#) (NRETAS 2009).

- support of the proponent's commitment to develop light-based site-specific trigger values by the end of 2023.

Matters raised during proponent consultation together with proponent responses are provided in Appendix B of the referral.

6.2.3. Potentially significant impacts

The proposal has the potential to significantly impact marine environmental quality through:

- changes due to reduced light availability and increased turbidity, sediment suspension, deposition and resuspension beyond natural levels during dredging, spoil disposal and seabed levelling activity
- accidental release of contaminants from vessels (waste, hydrocarbons and chemicals).

6.2.4. Avoidance and mitigation measures

The proponent's draft DMP (Appendix A of the referral) documents appropriate and site specific avoidance and mitigation measures to be implemented to minimise potentially significant impacts on marine environmental quality. These include:

- minimising and postponing the need for maintenance dredging through the use of seabed levelling as a best management practice for high spot removal during the ongoing maintenance dredging program
- minimising the release of fine material from the dredge vessel through controlled overflow, including a requirement that the TSHD is fitted with a 'green valve' to limit the areal extent of turbidity plumes generated by dredge operation, and that the overflow duration is limited to a maximum of 60 minutes per cycle. The green valve ensures that overflow from the dredge vessel is released under the keel of the vessel rather than at the water surface
- avoiding the exceedance of suspended sediment concentration (SSC) and sedimentation tolerance limits through the use of tiered hierarchy of turbidity (Nephelometric Turbidity Units (NTU)) trigger values for wet and dry season dredging works (proposed triggers previously endorsed by the Ichthys dredge expert panel and supported by peer reviews on the draft DMP)
- informed response management based on modelling outputs and turbidity and PAR monitoring with contingency actions for informative and reactive monitoring sites.

The proponent has addressed the matters raised through peer reviews by three independent dredging experts and committed to updating the draft DMP as required to incorporate any additional requirements through the Northern Territory Government environmental approval processes.

6.2.5. Assessment of impacts to environmental values

Changes to benthic light availability, turbidity, and suspended and deposited sediment

The water quality of Darwin Harbour is considered generally very good despite its natural turbidity. Natural turbidity is usually higher in the wet season months with increased suspended sediments due to stormwater inflows, and during the spring tides when current velocities are higher. Suspended sediment from maintenance dredging is likely to increase turbidity of the water column. As turbidity is naturally elevated during the wet season, the severity of potential impacts to primary producers associated with reduced light availability would potentially increase depending upon the intensity, duration and frequency of adverse events relative to background levels to which the receptors are adapted.

The proposed maintenance dredging differs from the proponent's previous capital dredging in that a higher proportion of fines (about 79%) is predicted to be encountered in the dredge material in comparison to the

mostly sandy and coarse sediment removed during capital works. The volume of sediment proposed to be dredged in a worst-case single maintenance campaign (0.75 Mm³) is less than 5% of the volume dredged during the original capital works. The duration of the campaign for the worst-case scenario presented is estimated at 39 days, in contrast to the capital dredging program which was conducted over two years.

Hydrodynamic and sediment plume modelling predicted that background turbidity levels may be exceeded in some low velocity areas within the zone of influence. However, the intensity, magnitude, duration and frequency of sediment plumes arising from dredging and spoil disposal activities are not expected to result in impacts above sensitive receptor tolerance thresholds, based on monitoring data from capital dredging works. Species or community specific biological response thresholds have not yet been established for the Darwin Harbour region. The proponent developed management triggers based on an understanding of the tolerance thresholds of sensitive receptors.

The draft DMP describes how turbidity generated during dredging would be monitored and managed, using a trigger action response plan (TARP) with defined turbidity trigger values and associated responses to be initiated in the event that a trigger level is reached.

The tiered hierarchy of site-specific turbidity triggers are based on a conservative 1:1 correlation of NTU and TSS and derived from a combination of site-specific turbidity threshold and duration components, both of which need to be exceeded for management responses to commence. The independent peer reviews of the draft DMP considered this approach to be consistent with published literature of the Western Australian Marine Science Institute (WAMSI) Dredging Science Node and supported as sound and appropriate for the intended use.

The TARP and development of turbidity trigger values are supported by monitoring data from the capital dredging monitoring program. The process used to develop the turbidity management triggers is outlined in section 6.1 of the draft DMP. The trigger values are based on the 95th percentile (Level 1) and 99th percentile (Level 2) daily average turbidity levels recorded by the proponent over 3.5 years across 2010 and 2012 to 2014. The proponent considers that both triggers are conservative and below the threshold beyond which the environmental objectives would not be met.

A trigger exceedance initiates an attributability investigation to determine the cause of an exceedance, then responsive management or contingency management as defined in the TARP respectively should dredging be determined as the cause of the exceedance. The NT EPA considers that the DMP should be designed to monitor and report on the pressures relevant to dredging activity so that avoidance and mitigation measures can be implemented to manage or respond to any observed changes such as increases in turbidity, whether or not those changes are attributable to the proposal. Impact predictions would be compared to actual impacts to improve understanding of cause/effect relationships.

The water quality monitoring program proposed for maintenance dredging is detailed in the DMP (see section 7) and contains four plans (see Table 3). Each plan has escalating monitoring requirements based on the volume and season of proposed dredging. Proposed monitoring locations are shown in Figure 2.

Table 3 Water quality monitoring sites and use for R = reactive or I = informative data. (Source: DMP, Appendix A of referral)

Location	Plan A wet season, <0.25 Mm ³	Plan B dry season, <0.25 Mm ³	Plan C wet season, >0.25 Mm ³	Plan D dry season, >0.25 Mm ³
Northeast Wickham Point	R	R	R	R
South Shell Island	R	R	R	R
Spoil Ground	I	I	I	I

Location	Plan A wet season, <0.25 Mm ³	Plan B dry season, <0.25 Mm ³	Plan C wet season, >0.25 Mm ³	Plan D dry season, >0.25 Mm ³
Fannie Bay		I	I	R
Weed Reef			I	I

The proponent acknowledged the importance of PAR criteria for the management of water quality condition to protect benthic habitats and communities, and committed to develop light-based trigger criteria measured as PAR with relevant stakeholders, by the end of 2023. The use of both turbidity and PAR triggers is discussed further in section 6.3.6 of this report relating to protection of benthic marine habitat and communities.

The NT EPA considers that implementation of the proponent's detailed trigger, monitoring and management measures proposed in a TARP is necessary to manage potential marine environmental quality impacts and has recommended conditions for marine environmental quality outcomes and implementation of the DMP.

Seasonality of dredging

The proponent considered seasonal variability in the prediction of dredging impacts and developed wet season and dry season triggers based on representative baseline water quality data. The DEPWS Flora and Fauna Division recommended that dredging occur during the wet season when natural water quality is typically lower, and that if it is essential to carry out dredging in the dry season, that it be restricted to the early dry season (until June) and that likely windows for coral spawning be avoided. The proponent's expert peer reviews of the DMP and submissions on the referral raised concerns about the increased impacts of sediment mobilisation on water quality and marine ecosystems during the dry season when environmental cues rely on marine waters that are less turbid.

The proponent proposes flexibility in timing of dredging, which would be informed by both operational and environmental considerations. The DMP identifies that dredging may occur in the dry season to coincide with planned plant shutdown periods (generally 4 to 5 weeks in the dry season), to fit in with the Ichthys Onshore LNG Facilities operations and to minimise disruption to loading and shipping schedules. The proponent modelled predicted dredge related impacts for wet and dry season conditions based on representative site-specific data.

The NT EPA considers that implementation of the DMP, with appropriate seasonal trigger values and action response measures developed with consideration of site-specific seasonal variation (as described in section 6.3.6 of this report) is an acceptable approach to manage potential significant impacts from dredging.

Management of accidental release of contaminants from vessels

The accidental release of contaminants from dredge and tender vessels may cause localised marine pollution (nutrients and toxicants) and localised impacts on mangroves and intertidal communities. The DMP outlines appropriate storage and handling of hydrocarbons and chemicals in accordance with MSDS and regulatory requirements.

The NT EPA is satisfied that through implementation of the measures outlined in the proponent's hydrocarbon and chemical management and spill response framework, section 6.2.6 of the DMP, impacts from accidental release of contaminants can be adequately mitigated and managed so risks to the environment is avoided or minimised to an acceptable level.

Cumulative impacts are considered and discussed in section 7 (Whole of environment) of this report.

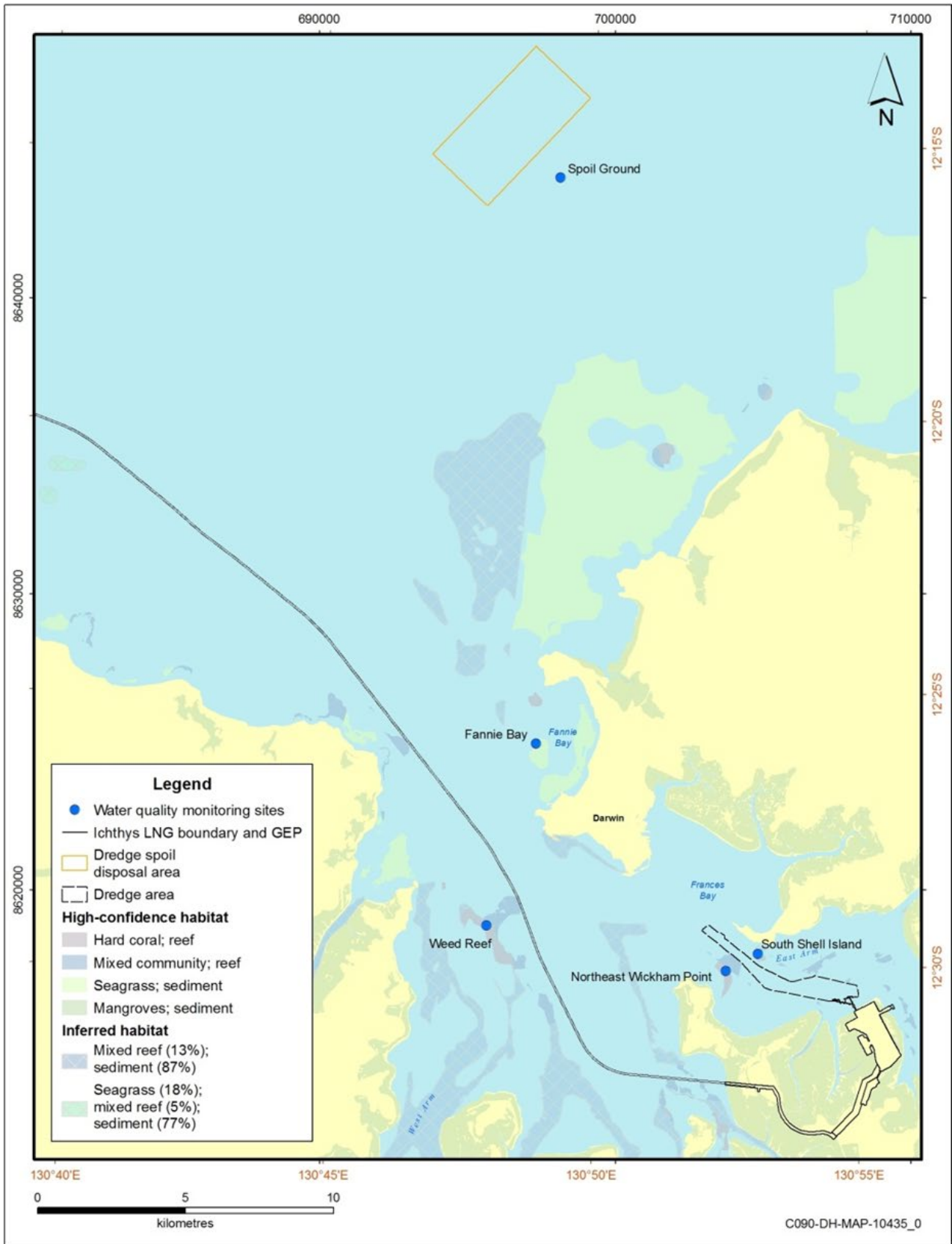


Figure 2 Indicative water quality monitoring sites and modelled benthic habitat. (Source: DMP, Appendix A of referral)

6.2.6. Summary of factor assessment and recommended regulation

The NT EPA has considered the potential significant impacts of the proposal on marine environmental quality values. In doing so, the NT EPA has considered whether reasonable conditions could be imposed, or whether other statutory decision-making processes could ensure the NT EPA's factor objective is likely to be met. Assessment findings are presented in Table 4.

The NT EPA has also taken into account the objects and principles of the EP Act (section 8) in assessing whether the residual impacts will meet its environmental factor objective and whether reasonable conditions can be imposed.

Table 4 Summary of assessment for marine environmental quality

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
Seasonal impacts from dredging	<p>Wet season dredging is considered best practice in Darwin Harbour. Uncertainty about the impact of dredging during the dry season is reduced through seasonal, site- specific management triggers.</p> <p>Management triggers are based on turbidity and will be augmented by light-based measures as PAR by the end of 2023.</p> <p>Proposal activities conducted in accordance with the DMP and recommended conditions are not likely to result in direct significant impacts on the marine environmental quality of Darwin Harbour.</p> <p>Implementation of measures in the DMP to avoid and minimise impacts, means impacts are not considered significant and are likely to meet the NT EPA's objective for marine environmental quality.</p>	<p>Regulated through recommended conditions:</p> <p>Condition 1 Limitations and extent</p> <p>Condition 2 Overarching objectives</p> <p>Condition 3 DMP including trigger values for each season</p> <p>Condition 6 Environmental performance reporting</p> <p>Regulated by existing regulatory processes:</p> <p>Planning Act</p> <ul style="list-style-type: none"> • Dredging permit.
TARP	<p>The Proponent's commitment to trigger action response measures to avoid, minimise and mitigate the impact of dredging on marine environmental quality.</p> <p>Implementation of the DMP means impacts are not considered significant and are likely to meet the NT EPA's objective for marine environmental quality.</p>	<p>Regulated through recommended condition:</p> <p>Condition 3 DMP</p> <p>Condition 6 Environmental performance reporting</p>
Accidental release of contaminants from vessels (waste, hydrocarbons and chemicals)	<p>The proponent has committed to storage and handling of hydrocarbons and chemicals in accordance with MSDS and regulatory requirements. Spill response and management capability by trained personnel, is documented in the proponent's hydrocarbon and chemicals management</p>	<p>Regulated through recommended condition:</p> <p>Condition 3 DMP</p> <p>Regulated by existing regulatory processes:</p>

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
	<p>and spill response framework. The probability of a spill is assessed as low, and if a spill were to occur, implementation of the proponent's spill response plan would minimise impacts to the marine environment.</p> <p>Implementation of the DMP in accordance with recommended condition, means that residual impacts are not considered significant and the environmental outcome is likely to meet the NT EPA's objectives for this factor.</p>	<p>EPBC Act approval condition 8. Liquid Discharge Management Plan</p>

6.2.7. Conclusion against the NT EPA objective

With the implementation of the proposed management measures, the recommended conditions, and regulation under other statutory decision-making processes, the NT EPA considers that the proposal could be conducted in such a manner that its objective for marine environmental quality is likely to be met.

6.3. Marine ecosystems

6.3.1. Environmental values

Darwin Harbour is considered a site of international conservation significance supporting a range of environments and beneficial uses (see section 1.1 of this report), and providing habitat and resources for conservation listed fauna species including dolphins, dugong, sea turtles, sawfish and migratory shorebirds.

The ecosystem condition of Darwin Harbour is very good overall. There are a number of marine pest species that are considered a potential threat to Darwin Harbour and could impact on marine ecosystems if introduced.

6.3.2. Consultation

Matters raised during consultation on the referral relating to potentially significant impacts to marine ecosystems include those affecting marine environmental quality (see section 6.2.3 of this report). Additional matters include:

- the importance of light availability, measured as PAR, as a better measure than turbidity to determine potential impacts on benthic habitats and communities than turbidity
- support for the proponent's commitment to develop and include site-specific PAR trigger values by the end of 2023
- that PAR triggers should be developed prior to any new dredging activity to allow appropriate baseline data to be collected
- the reasonably high level of uncertainty that remains about the spatial distribution of sensitive benthic habitats and communities, and their impact thresholds

- support for the avoidance and mitigation measures to protect marine megafauna as proposed in the DMP
- cumulative impacts from multiple dredging projects in Darwin Harbour, particularly to minimise the potential for lengthy periods of elevated SSC and allow sufficient breaks for benthic flora to recover
- communication, scheduling and monitoring with other proponents may be required to manage cumulative impacts
- the DMP contains modelling and monitoring requirements, reactive and contingency response actions and commitments.

The proponent consulted with three independent experts with dredging experience in Australia. Matters raised during proponent consultation and proponent responses are provided in Appendix B of the referral.

6.3.3. Potentially significant impacts

The proposal has the potential to significantly impact marine ecosystems through:

- sedimentation and the alteration of light availability affecting benthic habitats and communities, and the pelagic environment, during dredging, spoil disposal and seabed levelling
- vessel interactions and underwater noise impacting protected marine fauna
- accidental introduction of marine pests.

6.3.4. Avoidance and mitigation of impacts

The proponent's avoidance and mitigation measures to be implemented to minimise potentially significant impacts on marine ecosystems include:

- implementation of the DMP
- measures to minimise the release of fines (particle size <75 µm) by limiting the use of overflow in accordance with an overflow regime that is detailed in the DMP
- avoiding overflow during predicted coral spawning events and during marine heatwaves
- minimising impact to benthic habitats and communities through the development and inclusion of PAR triggers to complement the tiered hierarchy of NTU trigger criteria
- informed response management based on modelling outputs and turbidity and PAR monitoring with contingency actions for informative and reactive monitoring sites
- avoiding collision between marine megafauna and dredge vessel with trained marine megafauna observers on vessels with triggers for prescribed management actions (e.g. reducing vessel speeds, directional changes, suspension of dredging) based on predetermined megafauna approach distances
- minimising collision with marine megafauna through observation of prescribed vessel speed limits
- minimising entrainment of marine fauna, particularly turtles and sawfish by fitting dredges with equipment such as 'tickler' chains on drag heads
- avoiding the introduction of marine pest species through compliance with *Biosecurity Act 2015* (Cth) and Australian ballast water management requirements and conducting and reporting on

biofouling risk assessment, prior to mobilisation, of vessels from locations outside Darwin Harbour in accordance with international guidelines⁶.

6.3.5. Assessment of impacts to environmental values

The NT EPA's assessment of potentially significant environmental impacts on the factor of Marine ecosystems builds on its assessment for Marine environmental quality. Specifically, assessment of seasonal timing of dredging and the TARP to manage turbidity form the basis of its assessment of marine ecosystem applies and is not repeated here (see section 6.2.6 of this report).

Reduced light availability from increased turbidity and sediment suspension

Benthic primary producer and filter feed habitats comprise flora and fauna reliant on light availability to maintain their biodiversity, ecological integrity and ecological function. Darwin Harbour is naturally turbid resulting in the resilience of seagrasses, macroalgae and coral communities to relative high SSC and therefore relatively low light availability; however, biotic survival thresholds remain unknown.

The DEPWS Flora and Fauna Division submission advises that seagrasses and other benthic flora integrate their light requirements over a period of time that spans days to weeks rather than responding to spikes of turbidity, therefore the daily total amount of light that reaches benthic habitats and communities is important. However it is also noted that microalgae and macroalgae are sensitive to, and adaptively respond to changes in light availability. The proponent's peer review also supports this advice and describes that the use of turbidity for management triggers is less desirable than directly measuring light availability as the 'pressure parameter' due to the many ways that turbidity or SSC measures can be misleading with regard to impact management.

The DMP incorporates duration and frequency criteria combined with turbidity values in its tiered hierarchy of trigger values to address the timing component of impacts from increased turbidity during dredging (section 6.2.6 of this report). These triggers address the time period of impact pressure and are developed from site-specific baseline turbidity data collected prior to and during capital dredging. Further, the proponent has committed to developing light-based trigger criteria by the end of 2023, recognising the value of measuring light availability and spectral quality for benthic habitats and communities. This commitment is supported by the DEPWS submission and the independent expert reviews of the draft DMP.

The proponent has committed to develop light-based trigger criteria and to ensure meaningful triggers are developed. Engagement with the Northern Territory Government will be required to ensure alignment with the Darwin Harbour dredging strategy under development.

The NT EPA has recommended a condition that requires the proponent to develop and implement interim PAR trigger values, based on representative site-specific baseline data, prior to the commencement of dredging.

Sediment generated during dredging and loading

Marine sediments may be mobilised at the dredge site via a range of mechanisms including overflow dredging, direct disturbance by the dredge head, and spillage from a leaking hopper. Dredging would produce slurries that comprise a fine sediment-water mixture and dredged solids. The proponent proposes to allow the fine sediment-water mixture to escape during loading at the dredge area, which could introduce significant loads of fine sediment to the water column. This sediment-laden discharge, referred

⁶ International Maritime Organization. 2012. Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species. Available at:

<https://www.imo.org/en/OurWork/Environment/Pages/Biofouling.aspx>

to as overflow, is a key source of sediment generation in the water column, after mechanical interaction at the seabed and prior to spoil disposal.

Overflow is proposed to optimise loading of the dredge through the release of water with some fine sediment and to maximise the quantity of sediment within the hopper prior to transport of the dredged material to the dredge spoil disposal area. The proponent's proposed overflow management measures include the use of overflow funnel(s) to 0.5 m below the vessel and fitted with green valves as well as an overflow duration limit to restrict the release of fine material from the dredge vessel.

To minimise the sediment plume from overflow dredging, the proponent committed to restricting the use and duration of overflow. The proponent's expert review⁷ identifies that the use of dredge overflow is considered appropriate for sand material, but should be avoided for materials with very high silt content. The referral indicates that about 60% of the material to be dredged has a fines content >75%.

The referral outlines timing restrictions of dredge overflows so that overflow will not occur during predicted coral spawning events or, during periods of marine heatwaves, and will only occur at any time for a maximum of 60 minutes per cycle.

The NT EPA considers that excessive overflow discharge must be prevented so that turbidity triggers are not exceeded and impacts on marine ecosystems are minimised. A condition has been recommended requiring overflow limitations and that the proponent submit a report after each maintenance dredging campaign to verify the spatial extent, magnitude and characteristics of the dredge plume detailed in the referral report.

The NT EPA considers that potential impacts related to overflow would be managed through an overflow regime within the DMP. A condition is also recommended requiring that the proponent undertake monitoring and implement management measures and reporting so that impacts on marine ecosystems are minimised to an acceptable level.

Vessel interaction and underwater noise

The DMP describes the protected marine megafauna in Darwin Harbour and the DSDA, including potential impacts from vessel interaction, noise and altered foraging habitat on these fauna in section 3.3. The proponent's management frameworks (section 6.2.3 of the DMP) provide appropriate measures to avoid, mitigate and manage potential impacts on marine megafauna.

The NT EPA is satisfied that through implementation of the measures outlined in the proponent's protected marine megafauna management frameworks and recommended conditions, impacts from vessel interaction can be adequately mitigated and managed so risks to marine megafauna are avoided or minimised to an acceptable level.

Accidental introduction of marine pests

The DMP provides an account of the presence, eradication and current status of marine pest species in Darwin Harbour in section 3.4. The DMP identifies that only one marine pest species, a sea squirt, is listed as an aquatic pest species. Additionally, a vessel biofouling risk assessment would be undertaken by an independent biofouling expert engaged by the dredging contractor prior to mobilisation of any vessels from outside Darwin Harbour. The Commonwealth *Biosecurity Act 2015* provides for regulation of Australian biofouling management requirements⁸.

⁷ [Appendix B](#) (Draft Maintenance DMP– Expert Review) of INPEX's Ichthys LNG Maintenance Dredging Program 2023-2027: Referral Report (see Pronk, Pro Dredging Marine Consultants, 2022)

⁸ (former) Department of Agriculture, Water and Environment, 2022. Australian biofouling management requirements. Available at: <https://www.agriculture.gov.au/sites/default/files/documents/Australian-biofouling-management-requirements.pdf>

The NT EPA is satisfied that through implementation of the measures outlined in the proponent’s introduced marine pests management framework, section 6.2.1 of the DMP, impacts from accidental introduction of marine pests can be adequately mitigated and managed so risks to the environment are avoided or minimised to an acceptable level.

Cumulative impacts are considered and discussed in section 7 (Whole of environment) of this report.

6.3.6. Summary of factor assessment and recommended regulation

The NT EPA has considered the potential significant impacts of the proposal on marine environmental quality. In doing so, the NT EPA has considered whether reasonable conditions could be imposed, or whether other statutory decision-making processes could ensure the NT EPA’s factor objective is likely to be met. The NT EPA’s assessment findings are presented in Table 5.

The NT EPA has also taken into account the objects and principles of the EP Act (section 8) in assessing whether the residual impacts will meet its environmental factor objective and whether reasonable conditions can be imposed.

Table 5 Summary of assessment for Marine ecosystems

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
Seasonal impacts from dredging	See section 6.2.6	As per section 6.2.6 and Condition 1 Limitations and extent Condition 2 Overarching objectives Condition 3 DMP
TARP	See section 6.2.6	As per section 6.2.6
Reduced light availability to benthic primary producers	<p>Uncertainty remains about light availability requirements and biotic survival thresholds.</p> <p>The development of light-based trigger criteria, measured as PAR and, applied together with turbidity triggers should provide the baseline and evidence base required to effectively manage maintenance dredging activities during the wet and dry season.</p> <p>Commencement of maintenance dredging after the development of PAR trigger criteria would allow for appropriate baseline data to be collected and improve certainty about implementation measures proposed in the DMP.</p> <p>Proposal activities conducted in accordance with the DMP and recommended conditions are not likely to result in significant impacts on benthic marine ecosystems of Darwin Harbour so the environmental outcome is</p>	<p>Regulated through recommended conditions:</p> <p>Condition 3 DMP</p> <p>Condition 6 Environmental performance reporting</p>

Residual impact to environmental value	Assessment finding	Recommended conditions and regulation by other statutory decision-makers
	likely to meet the NT EPA's objective for Marine ecosystems.	
Reduced turbidity and sediment suspension through overflow management	<p>The proponent has committed to operational measures to minimise the amount of sediment released from overflow.</p> <p>The NT EPA considers that the acceptable application of an overflow regime would be managed through the DMP.</p> <p>Implementation of the DMP and in accordance with a recommended condition, means that residual impacts are not considered significant and the environmental outcome is likely to meet the NT EPA's objectives for this factor.</p>	<p>Regulated through recommended condition:</p> <p>Condition 3 DMP</p>
Disturbance of marine megafauna from dredge and associated vessel interactions and underwater noise	<p>Implementation of the Protected marine megafauna management frameworks in the DMP as conditioned, means that residual impacts are not considered significant and the environmental outcome is likely to meet the NT EPA's objectives for this factor.</p>	<p>Regulated through recommended condition:</p> <p>Condition 3 DMP including marine megafauna management measures</p> <p>Condition 6 Environmental performance reporting</p>
Impacts on marine habitat, productivity from accidental introduction of marine pests	<p>Implementation of the Introduced marine pests management framework in the DMP as conditioned, means that residual impacts are not considered significant and the environmental outcome is likely to meet the NT EPA's objectives for this factor.</p>	<p>Regulated through recommended condition:</p> <p>Condition 3 DMP</p>

6.3.7. Conclusion against the NT EPA objective

With the implementation of the proposed management measures, the recommended conditions, and regulation under other statutory decision-making processes, the NT EPA considers that the proposal could be conducted in such a manner that its objective for marine ecosystems is likely to be met.

6.4. Culture and heritage

The referral describes the cultural, historic and heritage values of Darwin Harbour (section 3.6 of the DMP) which includes sacred sites, shipwrecks, sunken aircraft and the heritage listed coral reef at Channel Island. Extensive survey effort informed the identification of values in the proposal area and vicinity. Further, the Northern Territory Government's Heritage Branch has advised that the proponent maintains ongoing engagement to manage discovery of unidentified underwater cultural heritage within the zones of impact and influence of proposed maintenance dredging works. The Aboriginal Areas Protection Authority (AAPA) confirms that the sacred sites information provided in the referral is correct and any potentially significant

impacts will be minimised through activities carried out in accordance with the proponent's Authority Certificates.

Potential impacts on underwater cultural heritage through vessel movements, anchoring and dredging activity may result in the loss of known and unidentified cultural and heritage values. The DMP provides avoidance and management measures including, but not limited to:

- exclusion and no anchor zones around heritage wreck/sunken aircraft sites
- provision of data files of known sites and buffer zones to contractors for inclusion in vessel navigation systems including those located directly adjacent to dredging activities
- activation of early warning alarm on entry to buffer zone and secondary alarm on entry to the heritage protection zone
- implementation of a chance find procedure in the event of discovery of previously unidentified heritage objects.

The NT EPA is satisfied that, based on the comprehensive evidence base, ongoing engagement between the proponent and Heritage Branch and AAPA, and the Heritage and sacred site management framework (section 6.2.4 of the DMP), the proponent has provided sufficient information to demonstrate that any residual impact on culture and heritage values from the proposal would not be significant.

The NT EPA has considered the potential significant impacts of the proposal on culture and heritage. In doing so, the NT EPA has considered whether reasonable conditions could be imposed, or whether other statutory decision-making processes could ensure the NT EPA's factor objective is likely to be met.

The NT EPA has also taken into account the objects and principles of the EP Act (section 8) in assessing whether the residual impacts will meet its environmental factor objective and whether reasonable conditions can be imposed.

With the implementation of the proposed management measures and regulation under other statutory decision-making processes, the NT EPA considers that the proposal could 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 has considered connections and interactions between the key environmental factors (Marine environmental quality, Marine ecosystems, Culture and heritage) and cumulative impacts in its consideration of impacts to the whole of environment.

When the separate environmental factors of the proposal were considered together in a whole of environment assessment, the NT EPA formed the view that the impacts from the proposal would not alter its views about whether the proposal could meet its factor objectives.

Cumulative impacts

Cumulative impacts may occur due to short-term water quality changes (high suspended sediment concentrations and reduced light availability) and increased sedimentation from sequential and/or concurrent dredging activity within Darwin Harbour. Indirect impacts from mobilised sediments include reduced productivity of benthic habitats and communities, and therefore protected marine fauna, mangrove habitat and marine ecosystems reliant on this productivity.

The proponent's cumulative impact assessment considered potential impacts from five proposed dredging activities, potential long-term effects on the sediment balance of East Arm and the scenario of back-to-

back maintenance dredging extending the duration of works. The assessment did not include other activities influencing water quality, such as wastewater discharge; however, the management of sedimentation impacts from mechanical interaction and overflow during dredging, and disposal of spoil at sea, are captured in the trigger, action and response measures included in the DMP.

The proponent considered cumulative impacts of sequential dredging campaigns for the proposal as well as concurrent campaigns across Darwin Harbour by other proposals and concluded that it is unlikely that any reasonably foreseeable dredging activities within Darwin Harbour, if undertaken concurrently with maintenance dredging, would result in significant cumulative impacts.

Submissions from government authorities and the proponent's independent expert reviews note that the TARP does not account for cumulative impacts of sediment mobilisation and deposition from non-dredging related activities.

The design and implementation of a future strategic, harbour-wide monitoring program would be the appropriate mechanism for determining if and how development activities in the harbour, including dredging, impact on marine environmental quality and marine ecosystems. There are a number of strategies applicable to Darwin Harbour that have been or will be designed to improve environmental outcomes. Of particular relevance is Northern Territory Government's planned development of a harbour-wide dredging strategy that would incorporate a monitoring program to better understand cumulative impacts in the harbour.

The NT EPA considers the harbour-wide approach is appropriate for managing potential cumulative impacts in Darwin Harbour. Best-practice management measures applied to this proposal by the proponent and the NT EPA's recommended conditions would minimise the proposal's contribution to cumulative dredging impacts in the harbour.

The NT EPA's recommended condition for water quality monitoring with the inclusion of PAR triggers, would contribute to a standardised approach to fill information gaps and reduce uncertainty about cumulative pressures and therefore improve predictive cumulative impact assessment.

Environmental performance reporting

The NT EPA considers that an environmental performance report is required from the proponent after each dredging campaign to report on compliance with the environmental approval and to verify the proponent's sediment plume modelling predictions for sediment transport, to inform the comparison of the actual and predicted impacts, and assessment of cumulative impacts. The reports will consolidate the outcomes of environmental monitoring to enable continuous improvement of subsequent dredging campaigns.

The NT EPA has recommended a condition to this effect. The purpose of the environmental performance reporting is to provide the Minister with an evaluation of the performance of the proposal with respect to actual impacts on environmental values over the life of the action compared to those predicted during the environmental impact assessment process.

The NT EPA is satisfied that the potential impacts of the proposal on the whole of environment, with consideration of the intrinsic interactions between environmental factors, would not lead to any significant impacts and that the NT EPA's environmental objectives can be met.

8. Matters taken into account during assessment

The NT EPA has considered the principles of environment protection and management (Part 2 of the EP Act) in its assessment of the proposal. The matters are detailed by the relevant provision of the EP Act and provided in Table 6.

Table 6 Matters taken into account during environmental impact assessment of the proposal.

Matters	NT EPA's consideration
Objects of the EP Act	
Section 3(a) To protect the environment of the Territory	The proponent's referral and this assessment report, including the NT EPA's recommended conditions for an environmental approval, provide detail about how and what aspects of the Territory's environment would be protected from potentially significant environmental impacts that could occur as a result of implementation of the proposal.
Section 3(b) 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	The NT EPA's consideration of the principles of ecologically sustainable development in relation to the proposal is addressed below.
Section 3(c) 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 the 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 proposal to inform an environmental approval decision by the Minister that, in the NT EPA's view, promotes the protection and management of the Territory's environment.
Section 3(d) To provide for broad community involvement during the process of environmental impact assessment and environmental approval	The NT EPA's public consultation undertaken during its assessment of the proposal provided for community involvement during the environmental impact assessment process of the proposal.
Section 3(e) To recognise the role that Aboriginal people have as stewards of their country as conferred under their traditions and recognised in law, and the importance of participation by Aboriginal people and communities in environmental decision-making processes.	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 proponent maintains engagement with a range of Aboriginal stakeholders including, but not limited to; INPEX Larrakia Advisory Committee, Larrakia Development Corporation and the Larrakia Nation Aboriginal Corporation to maximise Aboriginal employment and training opportunities. Opportunities exists for the proposal workforce to employ the Larrakia Rangers in site demarcation, marine fauna spotting and monitoring activities during maintenance dredging
Principles of ecologically sustainable development	
Section 18 Decision-making principle (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	The NT EPA has considered the decision-making principle in its assessment and has had particular regard to this principle in its assessment of marine environmental quality and marine ecosystems. The NT EPA considers that the proposal design (use of seabed levelling and controlled overflow) incorporates a combination of the application of the environmental

Matters	NT EPA's consideration
<p>decisions and actions that affect the community.</p>	<p>decision-making hierarchy under section 26 of the EP Act, the waste management hierarchy under section 27 of the EP Act, and the principles of ecologically sustainable development.</p> <p>The NT EPA has recommended conditions for environmental objectives to be achieved through implementation of the proposal.</p> <p>While the proposal is short-term, the NT EPA considers that its environmental impact assessment and recommended conditions for an environmental approval have identified and mitigated both short-term and long-term potential environmental impacts, and that this has not resulted in any compromise between short-term and long-term environmental and equitable considerations.</p> <p>The broader community has been provided the opportunity for involvement in the environmental impact assessment process during the NT EPA's public consultation on the proposal. Government authority submissions received have been taken into account in the preparation of this report and the recommended conditions to inform the Minister's decision on environmental approval.</p>
<p>Section 19 Precautionary principle</p> <p>(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.</p> <p>(2) Decision-making should be guided by:</p> <p>(a) a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and</p> <p>(b) an assessment of the risk-weighted consequences of various options.</p>	<p>The precautionary principle was considered by the NT EPA when assessing the impacts of the proposal on its environmental factors.</p> <p>The proponent has identified appropriate measures to avoid or minimise impacts on the environment through the application of best practice dredging methods and guidance.</p> <p>This includes development of light availability triggers to manage potentially significant impacts on benthic habitats and communities in the absence of species and community specific threshold limit values.</p> <p>The NT EPA's assessment has concluded that environmental values will be protected provided its recommended conditions, and the proponent's commitments, are implemented.</p> <p>The proposal may result in some irreversible impacts on marine ecosystems associated with sediment mobilisation during dredging; however, those impacts are not considered significant.</p>
<p>Section 20 Principle of evidence-based decision-making</p> <p>Decisions should be based on the best available evidence in the circumstances that is relevant and reliable.</p>	<p>The NT EPA has considered the available evidence during the course of its assessment of the proposal. Multiple lines of evidence (scientific, process and peer review) provide the foundation for the NT EPA's decision making and recommended conditions. The evidence made available to the NT EPA during the</p>

Matters	NT EPA's consideration
	<p>course of the assessment was adequate to inform the NT EPA's recommendation to the Minister.</p> <p>The NT EPA recognises the proponent's commitment to improve the evidence base around light availability for benthic habitats and communities and the application of PAR trigger values to inform the management of potentially significant impacts on the environment. The NT EPA has recommended conditions requiring that the proponent obtain representative site-specific baseline PAR data and use this information to develop PAR triggers prior to commencement of the action.</p>
<p>Section 21 Principle of intergenerational and intragenerational equity</p> <p>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.</p>	<p>The NT EPA considers that it is important to protect the sensitive environmental values of Darwin Harbour for the benefit of future generations. It considers that the recommended conditions for an environmental approval would provide an appropriate degree of protection for these values and not constrain the ability of future generations to access the healthy, diverse and productive marine environment for a range of beneficial uses.</p> <p>Effective implementation of the proposal to maintain environmental quality and biodiversity would ensure that environment is maintained into the future for the benefit of future generations.</p>
<p>Section 22 Principle of sustainable use</p> <p>Natural resources should be used in a manner that is sustainable, prudent, rational, wise and appropriate.</p>	<p>The NT EPA notes the importance of sustainable use of resources and has considered this principle during the environmental impact assessment process. It considers that this principle is closely linked to the principles of intergeneration and intragenerational equity, and conservation of biological diversity and ecological integrity.</p>
<p>Section 23 Principle of conservation of biological diversity and ecological integrity</p> <p>Biological diversity and ecological integrity should be conserved and maintained.</p>	<p>The principle of conservation of biological diversity and ecological integrity was considered by the NT EPA when assessing the impacts of the proposal on the environmental values of the receiving environment. In considering this principle, the NT EPA notes that marine environmental quality and marine ecosystems could be significantly impacted by the proposal if appropriate measures were not implemented to avoid and mitigate impacts. The assessment of these impacts is provided in this report.</p> <p>Biological diversity and ecological integrity are likely to be conserved due to the avoidance, mitigation and management measures that will be implemented by the proponent and its contractor. The NT EPA has recommended conditions to ensure that environmental protection outcomes are achieved.</p>

Matters	NT EPA's consideration
	The NT EPA has concluded through its assessment of the proposal, that the biological diversity and ecological integrity of the affected areas would not be compromised.
<p>Section 24 Principle of improved valuation, pricing and incentive mechanisms</p> <p>(1) Environmental factors should be included in the valuation of assets and services.</p> <p>(2) Persons who generate pollution and waste should bear the cost of containment, avoidance and abatement.</p> <p>(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.</p> <p>(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.</p>	<p>This principle was considered by the NT EPA when assessing the impacts of the proposal.</p> <p>The NT EPA notes that the proponent would adhere to a DMP which includes provisions to manage waste disposal and prevent environmental harm during dredging.</p>
Environmental decision-making hierarchy	
<p>Section 26(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:</p> <p>(a) ensure that actions are designed to avoid adverse impacts on the environment;</p> <p>(b) identify management options to mitigate adverse impacts on the environment to the greatest extent practicable;</p> <p>(c) if appropriate, provide for environmental offsets in accordance with this Act for residual adverse impacts on the environment that cannot be avoided or mitigated.</p>	<p>In its assessment of the proposal, the NT EPA considered the extent to which the proponent has applied the environmental decision-making hierarchy in its design of the proposal and the proposed measures to avoid and then mitigate significant impacts through implementation of its environmental management frameworks.</p> <p>The NT EPA is satisfied that this hierarchy has been applied appropriately to avoid and/or mitigate impacts (see sections 6.2.4 and 6.3.4) and has recommended conditions to support the proponent's commitments.</p> <p>The NT EPA recognises the proponent's application of the environmental decision-making hierarchy extends to its dredging contractor during implementation of the proposal.</p> <p>The NT EPA did not identify any residual impacts that would require offsetting.</p>
<p>Section 26(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</p>	<p>The proposal is located in an area with high recreational, economic and biodiversity value. Proposed measures to improve scientific knowledge about dredging pressure tolerance thresholds and light availability to benthic habitats and communities, would inform management measures to enable natural</p>

Matters	NT EPA's consideration
<p>quality is identified and provided for to the extent practicable.</p>	<p>restoration of the adjacent environmental quality if undertaken successfully.</p> <p>The NT EPA has recommended conditions requiring upfront information based the development of PAR triggers so that impacts can be managed and environmental quality is restored naturally to meet the NT EPA's objectives.</p>
Waste management hierarchy	
<p>Section 27(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>The NT EPA has considered the waste management in its assessment and has had particular regard to this principle in its assessment of marine environmental quality.</p> <p>The NT EPA is satisfied that the short duration and low magnitude of impacts together with the proponent's proposal design (trigger values, use of seabed levelling and overflow) will ensure compliance with the waste management hierarchy.</p>
<p>Section 27(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 NT EPA considers that the waste management hierarchy has been appropriately applied to the proposal.</p>
Ecosystem-based management	
<p>Section 4 Management that recognises all interactions in an ecosystem, including ecological and human interactions.</p>	<p>The NT EPA notes the importance of ecosystem-based management for achieving both sustainable development and biodiversity protection goals. The NT EPA considered the connections and interactions between and within marine environmental quality and marine ecosystems to inform a holistic view of impacts to the whole environment.</p> <p>From its assessment of this proposal the NT EPA has concluded that the proposal would not compromise the biological diversity and ecological integrity of the affected areas.</p> <p>The NT EPA formed the view that the impacts from this proposal can be managed to be consistent with the NT EPA's environmental factors and objectives.</p>
The impacts of a changing climate	

Matters	NT EPA's consideration
<p>Section 42(b)(v) The effects of a changing climate on the proposal and resilience of the proposal to a changing climate</p>	<p>The NT EPA notes the proponent's consideration of the effects of a changing climate through discussion of greenhouse gas emissions in its DMP. Greenhouse gas emissions from the proposed maintenance dredging are not considered to be significant. Short-term dredging activities are not expected to be impacted by a changing climate.</p>

Appendix 1 – Draft environmental approval

Draft Environmental Approval

PURSUANT TO SECTION 69 OF THE ENVIRONMENT PROTECTION ACT 2019

Approval number	EPA2022/018-001
Approval holder	INPEX Operations Australia Pty Ltd
Australian business number (ABN)	48 150 217 262
Registered business address	Level 22/100 St Georges Terrace Perth, Western Australia 6000

Action: Ichthys LNG Maintenance Dredging Program 2023-2027

Undertake maintenance dredging activities within the existing dredged footprint of the shipping channel and turning basin in Darwin Harbour. Direct loading of the dredge material, transport of spoil and spoil disposal would be by a single trailing suction hopper dredge to the previously used dredge spoil disposal area in NT coastal waters of the Beagle Gulf. Maintenance dredging is proposed to be undertaken within a five year period.

The action includes:

- one planned maintenance dredging campaign and up to four contingency campaigns
- dredging of a maximum of 1.5 million cubic metres (Mm³) of material
- no single dredge campaign to exceed 0.75 Mm³.

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 with implementation of the environmental management measures, commitments and safeguards documented in the Referral information (including the Referral Report and Appendices). If there is an inconsistency between the Referral information 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 *Water Act 1992*.
- 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

Address of action	NT Portion 7168, Darwin Harbour NT Portion 7634, Beagle Gulf
NT EPA Assessment Report number	100
To Decision maker	NOT FOR SIGNING
	Hon Lauren Jane Moss MLA, Minister for Environment, Climate Change and Water Security
Date of approval	NOT FOR APPROVING

Environmental approval conditions

Marine environmental quality and marine ecosystems

1 Limitations and extent

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

Table 1 Limitations and extent

Action element	Figure	Limitation or maximum extent
Dredging	Figure 1	No more than 1.5 Mm ³ of material to be dredged within the 248 hectare (ha) dredge area of the approved extent . No single dredge campaign to exceed 0.75 Mm ³ within the approved extent .
Overflow	Figure 1	Overflow may only occur during the months of November to April inclusive. Overflow must be limited to ≤60 minutes per cycle. Overflow must not occur when dredging material with fines content* ≥75%.
Seabed levelling	Figure 1	Seabed levelling may only occur within the 248 ha dredge area of the approved extent
Spoil disposal	Figure 1	Spoil disposal may only occur within the 125 ha area of the dredge spoil disposal area of the approved extent .

* The Australian Standard (Geotechnical site investigations) AS 1726-1993 defines fine sediment as a particle size <75 µm.

2 Environmental objectives

- 2-1 The approval holder must ensure the implementation of the action achieves the following environmental objectives:
- (1) no **material environmental harm** to the environmental values and declared **beneficial uses** of water in Darwin Harbour, 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 and health impacts on protected marine fauna are minimised.
- 2-2 The approval holder must undertake monitoring in the zones of impact and influence during and following the cessation of **dredging activity** that is capable of demonstrating whether the environmental objectives in condition 2-1(1) and 2-1(2) have been met.

3 Maintenance Dredging and Spoil Disposal Management Plan

3-1 Prior to **dredging activity**, the approval holder must submit to the **Minister** a **Maintenance Dredging and Spoil Disposal Management Plan (DMP)** to meet the requirements specified in condition 3-2.

3-2 The **DMP** required by condition 3-1 must include:

- (1) a requirement for all **dredging activity** to achieve the environmental objectives required by condition 2-1;
- (2) benthic mapping showing the field-validated extent and distribution of potentially affected **benthic habitats and communities**;
- (3) the modelled zones of impact and influence from **dredging activity** and dredge-generated sediment plumes on **benthic habitats and communities**, including a cumulative loss assessment;
- (4) management **trigger values** based on seasonal pressure response pathways including:
 - (a) turbidity (**NTU**) **trigger values** in accordance with **Table 2**
 - (b) light availability (**PAR**¹) **trigger values**:
 - (i) interim **PAR trigger values** must be set by the approval holder based on current available data and be implemented prior to commencement of any **dredging activity** in 2023; and
 - (ii) final **PAR trigger values** must be set by the approval holder as the preferred indicator to measure dredging impacts, and be implemented prior to commencement of any **dredging activity** in 2024.
- (5) a trigger action response plan (with actions to be initiated if **trigger values** are exceeded) to manage **dredging activity** to achieve the environmental objectives required by condition 2-1;
- (6) a detailed description of the water quality monitoring program associated with dredge-generated sediment plumes (in line with condition 2-2), including:
 - (a) monitoring indicators, methods and sampling frequency;
 - (b) reference and impact monitoring site locations;
 - (c) quality assurance methods and reporting of results;
 - (d) a requirement for near real-time telemetered monitoring of turbidity, benthic and surface **PAR**, depth, conductivity and temperature, with **continuous logging** at reference and impact sites with a **baseline data** collection phase;

¹ PAR monitoring must be undertaken consistent with the Queensland Government 2018, [Guidance on using Photosynthetically Active Radiation \(PAR\) as a method to measure light availability for aquatic photosynthetic organisms facing acute impacts](#), Queensland.

- (e) a requirement for monitoring of total suspended solids, total organic carbon and spectrophotometric water colour at reference and impact sites, with a **baseline data** collection phase;
 - (f) use of accurate and reliable monitoring approaches sufficient to describe temporal variation e.g. seasonality, tidal cycles and weather conditions; and
 - (g) a requirement for the monitoring program to facilitate assessment against the environmental objectives in conditions 2-1(1) and 2-1(2), **trigger values** in condition 3-2(4), and to inform adaptive monitoring and management in line with condition 3-2(11).
- (7) procedures to minimise impacts of **dredging activity** and vessel anchoring;
- (8) a regime for dredge **overflow** including but not limited to requirements that **overflow** at the dredge site must:
- (a) only occur in line within the limitations and extent in condition 1-1;
 - (b) only occur with green valves on **overflow** funnel(s) at all times;
 - (c) cease if the 21 day rolling daily average water temperature at all water quality sites adjacent to coral communities exceeds 31°C and only recommence once the 21 day rolling average water temperature is below 31°C;
 - (d) cease three days before, and not recommence within seven days after any potential **coral spawning window**; and
 - (e) cease in the event that monitoring indicates that a management **trigger value** has been exceeded and only recommence once the relevant water quality parameter has fallen below the **trigger value** and the risk of any further exceedance is minimised in line with the trigger, action, response plan required by condition 3-2(5) and after the **Minister** has been advised.
- (9) procedures to prevent the introduction of marine pests into the Northern Territory;
- (10) monitoring and management measures to achieve the environmental objective required by condition 2-1(3) including but not limited to:
- (a) measures to avoid vessel strikes with marine megafauna including vessel speed limits and marine megafauna approach distances for all vessels used during implementation of the action;
 - (b) defined exclusion zones and **dredging activity** protocols for marine megafauna, including observation and recording sightings and locations of marine fauna in the vessels' daily log book;
 - (c) trained marine megafauna observers on duty during daylight **dredging activity** including spoil disposal;
 - (d) night and low visibility marine megafauna observation procedures;

- (e) measures to minimise direct entrainment impacts on turtles; and
 - (f) documenting and reporting to relevant regulators any incidents relating to marine fauna injury / mortality.
- (11) a tiered adaptive monitoring and management approach (including a feedback loop) to manage **dredging activity** to achieve the environmental objectives required by condition 2-1;
- (12) procedures for determining whether any management **trigger value** exceedances are attributable to the action;
- (13) contingency management strategies to be implemented and clear reporting procedures to be employed if management **trigger values** are reached; and
- (14) mechanisms to publish reports with details of dredging attributable exceedances of management **trigger values** and contingency actions as soon as practicable.
- 3-3 The approval holder:
- (1) must review and revise the **DMP** as and when directed by the **Minister**; or
 - (2) may review and revise the **DMP**, and must provide:
 - (a) the revised **DMP** to the **Minister** within 10 business days prior to any amendment(s) being implemented;
 - (b) a tabulated summary of the amendment(s) with document references;
 - (c) reasons for the amendment(s);
 - (d) an assessment of environmental risks and potential impacts associated with the amendment(s); and
 - (e) a written review and endorsement from an **independent qualified person** that the amended **DMP** appropriately identifies and mitigates any environmental risk and complies with the conditions of this approval.
- 3-4 The approval holder must implement the action to comply with the latest revision of the **DMP** required by condition 3-1.
- 3-5 In the event that monitoring carried out under the **DMP** determines that the relevant environmental objectives required by condition 2-1 are not being achieved, the approval holder must:
- (1) immediately implement the relevant response and contingency management measures specified in the **DMP**, and continue implementation of those actions until it is demonstrated that the environmental objectives are being achieved and will continue to be achieved;
 - (2) investigate the likely root cause of non-achievement of the environmental objectives;

- (3) within twenty-four (24) hours of determining that any of the environmental objectives are not being achieved, report the non-achievement to the **Minister**;
- (4) within seven (7) days of determining that any of the environmental objectives are not being achieved submit to the **Minister** a report detailing the following:
 - (a) the results of the monitoring that led to the determination that any of the environmental objectives are not being achieved;
 - (b) the investigation being undertaken as required by condition 3-5(2);
 - (c) any notifications and contingency management actions implemented by the approval holder following determination that any of the environmental objectives are not being achieved; and
 - (d) the findings of the investigation required by condition 3-5(2) to the **Minister** within twenty-one (21) days of first determining that any of the environmental objectives are not being achieved.

4 Commencement of action

- 4-1 This approval expires five years after the date on which it is granted, unless **dredging activity** has commenced on or before that date.
- 4-2 The approval holder must provide notification in writing to the **Minister**, at least 5 business days prior to the commencement of **dredging activity**.

5 Change of contact details

- 5-1 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.

6 Environmental performance reporting

- 6-1 The approval holder must:
 - (1) within six months of the completion of **dredging activity** carried out under this approval, obtain from an **independent qualified person**, a report on the environmental performance of the action and compliance with the conditions of this environmental approval; and
 - (2) submit each report to the **Minister** within 30 days of its completion.
- 6-2 The reports required by condition 6-1(1) must:
 - (1) provide all monitoring 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 condition 2-1 has been achieved;

- (3) describe the approaches used to validate the sediment plume modelling outputs;
- (4) provide a comparison between the actual and predicted:
 - (a) turbidity, suspended sediment and total suspended solids concentrations and **PAR**; and
 - (b) spatial extent of sediment plumes in relation to **dredging activity**.
- (5) describe measurements of sediment and hydrodynamic information obtained under representative conditions;
- (6) include an assessment of the effectiveness of monitoring, management and contingency measures implemented to comply with the requirements of condition 2-1;
- (7) be endorsed by the approval holder's Chief Executive Officer or a person delegated to sign on the approval holder's Chief Executive Officer's behalf;
- (8) include a statement as to whether the approval holder has complied with the conditions of this approval; and
- (9) identify all non-compliances and describe corrective and preventative actions taken.

7 Provision of environmental data

- 7-1 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 10 years commencing from the date that the data is collected or obtained.
- 7-2 The approval holder must, as and when directed by the **Minister**, provide any 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.

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 of this approval that is the dredging footprint, the dredge spoil disposal area and water on which the action is situated.
baseline data	The environmental monitoring data, including chemical, physical and biological data collected (from studies undertaken) prior to commencement of dredging activity , that is used to characterise baseline conditions.
beneficial uses	Has the same meaning as 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). 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	Has the same meaning as in section 4 of the <i>Environment Protection Act 2019</i> .
continuous logging	Requires ongoing data collection to be undertaken during and between dredging activity . Parameters specified in condition 3-2(6)(d) must be telemetered to ensure near real time availability of data to satisfy compliance monitoring.
coral spawning window	Identified as, but not limited to, the coral spawning window defined as four days after the first full moon in April of any calendar year.
dredging activity	Dredging works carried out under this approval including dredging, overflow , seabed levelling and spoil disposal.
DMP	Dredging Management Plan, which includes management and disposal of spoil.
EP Act	<i>Environment Protection Act 2019</i> .
independent qualified person	A qualified person as defined under section 4 of the EP Act ; and who also meets the following requirements: <ul style="list-style-type: none"> a) was not involved in the preparation of the approval holder's referral; b) is independent of the personnel involved in the design and implementation of the action; and

	c) has obtained written approval from the CEO , on the advice of the Executive Director, of the NT Department of Environment, Parks and Water Security Flora and Fauna Division to be the qualified person to satisfy the independent qualified person reporting requirements under this approval.
material environmental harm	Has the same meaning as in section 8 of the <i>Environment Protection Act 2019</i> .
Minister	The Minister responsible for administering the <i>Environment Protection Act 2019</i> .
NT EPA	Northern Territory Environment Protection Authority.
overflow	A method used to optimise loading of the dredge hopper through the release of water with some fine sediment and maximise the quantity of sediment within the hopper prior to transport of the dredged material to the dredge spoil disposal area.
PAR	Photosynthetically active radiation (including benthic and surface)
referral	The approval holder's referral to the NT EPA under section 48 of the EP Act ; Ichthys LNG Maintenance Dredging Program 2023-2027: Referral Report, dated 9 August 2022.
trigger value(s)	The values of monitored environmental parameters that indicate when response actions are required to prevent impact.

Location and extent of action

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

NTEPA2022/0126-005: Spatial files - Ichthys LNG Maintenance Dredging Program 2023-2027.



Figure 1. Location and approved extent of dredge footprint and dredge spoil disposal area (Source: Draft DMP, Appendix A of the referral)

Table 2 Trigger values - turbidity and time limits for reactive monitoring sites shown in Figure 2 (Source DSDMP, Appendix A of the referral)²

Monitoring site	Season	Level 1 trigger (daily average) >intensity value and >duration or >frequency			Level 2 trigger (daily average) >intensity value and >duration or >frequency		
		Intensity (95 th %ile)	Duration (consecutive days)	Frequency (days per 7 day rolling period)	Intensity (99 th %ile)	Duration (consecutive days)	Frequency (days per 7 day rolling period)
South Shell Island	Wet season	27 NTU	4 days	4 days	35 NTU	1 day	1 day
	Dry season	13 NTU	5 days	4 days	21 NTU	5 days	5 days
Northeast Wickham Point	Wet season	30 NTU	7 days	5 days	48 NTU	3 days	3 days
	Dry season	14 NTU	3 days	3 days	17 NTU	2 days	2 days
Fannie Bay*	Dry season	13 NTU	7 days	5 days	24 NTU	5 days	4 days

*Only applicable where volumes to be dredged are more than 0.25 Mm³

² Weed Reef monitoring site is not included in this table as it is an informative monitoring site in line with the DMP.

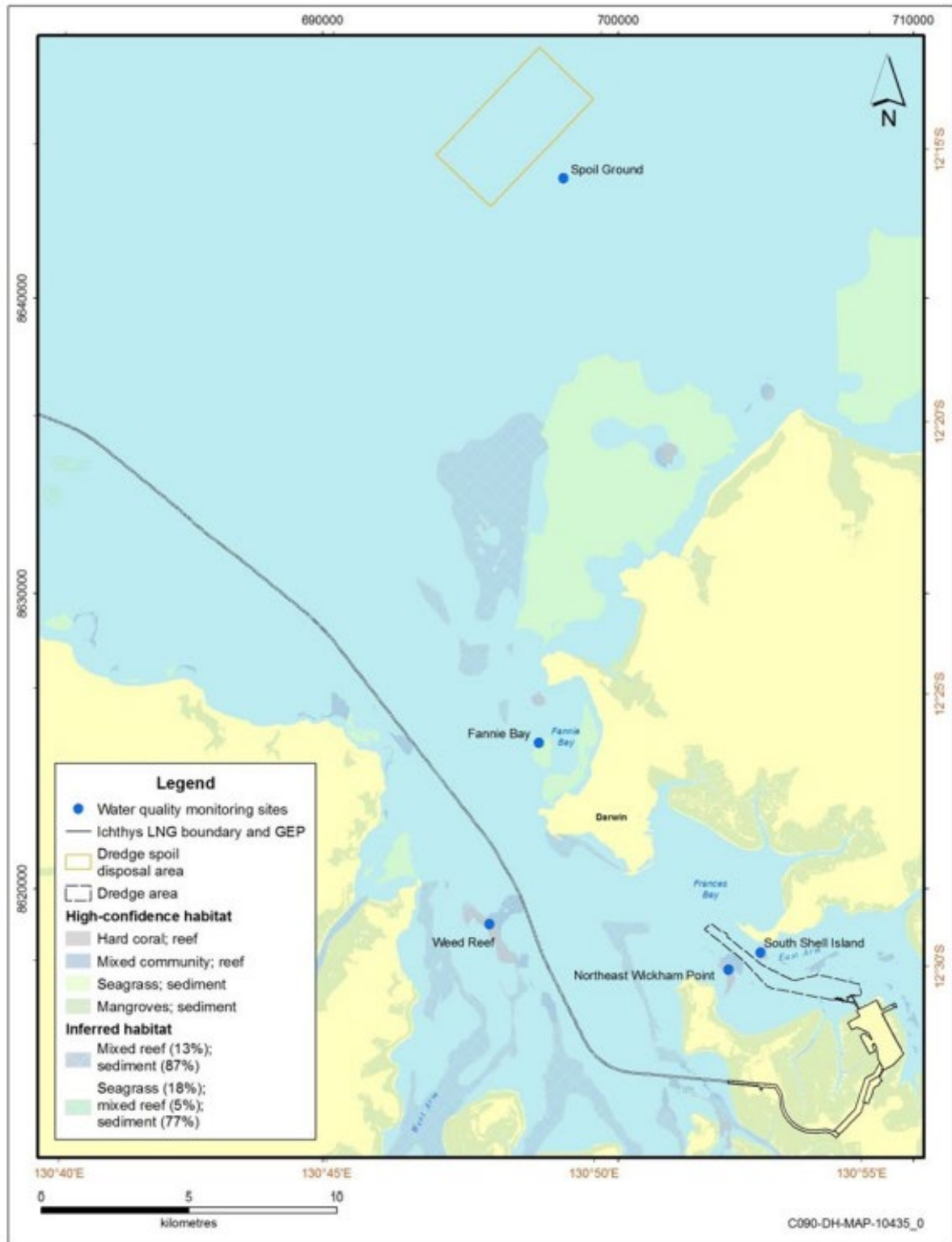


Figure 2 Indicative water quality monitoring sites (Source: Draft DMP, Appendix A of referral)

Appendix 2 – Environmental impact assessment timeline

Date	Assessment stages
29 August 2022	Referral information received
16 September 2022	Referral information accepted
21 September to 18 October, 2022	Submission period on referral information
6 December 2022	NT EPA decided environmental impact assessment required – assessment by referral information method
24 January 2023	19 business day assessment timeframe extension granted
3 to 16 March, 2023	Consultation with proponent and statutory decision makers
23 March 2023	Extended statutory timeframe for the NT EPA's assessment report to be provided to the Minister for Environment, Climate Change and Water Security
19 April 2023	Date assessment report 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).